



**Health Survey for England**

**2008**

Volume 1

**Physical activity  
and fitness**

A survey carried out on behalf of The NHS Information Centre

*Edited by Rachel Craig, Jennifer Mindell, Vasant Hirani*

*Joint Health Surveys Unit*



National Centre for Social Research



Department of Epidemiology and Public Health,  
UCL Medical School

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*Edited by*

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Designed by Davenport Associates

# Contents

## Volume 1: Physical activity and fitness

Foreword	8
Editors' acknowledgements	9
Notes	10

### 1 Introduction 11

1.1 The Health Survey for England series	11
1.2 The 2008 survey	11
1.3 Ethical approval	12
1.4 2008 survey design	12
1.5 Survey response	14
1.6 Data analysis	15
1.7 Content of this report	18
References and notes	18

### 2 Self-reported physical activity in adults Marilyn Roth 21

2.1 Introduction	23
2.2 Methods and definitions	25
2.3 Self-reported summary activity levels	29
2.4 Self-reported participation in physical activities and sedentary time	32
2.5 Discussion	37
References and notes	40
Tables	43

### 3 Accelerometry in adults Moushumi Chaudhury, Dale Eslinger 59

3.1 Introduction	61
3.2 Methods and definitions	62
3.3 Response to accelerometry	66
3.4 Objective measures of physical activity	66
3.5 Comparison of objective measurement and self-reported physical activity levels	70
3.6 Predictors of low activity levels	72
3.7 Discussion	72
References and notes	75
Tables	78

### 4 Physical fitness in adults Maria Aresu, Soren Brage, Jennifer Mindell 89

4.1 Introduction	90
4.2 Methods and definitions	91
4.3 Participation rates	95
4.4 Physical fitness	97
4.5 Discussion	101
References and notes	104
Tables	107

### 5 Self-reported physical activity in children Deanna Pickup, Natalie Gunning 117

5.1 Introduction	119
5.2 Method and definitions	120
5.3 Self-reported summary activity levels	124
5.4 Self-reported participation in physical activities and sedentary time	126

5.5 Discussion	133
References and notes	135
Tables	137

## **6 Accelerometry in children** *Dale Esliger, Julia Hall* 159

6.1 Introduction	160
6.2 Methods and definitions	161
6.3 Response to accelerometry	163
6.4 Objective measures of physical activity	164
6.5 Comparison of objective measurement and self-reported physical activity levels	166
6.6 Discussion	167
References and notes	171
Tables	173

## **7 Adult anthropometric measures, overweight and obesity** *Vasant Hirani* 181

7.1 Introduction	182
7.2 Methods and definitions	183
7.3 Prevalence of overweight, obesity and raised waist circumference	185
7.4 Health risk category with overweight, obesity and waist circumference	188
7.5 Trends in obesity	188
References and notes	189
Tables	191

## **8 Hypertension** *Moushumi Chaudhury* 207

8.1 Introduction	208
8.2 Methods and definitions	208
8.3 Prevalence, treatment and control of hypertension	210
8.4 Comparison with results from Quality and Outcomes Framework (QOF)	211
References and notes	212
Tables	213

## **9 Blood analytes** *Laia Bécaries, Jennifer Mindell* 221

9.1 Introduction	222
9.2 Methods and definitions	223
9.3 Response to non-fasting blood samples and proportion of valid samples for each analyte	223
9.4 Cholesterol levels and glycated haemoglobin levels	224
9.5 Changes over time	226
References and notes	227
Tables	228

## **10 Adult fruit and vegetable consumption** *Melanie Doyle-Francis* 241

10.1 Introduction	242
10.2 Methods and definitions	242
10.3 Fruit and vegetable consumption	244
10.4 Discussion	247
References and notes	247
Tables	249

## **11 Adult cigarette smoking** *Heather Wardle* 261

11.1 Introduction	263
11.2 Methods and definitions	264
11.3 Smoking behaviour in England	265
11.4 The impact of smokefree legislation	268
11.5 Discussion	271
References and notes	274
Tables	276

<b>12</b>	<b>Adult alcohol consumption</b>	<i>Elizabeth Fuller</i>	289
12.1	Introduction		290
12.2	Methods and definitions		291
12.3	Prevalence of drinking alcohol		292
12.4	Maximum daily consumption in the last week		294
12.5	Discussion		296
	References and notes		296
	Tables		298
<b>13</b>	<b>Children's BMI, overweight and obesity</b>	<i>Tosin Ogunbadejo</i>	311
13.1	Introduction		313
13.2	Methods and definitions		314
13.3	BMI and prevalence of overweight and obesity		314
13.4	Trends in BMI, overweight and obesity		316
13.5	Comparisons between Health Survey for England and National Child Measurement Programme data		318
	References and notes		321
	Tables		324
<b>14</b>	<b>Children's fruit and vegetable consumption</b>	<i>Dhriti Jotangia</i>	333
14.1	Introduction		334
14.2	Methods and definitions		335
14.3	Fruit and vegetable consumption		336
14.4	Discussion		338
	References and notes		339
	Tables		341
<b>15</b>	<b>Children's smoking and exposure to others' smoke</b>	<i>Alison Moody, Natasha Reilly</i>	349
15.1	Introduction		351
15.2	Methods and definitions		352
15.3	Children's self-reported smoking behaviour		354
15.4	Cotinine analysis		354
15.5	Children's reported exposure to other people's smoke pre and post 1st July 2007		357
15.6	Discussion		358
	References and notes		360
	Tables		363
<b>16</b>	<b>Children's experience of alcohol</b>	<i>Chloe Robinson</i>	375
16.1	Introduction		376
16.2	Methods and definitions		377
16.3	Experience of drinking alcohol		379
16.4	Discussion		381
	References and notes		382
	Tables		383
<b>Appendices</b>			
A	Accelerometry: data collection and processing		389
B	Step test: details of data processing and variable definitions		393

## Foreword

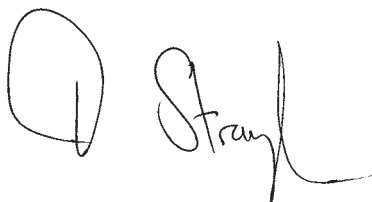
This report presents the findings of the eighteenth annual survey of health in England. I am pleased to present this important research which has been undertaken on behalf of The NHS Information Centre for health and social care.

The Health Survey for England is conducted annually and collects information about a representative sample of the general population. It is vital to our understanding of the health situation and behaviours of the public in England and helps to ensure that policies are informed by these data.

The survey combines information gathered through interviewing the sampled respondents, including a wealth of socio-demographic variables, with objective measures of health, such as blood pressure measurements. Thus we can study the inter-relationship of the characteristics and circumstances of adults and their children, with their health situation.

The primary focus of the Health Survey for England in 2008 was physical activity and fitness. Adults and children were asked to recall their physical activity over recent weeks, and objective measures of physical activity were also obtained. Physical activity has become an increasingly important public health issue as governments attempt to curb the levels of child and adult obesity. This report also examines cardiovascular fitness; greater physical fitness is associated with lower mortality in the general population. Increasing physical activity amongst adults has been a subject of public health promotion policies and government health strategies in England since the early 1990s. It is essential to monitor progress towards targets for increasing levels of physical activity among the population, and the Health Survey for England plays an important role as a monitoring tool.

I am honoured to welcome this valuable report and to thank all my colleagues in the Information Centre and our counterparts in the Joint Health Surveys Unit for their work. Surveys of this complexity are a team effort. The dedication of the skilled interviewing force is especially noteworthy. May I also thank the anonymous respondents across England who gave up their time to take part in the survey and who were willing to submit to various health tests. Without their help we would lose a public tool of enormous potential to benefit and protect the health of every one of us.

A handwritten signature in black ink, appearing to read 'Tim Straughan', with a stylized 'S' and a long horizontal flourish at the end.

**Tim Straughan**

Chief Executive

The NHS Information Centre for health and social care



## Editors' acknowledgements

We wish to thank, first of all, all those who gave up their time to be interviewed and who welcomed interviewers and nurses into their homes. We would also like to acknowledge the debt the survey's success owes to the commitment and professionalism of the interviewers and nurses who worked on the survey throughout the year.

We would like to thank all those colleagues who contributed to the survey and this report. In particular we would like to thank:

- The authors of all the chapters: Maria Aresu, Laia Bécares, Soren Brage, Moushumi Chaudhury, Melanie Doyle-Francis, Dale Esliger, Elizabeth Fuller, Natalie Gunning, Julia Hall, Vasant Hirani, Dhriti Jotangia, Jennifer Mindell, Alison Moody, Tosin Ogunbadejo, Deanna Pickup, Natasha Reilly, Chloe Robinson, Marilyn Roth, and Heather Wardle.
- Emily Diment, whose hard work and support has been crucial in putting this report together.
- Other research colleagues, especially Julia Hall, Kevin Pickering, Sarah Tipping and Nicola Shelton.
- Operations staff, especially Lesley Mullender, Sue Roche and the Area Managers at NatCen and Barbara Carter-Szatynska at UCL.
- The principal programmers, Jo Periam, Sven Sjodin and Colin Miceli.

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Last, but certainly not least, we wish to express our appreciation of the work of the staff at The NHS Information Centre at all stages of the project, and in particular the contribution made by Andy Sutherland, Julie Stroud, Bethan Thomas, Alison Crawford, Sharon Thandi, Alyson Whitmarsh, Paul Eastwood, Carol Hunter and Stephanie Gebert.

*Rachel Craig, Jenny Mindell, Vasant Hirani*

1. The data used in the report have been weighted. The weighting is described in Chapter 7, in Volume 2 of this report. Both unweighted and weighted sample sizes are shown at the foot of each table. The weighted numbers reflect the relative size of each group in the population, not numbers of interviews made, which are shown by the unweighted bases.
2. Children's data each year have been weighted to adjust for the probability of selection, since a maximum of two children are selected in each household. This ensures that children from larger households are not under-represented. Since 2003, as for adults, non-response weighting has also been applied.
3. Four different non-response weights have been used: for the interview stage, for the nurse visit, for the blood sample and for the cotinine sample. In addition there are separate weights for the subsample taking part in accelerometry, reported in Chapters 3 and 6, relating to interview, nurse visit and blood sample data.
4. The following conventions have been used in tables:
  - no observations (zero value)
  - 0 non-zero values of less than 0.5% and thus rounded to zero
  - [ ] used to warn of small sample bases, if the unweighted base is less than 50. If a group's unweighted base is less than 30, data are normally not shown for that group.
5. Because of rounding, row or column percentages may not add exactly to 100%.
6. A percentage may be quoted in the text for a single category that aggregates two or more of the percentages shown in a table. The percentage for the single category may, because of rounding, differ by one percentage point from the sum of the percentages in the table.
7. Values for means, medians, percentiles and standard errors are shown to an appropriate number of decimal places. Standard Error may sometimes be abbreviated to SE for reasons of space.
8. 'Missing values' occur for several reasons, including refusal or inability to answer a particular question; refusal to co-operate in an entire section of the survey (such as the nurse visit or a self-completion questionnaire); and cases where the question is not applicable to the participant. In general, missing values have been omitted from all tables and analyses.
9. The group to whom each table refers is stated at the upper left corner of the table.
10. The term 'significant' refers to statistical significance (at the 95% level) and is not intended to imply substantive importance.

## 1.1 The Health Survey for England series

The Health Survey for England (HSE) comprises a series of annual surveys, of which the 2008 survey is the eighteenth. All surveys have covered the adult population aged 16 and over living in private households in England. Since 1995, the surveys have also covered children aged 2-15 living in households selected for the survey, and since 2001 infants aged under two have been included as well as older children.

The Health Survey for England (HSE) is part of a programme of surveys currently commissioned by The NHS Information Centre for health and social care, and before April 2005 commissioned by the Department of Health. The surveys provide regular information that cannot be obtained from other sources on a range of aspects concerning the public's health, and many of the factors that affect health. The series of Health Surveys for England was designed to:

1. Provide annual data from nationally representative samples to monitor trends in the nation's health;
2. Estimate the proportion of people in England who have specified health conditions;
3. Estimate the prevalence of certain risk factors associated with these conditions;
4. Examine differences between subgroups of the population (by age, sex or income) in their likelihood of having specified conditions or risk factors;
5. Assess the frequency with which particular combinations of risk factors are found, and in which groups these combinations most commonly occur;
6. Monitor progress towards selected health targets;
7. (Since 1995) measure the height of children at different ages, replacing the National Study of Health and Growth; and
8. (Since 1995) monitor the prevalence of overweight and obesity in children.

Each survey in the series includes core questions and measurements such as blood pressure, anthropometric measurements and analysis of blood and saliva samples, as well as modules of questions on specific issues that vary from year to year. In recent years, the core sample has also been augmented by an additional boosted sample from a specific population subgroup, such as minority ethnic groups, older people or, as in 2008, children.

The Health Survey for England has been designed and carried out since 1994 by the Joint Health Surveys Unit of the National Centre for Social Research (NatCen) and the Department of Epidemiology and Public Health at the University College London Medical School (UCL).

## 1.2 The 2008 survey

The primary focus of the Health Survey for England in 2008 was physical activity and fitness. Adults and children were asked to recall their physical activity over recent weeks, and objective measures of physical activity and fitness were also obtained.

Physical activity has become an increasingly important public health issue as governments attempt to curb the levels of child and adult obesity. The health benefits of a physically active lifestyle have been well documented,<sup>1,2</sup> and participation in regular physical activity

can increase the quality of life and independence in older age.<sup>3</sup> Physical inactivity is associated with all-cause mortality and many chronic diseases, including ischaemic heart disease, diabetes, certain cancers, and obesity.

Although the amount of habitual physical activity undertaken is closely linked with all-cause mortality risk, the majority of people in many countries do not accrue sufficient exercise to derive health related benefits.<sup>4</sup> The majority of adults in England would like to do more physical activity; however, both men and women cite work commitments and not having enough leisure time as the most common barriers to doing more physical activity.<sup>5</sup>

In England, physical inactivity was estimated in 2002 to cost £8.2 billion a year.<sup>6</sup> Sedentary time is at least as important as moderate-intensity physical activity as a disease risk factor: sedentary behaviours are also associated with increased risk of obesity and cardiovascular disease independently of moderate to vigorous activity levels.<sup>7</sup>

This report also examines cardiovascular fitness. Greater physical fitness is associated with lower mortality in the general population<sup>8</sup> and mitigates the effect of metabolic syndrome<sup>9</sup> on all-cause and cardiovascular death.<sup>10</sup> Lack of fitness affects deaths from all causes, cardiovascular disease, and cancers.<sup>8</sup> Increasing activity levels increases fitness as well as reducing obesity and risks of diseases associated with inactivity, low fitness levels or obesity.

Increasing physical activity amongst adults has been a subject of public health promotion policies and government health strategies in England since the early 1990s. Guidelines for physical activity for maintaining optimal health have been available since the mid to late 1970s.<sup>11</sup> Recent National Institute for Health and Clinical Excellence (NICE) guidance highlights the contribution of regular physical activity to promoting the health of communities. It is essential to monitor progress towards targets for increasing levels of physical activity among the population, and the HSE plays an important role as a monitoring tool.

A total of 15,102 adults and 7,521 children were interviewed in 2008, with 3,473 children from the core sample and 4,048 from the boost. A household response rate of 64% was achieved for the core sample, and 73% for the boost sample.

Data collection involved an interview, followed by a visit from a specially trained nurse for all those in the core sample who agreed. The nurse visit included measurements and collection of blood and saliva samples, as well as additional questions.

## **1.3 Ethical approval**

Ethical approval for the 2008 survey was obtained from the Oxford A Research Ethics Committee (reference number 07/H0604/102).

## **1.4 2008 survey design**

### **1.4.1 Introduction**

The survey was designed to yield a representative sample of the general population of any age, and a boost sample of children aged 2-15, living in private households in England. In addition, a sub-sample of participants was selected for accelerometry, so that physical activity could be objectively measured. More detailed information about survey design is presented in Chapters 2-7, Volume 2 of this report.

People living in institutions, who are likely to be older and, on average, in poorer health than those in private households, were not covered. This should be borne in mind when considering the Health Survey's account of the population's health.

### 1.4.2 The core general population sample

A random sample of 16,056 of core addresses and 19,404 child boost addresses was selected from the Postcode Address File (PAF), using a multi-stage sample design with appropriate stratification. This was to ensure that households were sampled proportionately across the nine Government Office regions of England. 1,176 postcode sectors were selected, and 13 or 15 addresses were issued in each, depending on whether or not the sample point was in the accelerometry sub-sample.

Where an address was found to have multiple dwelling units, one was selected at random. Where there were multiple households at a dwelling unit, up to three households were included, and if there were more than three, a random selection was made.

Each individual within a selected household was eligible for inclusion. Where there were more than two children in a household, two were randomly selected for inclusion to limit the burden on any household.

### 1.4.3 The child boost sample

To increase the number of children in the sample, a boost sample was used. The boost sample was obtained by randomly selecting 19,404 addresses in 996 of the core postcode sectors. 12,672 addresses were selected in 792 core postcode sectors that were not in the accelerometry sub-sample (16 per sector); and 6,732 addresses were selected in 204 core postcode sectors that were included in the accelerometry sub-sample (33 per sector). As for the core sample, where there were three or more children in a household, two of the children were selected at random to limit the respondent burden for parents.

### 1.4.4 The accelerometry sub-sample

At the core addresses that were eligible for accelerometry, up to two individuals were selected to wear the accelerometer. In households with adults and children of the appropriate age, an adult and a child were selected.

At the child boost addresses that were eligible for accelerometry, any children aged between 4 and 15 that had been selected for the interview were eligible to wear the accelerometer.

### 1.4.5 Fieldwork

#### *Interview*

A letter stating the purpose of the survey was sent to each sampled address before the interviewer visited. The interviewer sought the permission of each eligible selected adult in the household to be interviewed, and both parents' and children's consent to interview selected children aged up to 15.

Computer-assisted interviews were conducted. The content of the interview is detailed in Volume 2, Chapter 3; full documentation is provided in the Appendices to Volume 2.

The 2008 survey for adults focused on physical activity and fitness levels. Adults were asked modules of questions on general health, alcohol consumption, smoking, and fruit and vegetable consumption, as well as questions about physical activity.

Children aged 13-15 were interviewed themselves, and parents of children aged 0-12 were asked about their children, with the interview including questions on eating habits (fat and sugar consumption) and fruit and vegetable consumption. Children were also asked detailed questions about physical activity.

In a sub-sample of households, up to two participants were selected and asked to wear an accelerometer for a week to provide an objective measure of physical activity.

Height and weight measurements were taken at the end of the interview.

## Nurse visit

Nurse visits were offered to all participants in the core sample. At the nurse visit, questions were asked about prescribed medication, vitamin supplements and use of nicotine replacements. For infants, additional information was collected on immunisations and measurements at birth. Nurses measured infant length (for those aged six weeks to under 2 years). The nurse also took the blood pressure of those aged 5 and over, and took waist and hip measurements for those aged 11 and over.

Non-fasting blood samples were taken from adults aged 16 and over (for the analysis of total and HDL cholesterol and glycated haemoglobin), and samples of saliva (for the analysis of cotinine, a derivative of nicotine) were taken from participants aged 4 and over. Written consent was obtained for these samples.

In those households selected for the accelerometer sub-sample, nurses established eligibility among adults aged 16-74, and guided those eligible through a timed step test to assess individual fitness levels.

Nurses administered a self-completion booklet about eating habits to those aged 16 and over.

## 1.5 Survey response

Interviews were held in 9,191 households with 15,102 adults aged 16 or over, and 3,473 children from the general population. The boost sample resulted in an additional 4,048 children aged 2-15 being interviewed, giving a total child sample of 7,521. Among the general population sample, 10,740 adults and 2,464 children had a nurse visit. More detailed information on survey response can be found in Volume 2, Chapter 6.

Response to the survey can be calculated in two ways: at a household level and at an individual level. Interviews were carried out at 64% of sampled eligible households in the general population (after removing vacant addresses etc.), and at 73% of known eligible boost sample households. Within the general population sample, interviews were obtained with 88% of adults and 93% of (sampled) children in 'co-operating' households (where at least one person was interviewed).

The assumption is made that households where the number of adults and children was not known contained, on average, the same number of adults and children as households where it was known. On this basis, the individual response rate for the general population sample, based on all eligible households, was estimated to be 58% among adults and 63% among (sampled) children.

Table 1A below shows individual response rates to the different stages of the survey for adults in the general population sample. The first column gives the individual response rates for adults in all eligible households, and the second column gives individual response rates for adults in co-operating households.

In the core sample, the response among eligible children in all eligible households was 63%, and 44% saw a nurse. Table 1B below shows a summary of responses obtained to the interview component of the survey among the total sample of children, from the core and boost sample, in co-operating households.

Only children in the core sample were eligible for the nurse visit. Table 1C below shows, for children in core co-operating households only, the response to the nurse visit and nurse measures.

Table 1A		
<b>Individual response: adults in the general population sample</b>		
	Adults in all eligible households	Adults in co-operating households
	%	%
Interviewed	58	88
Height measured	52	79
Weight measured	50	77
Saw nurse	41	63
Waist and hip measured	40	61
Blood pressure measured	40	61
Saliva sample obtained	39	59
Blood sample obtained	29	44

Table 1B	
<b>Children aged 0-15 in co-operating households (core and boost)</b>	
	%
Interviewed	96
Height measured	86
Weight measured	83

Table 1C	
<b>Children aged 0-15 in core co-operating households</b>	
	%
Saw nurse	66
Infant length measured	41
Waist and hip measured	59
Blood pressure measured	61
Saliva sample obtained	57

## 1.6 Data analysis

### 1.6.1 Introduction

The HSE is a cross-sectional survey of the population. It examines associations between health states, personal characteristics and behaviour. However, such associations do not necessarily imply causality. In particular, associations between current health states and current behaviour need careful interpretation, as current health may reflect past, rather than present, behaviour. Similarly, current behaviour may be influenced by advice or treatment for particular health conditions.

### 1.6.2 Weighting the samples

#### *The general population sample*

For the general population sample, weights were calculated at the household level and at the individual participant level. The household weight corrected for the probability of selection where additional dwelling units or households were identified at a selected address. Calibration weighting was also used for adults to reduce non-response bias resulting from differential non-response at the household level, based on the age and sex profile of the residents and the region in which the household was situated. 88% of adults in participating households were interviewed, and weights were therefore also calculated at an individual level to correct for non-response within participating households.

#### *The sample of children*

The sample of children comprised all those aged 0-15 from the core sample and those aged 2-15 from the boost sample. The weights for the child sample include selection weights for the dwelling unit/household, selection weights for the children in the household, and calibration weighting to adjust the sex and age profile of the achieved sample.



### ***Non-response weighting for the nurse visit, blood and saliva samples***

Three further weights were calculated for the core sample, as well as weights to allow for non-response at the interview stage. One was to adjust for non-response to the nurse visit, and the second and third to adjust for non-response for obtaining a blood or saliva sample.

### ***Weighting for the accelerometry sub-sample***

Weights were calculated for the accelerometry sub-sample to adjust for dwelling unit and household selection, and for the age/sex and region profiles of participating households. Calibration weights were generated for the interview data, nurse data and blood and cotinine data for the accelerometer sample.

Further details on the weighting procedures are given in Volume 2, Chapter 7.

## **1.6.3 Weighted and unweighted data and bases in the report**

All 2008 data in this report are weighted. Both weighted and unweighted bases are given in each table in the report. The unweighted bases show the number of participants involved. The weighted bases show the relative sizes of the various sample elements after weighting, reflecting their proportions in the English population, so that data from different columns can be combined in their correct proportions.

Non-response weighting was introduced to the HSE in 2003, and has been used in all subsequent years. In this report, most chapters focus on 2008 results, but in a small number of chapters trend tables are presented. In tables for adults, results for years up to 2002 are unweighted and from 2003 onwards results are weighted. For tables showing trends in children's data, results for years up to 2002 have selection weighting only, and results for 2003 onwards have selection and non-response weighting.

## **1.6.4 Age as an analysis variable**

Age is a continuous variable but results are presented in the report by age groups. Age in Health Survey for England reports always refers to age at last birthday.

## **1.6.5 Age standardisation**

Adult data have been age-standardised throughout the 2008 report to allow comparisons between groups after adjusting for the effects of any differences in their age distributions. When different sub-groups are compared in respect of a variable on which age has an important influence, any differences in age distributions between these sub-groups are likely to affect the observed differences in the proportions of interest.

It should be noted that all analyses in the report are presented separately for men and women. All age standardisation has been undertaken separately within each sex, expressing male data to the overall male population and female data to the overall female population. When comparing data for the two sexes, it should be remembered that no age standardisation has been introduced to remove the effects of the sexes' different age distributions.

Details of the direct standardisation method used are given in Volume 2, Chapter 8.

## **1.6.6 Standard analysis breakdowns**

For most tables in this report, three standard analysis breakdowns have been used as well as age. The first of these is Strategic Health Authority (SHA), the second is equivalised household income, and the third is Spearhead status.

### ***Strategic Health Authority***

From July 2006 a new configuration of Strategic Health Authorities (SHAs) was introduced in England, reducing the number from 28 to 10 SHAs. (The boundaries are the same as those of Government Office Regions with the exception of South East Coast SHA and South Central SHA, which are combined into the South East GOR.)



Both observed and age-standardised data are provided by SHA in the tables. Observed data can be used to examine actual prevalence or mean values within a region; age-standardised data are required for comparisons between areas to exclude age-related effects, and are discussed in the report text.

It should be noted that base sizes for SHAs are often relatively small, and caution should be exercised in examining regional differences.

### ***Equivalised household income***

The second standard breakdown looks at equivalised household income. Household income was established by means of a show-card (see Appendix A in Volume 2) on which banded incomes were presented. This can be used as an analysis variable, but there has been increasing interest recently in using measures of equivalised income that adjust income to take account of the number of persons in the household. To derive this, each household member is given a score based, for adults, on the number of adults apart from the household reference person, and for dependent children, on their age. The total household income is divided by the sum of the scores to provide the measure of equivalised household income. All individuals in each household were allocated to the equivalised household income quintile to which their household had been allocated.

Further details about equivalised household income are given in the Glossary at the back of Volume 2.

### ***Spearhead status***

Spearhead PCTs are the most health deprived areas of England. They are defined as the Local Authority (LA) areas that are in the bottom fifth nationally for three or more of the following five indicators:

- Male life expectancy at birth
- Female life expectancy at birth
- Cancer mortality rate in those aged under 75
- Cardiovascular disease (CVD) mortality rate in those aged under 75
- Index of multiple deprivation 2004 (LA summary), average score.

These local authority areas have been mapped onto primary care trust boundaries to identify Spearhead PCTs. This report uses Spearhead status as designated in 2008.

## **1.6.7 Logistic regression analysis**

Logistic regression modelling has been used in two chapters to examine the factors associated with selected outcome variables, after adjusting for other predictors. For instance in Volume 1, Chapter 4, regression analyses have been performed to examine the association between lack of cardiovascular fitness (the outcome variable), and a variety of predictor variables including age, participants' self-reported and objectively measured physical activity, BMI status and income. Forward stepwise models have been used for men and women separately. A wide range of possible predictor variables were tested in each model, and any that were significant among men or women were included in the final model in both sexes, as is customary practice in HSE reports. This gives an estimate of the independent effect of each predictor variable on the outcome when all the other independent variables were included in the model.

The results of the regression analyses are presented in tables showing odds ratios for the final models, together with the probability that the association is statistically significant. The predictor variable is significantly associated with the outcome variable if  $p < 0.05$ . The models show the odds of being in the particular category of the outcome variable (i.e. lacking fitness) for each category of the independent variable (e.g. whether overweight or obese). Odds are expressed relative to a reference category, which has a given value of 1. Odds ratios greater than 1 indicate higher odds, and odds ratios less than 1 indicate lower odds. Also shown are the 95% confidence intervals for the odds ratios. Where the interval does not include 1, this category is significantly different from the reference category. Missing values were included in the analyses, that is, people were included even if they did not have a valid answer, score or classification in one or more of the explanatory variables.

Where this was a large number of people, the missing values were included as a separate category (e.g. income), and where there were few records with a missing value, these individuals were included with the category containing the largest number of informants (e.g. current smokers).

### 1.6.8 Presentation of results

Commentary in the report highlights differences that are statistically significant at the 95% level. It should be noted that statistical significance is not intended to imply substantive importance.

A summary of findings is presented at the beginning of each chapter. Following the chapter introduction and details of methods and definitions, the results are outlined in detail, and a discussion section at the end of some chapters makes comparisons with other data sources and trend data, and sets the results in a broader context.

### 1.6.9 Availability of unpublished data

As with the previous surveys, an anonymised copy of the 2008 Health Survey for England data will be deposited at The Data Archive at the University of Essex. Copies of the data files can be obtained for specific research projects from the Archive: [www.data-archive.ac.uk](http://www.data-archive.ac.uk)

In addition, trend tables showing data for variables collected every year ('core' modules) for adults and children are available on The NHS Information Centre's website.<sup>12</sup>

## 1.7 Content of this report

This volume contains chapters with substantive results from the HSE 2008, and is one of two volumes based on the survey, published as a set as 'The Health Survey for England 2008':

1. Physical activity and fitness<sup>13</sup>
2. Methods and documentation<sup>14</sup>

Volume 2 gives full details of the survey methods and documentation. This includes a description of the survey design and response rates; sampling errors; analysis of non-response; description of weighting procedures; and information on laboratory techniques and quality control of analysis of saliva and blood samples. Appendices to Volume 2 are as follows:

- Appendix A: Questions asked by interviewers and nurses and copies of other key fieldwork documents
- Appendix B: Protocols for measurements
- Appendix C: Glossary and definitions

### References and notes

- 1 The Chief Medical Officer. *At least five a week: evidence on the impact of physical activity and its relationship to health*. Department of Health, London, 2004.
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- 9 Metabolic syndrome is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes. The disorders include central obesity, abnormal fat levels in the blood which can lead to arteriosclerosis (fatty plaques) on the walls of blood vessels, high blood pressure and insulin resistance or glucose intolerance.
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- 12 <http://www.ic.nhs.uk/pubs/08trends>
- 13 Craig R, Mindell J and Hirani V (eds). *Health Survey for England 2008. Volume 1: Physical activity and fitness*. The NHS Information Centre, Leeds, 2009.
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# Self-reported physical activity in adults

## 2

Marilyn Roth

### Summary

- This chapter focuses on self-reported physical activity in the English adult population. Information was collected using the new, enhanced version of the HSE physical activity questionnaire.
- Physical inactivity is associated with all-cause mortality and many chronic diseases, including ischaemic heart disease, diabetes, certain cancers, and obesity. Previous surveys have found that a minority of people meet the current minimum recommendations (30 minutes or more activity per day of at least moderate intensity, on at least five days per week). In 2007, many people attributed their failure to achieve the target recommendations to work commitments and not having enough time to exercise.
- In 2008, based on self-reported physical activity, 39% of men and 29% of women aged 16 and over met the Chief Medical Officer's minimum recommendations for physical activity in adults (using information from the enhanced 2008 questionnaire). The proportion of both men and women who met the recommendations generally decreased with age.
- The proportion of adults meeting the physical activity recommendations has increased steadily since 1997 for men and 1998 for women. In 1997, 32% of men met the recommendations, increasing to 42% in 2008. For women, 21% met the recommendations in 1997, increasing to 31% in 2008. Results for the trend data were calculated using the previous version of the summary activity level variable, which did not include detailed information on occupational activity, so that they were comparable with previous years.
- Achieving the recommended amount of physical activity was significantly related to region, equivalised household income, and Spearhead status. For men, there was little variation with income except that those in the lowest income quintile were least likely to meet the target (31%). For women, the proportion meeting the target generally decreased with household income (from 34% in the highest quintile to 26% in the lowest quintile). Men and women living in non-Spearhead PCTs were more likely to meet the physical activity target than those living in Spearhead PCTs.
- There was a clear association between meeting the physical activity recommendations and BMI category. 46% of men and 36% of women who were neither overweight nor obese met the recommendations, followed by 41% of men and 31% of women who were overweight and only 32% of men and 19% of women who were obese.
- Men averaged more days than women in each activity except heavy housework. The most common type of activity for men was sports and exercise (51% had participated in the last four weeks) and least common was heavy manual/gardening/DIY activities (28% had participated in the last four weeks). For women, heavy housework was the most common activity (59%), while heavy manual/gardening/DIY activities were least common (12%). On average, men participated in non-occupational physical activity on 13.9 days in the past four weeks, compared with 12.2 days for women. 18% of men

and 21 % of women spent no time in non-occupational physical activity in the last four weeks.

- Men also averaged more time than women in each activity, with the exception of heavy housework. Men aged 16-24 averaged the most hours in non-occupational physical activity (7.3 hours per week), whereas for women, those aged 25-64 averaged the most hours per week (between 5.7 and 5.8). Both men and women spent more time walking (2.2 and 1.9 hours respectively) than on any other non-occupational physical activity.
- Men and women were similar in terms of the proportion who spent at least some time walking around at work. However, men spent slightly more time than women sitting and/or standing; climbing stairs or ladders; and lifting, carrying, or moving heavy loads. Most men (62%) and women (59%) considered themselves to be very or fairly physically active at work but answers to the new occupational activity questions do not support this claim.
- Total average sedentary time on weekdays was very similar for men and women; however, on weekend days men were more likely than women to average six or more hours of sedentary time (44% and 39% respectively). For both men and women, time spent in TV watching on weekdays and other sedentary time on both weekdays and weekend days decreased into middle age and rose again into older age.
- Average sedentary time varied by BMI category. The proportion of women who spent more than four hours in sedentary time per weekday and weekend day increased as BMI category increased, and this was the case for men on weekend days. The majority of men and women spent more than four hours in sedentary time per weekday and per weekend day regardless of their BMI category.

## 2.1 Introduction

This chapter focuses on self-reported physical activity in the adult English population aged 16 and over. Questions concerned participation in housework, manual/gardening/DIY activity, walking, sports and exercise, occupational activity, and sedentary time in the last four weeks. The enhanced physical activity questionnaire was developed for the 2008 Health Survey for England (HSE 2008) to catch shorter bouts of activity, and to improve measurement of occupational activity, a domain that was previously not well captured. Variations in summary activity levels are presented in relation to socio-demographic characteristics. This chapter also presents trends in physical activity over time using HSE data from 1997, 1998, 2003, 2004, 2006 and 2008, and includes analysis of the proportion of the adult population meeting the current physical activity recommendations. Despite the additions to the enhanced questionnaire, trends can still be compared using definitions and questions used in previous years.

Physical activity has become an increasingly important public health issue as governments attempt to curb the levels of child and adult obesity. The health benefits of a physically active lifestyle have been well documented.<sup>1,2</sup> Physical inactivity is associated with many chronic conditions, including ischaemic heart disease,<sup>3</sup> diabetes,<sup>4</sup> osteoporosis,<sup>5</sup> certain types of cancer,<sup>6,7</sup> as well as obesity, which itself contributes to many of these diseases.<sup>1</sup> Physically active adults have a 20-30% reduced risk of premature death and up to 50% reduced risk of developing major chronic diseases.<sup>1</sup> Moreover, participation in regular physical activity can increase the quality of life and independence in older age<sup>8</sup> and, by increasing muscle strength, reduce the risk of falls and broken hips which are a major cause of mortality amongst the elderly.<sup>8</sup> The amount of habitual physical activity undertaken is also closely linked with all-cause mortality risk,<sup>9</sup> yet the majority of people in many countries do not accrue sufficient exercise to derive health related benefits.<sup>10</sup>

In England, physical inactivity was estimated in 2002 to cost £8.2 billion a year.<sup>11</sup> The World Health Organisation (WHO) rated physical inactivity as one of the leading causes of death in developed countries. The WHO estimated that physical inactivity is responsible for 22-23% of coronary heart disease, 16-17% of colon cancers, 15% of diabetes, 12-13% of strokes, and 11% of breast cancers.<sup>12</sup> The time spent sedentary is at least as important as moderate-intensity physical activity as a disease risk factor: sedentary behaviours are also associated with increased risk of obesity and cardiovascular disease independently of moderate to vigorous activity levels.<sup>13</sup>

The majority of adults in England would like to do more physical activity; however, both men and women cite work commitments and not having enough leisure time as the most common barriers to doing more physical activity. Similarly, both sexes most frequently mention having more leisure and self-motivation as factors that would encourage them to do more physical activity.<sup>14</sup>

Increasing physical activity amongst adults has been a subject of public health promotion policies and government health strategies in England since the early 1990s.<sup>1,11,15,16,17</sup> Guidelines for physical activity for maintaining optimal health have been available since the mid to late 1970s.<sup>18</sup> Recent National Institute for Health and Clinical Excellence (NICE) guidance highlights the contribution of regular physical activity to promoting the health of communities.<sup>19</sup> In 2004, the Chief Medical Officer (CMO) published '*At least five a week: evidence on the impact of physical activity and its relationship to health*'.<sup>1</sup> It is recommended that adults be active at moderate or greater intensity for at least 30 minutes a day either in one session or through shorter bouts of activity of 10 minutes or longer, on at least five days a week. The recommended targets can be achieved through lifestyle activity, or structured exercise or sports, or a combination of these. These recommendations are also considered to be appropriate for older adults.

'Game Plan' set out physical activity targets for the UK:

- By 2020, 70% of adults should be undertaking 30 minutes of physical activity on at least 5 days a week.



- An interim target was also specified: 50% of individuals partaking in this amount of physical activity by 2011.<sup>11</sup>

In 2006, 34% of the adult population undertook that level of activity.<sup>20</sup> This aspirational target was based on the levels of physical activity that have been reported in Scandinavian countries and in particular in Finland.<sup>11</sup> The report further highlighted its primary aim, *‘to develop a sport and physical activity culture to produce a fitter, more active population and realise the significant health benefits and savings available, and the potential wider social benefits. Such an aim requires long-term cultural change’*.

Regarding participation in formal sports, *‘Game Plan’* was replaced by *‘Playing to Win’*, which focuses on increasing sport participation by 2012, the London Olympics, particularly among children and young people.<sup>21</sup> The government has also produced policy, programmes and additional targets in an attempt to increase levels of activity in the general population. The Department of Health recently published *‘Be active, be healthy: A plan for getting the nation moving’*, which outlined strategies to increase physical activity and targets they hope to achieve. They have set three targets for 2012:

- Lift one million people out of inactivity by reducing the proportion of the population achieving 30 minutes of continuous physical activity on less than one day per week;
- Help 200,000 more people to realise the general health benefits of achieving 30 minutes of physical activity on five or more days per week; and
- Increase the average weekly duration of physical activity by approximately 5% over the baseline.<sup>22</sup>

Monitoring whether these targets are achieved is essential; the HSE plays an important role as a monitoring tool. There are several advantages to using the HSE to assess whether the physical activity targets in *‘Game Plan’* and *‘Be active, be healthy’* are being met. For instance, the HSE is a continuous survey and is, therefore, immune to seasonal effects on physical activity levels. Moreover, existing data allow for the retrospective assessment of physical activity trends from 1997 or 1998, depending on the measure.

The prevalence of obesity, the ‘disease of the millennium’, rose steadily in the UK among adults and children from the early to mid-1990s until the early 2000s.<sup>14</sup> Some evidence suggests that physical inactivity and the overall decrease in energy expenditure levels contribute to the rise in obesity at least as much as, if not more than, dietary intake and related factors.<sup>23</sup> However, caution should be exercised when considering results that suggest physical activity levels are declining,<sup>24</sup> as much of the evidence which supports this claim is based on proxy measures (e.g. TV watching<sup>25</sup> and increased car usage<sup>26</sup>), rather than direct measures or reports of physical activity like those used in the HSE.

There are various limitations in using a questionnaire to collect data about physical activity. Self-reported physical activity measures are well known to have limitations in the scope of their measurement.<sup>27</sup> For example, sports and exercise are typically carried out in a planned and organised manner and therefore are relatively easy to recall. However, routine activities such as domestic activity (housework, gardening, etc) and walking or cycling for travel rather than leisure, which are categorised as ‘lifestyle’ activities by the Chief Medical Officer, are more difficult to recall and report. As a result, there are a number of areas where error may be introduced in subjectively measured activities:

- Participants may experience difficulty in recalling all activities (this can lead to either under-reporting, if they omit activities, or over reporting, if they include activities beyond the recall period).
- Individuals’ assessment of the duration and intensity of physical activity may be inaccurate.
- Social desirability biases – participants may overestimate their levels of activity to provide socially desirable answers.

Moreover, while questionnaires can provide broad estimates of physical activity that can be used to assess health benefits, self-report questionnaires have been found to be of limited usefulness for measuring energy expenditure to enable ‘energy in/energy out’ comparisons



at an individual level. For this, much more detailed recording of precise durations, types and intensity of all activities is necessary than is usually feasible in a questionnaire.<sup>28,29</sup>

Self-reported physical activity measures are, therefore, subject to recall limitations, as well as social desirability bias, and lack of objectivity.<sup>27,30,31</sup> Chapter 3 introduces accelerometry, an objective measure for physical activity, and discusses the advantages and disadvantages of that type of measure. However, despite the limitations, questionnaires are the most practical and cost-effective way of measuring physical activity in large-scale epidemiological research.

The HSE is the only nationally representative, population-based survey that has collected multiple-domain (i.e. occupational, lifestyle, sport and exercise) physical activity data in England several times since its inception in 1991. However the questionnaires had not previously been validated against objective measures. Given the inherent limitations of subjective measures of physical activity, it was essential that the adult and children's newly revised questionnaires were assessed for reliability and validity against an objective measure, which was done in 2007 in preparation for HSE 2008.<sup>32</sup>

## 2.2 Methods and definitions

### 2.2.1 The physical activity questionnaire

This section describes the evolution of the various different questionnaires that have been used in the HSE to assess adult physical activity, and then describes the specific differences in more detail.

Information was collected in 2008 using the enhanced long version of the HSE physical activity questionnaire developed and validated in 2007. The questions for the HSE were derived from a major national study of activity carried out in 1990, the Allied Dunbar National Fitness Survey.<sup>33</sup> The physical activity module was first used in the HSE 1991, repeated in 1992 to 1994 with minor changes, and received more substantial revisions in 1997 and 1998 (producing what is generally referred to as the 'long' version of the questionnaire). A 'shorter' version of the questionnaire was introduced in 1999, when the focus was minority ethnic groups; the shorter questionnaire was repeated in 2002, 2003 and 2004. In 2006, a slightly modified version of the long (1998) form of the questionnaire was used. Questions concerned participation during the last four weeks in housework, manual/gardening/DIY activities, walking and sports and exercise; the differences between questionnaires relate to the minimum time spent in an activity for it to be recorded, as detailed below. The other main difference from the 1998 questionnaire was that from 1999 to 2006, only a single question relating to occupational activity levels was included.

In 2008, the enhanced version of the physical activity questionnaire was used in the main HSE for the first time. It has additional question sets relating to occupational activity, sedentary activity, and follow-up questions for those people who swim, work out at a gym or do exercise classes. In 2008, the reference period for bouts of activities to report was lowered from 15 minutes to 10 minutes to reflect changes in policy recommendations for physical activity. The enhanced questionnaire was validated in 2007.<sup>32</sup> In total, 112 adults aged 16 and above were involved in the validation study. It found the enhanced questionnaire to have moderate to substantial repeatability, and, when compared with accelerometry data, to have fair external validity for meeting the recommendations as well as moderate external validity for the amount of moderate activity.<sup>32</sup> These results compare well with published studies of other physical activity questionnaires.<sup>34,35</sup> Further analyses of the HSE 2008 data are being conducted to repeat these analyses with greater power.<sup>36</sup>

The new occupational activity questions were included to capture more accurate information about activity whilst at work. Previous HSE occupational activity questions simply asked whether the respondent was very physically active, fairly physically active, not very physically active, or not at all physically active, then used arbitrary estimations of 12 or 20 working days depending whether the respondent worked full or part time to assess

levels of activity whilst at work. The new questions focus on what people actually do at work, and ask how many hours they typically work and on how many days, to capture these data more accurately.

There had been concern about overestimating the level of intensity of swimming, so a question was asked to capture information on what type of swimming people were normally doing (i.e. splashing around or swimming lengths or both). Likewise, questions were asked relating to what activities people do at the gym or when they work out, as different activities have different intensity levels.

The enhanced questionnaire also asks about sedentary time. Because of emerging evidence of the importance of sedentary time as a risk factor for obesity and disease,<sup>13</sup> a short set of questions were developed asking about television watching and about other time spent sitting down in leisure time activities, such as reading, studying, using a computer, playing video games, on weekdays and at weekends.

Adults' physical activity in the four weeks prior to interview was measured in HSE 2008 by examining overall participation; frequency of participation in activities that lasted at least 10 minutes; type of activities; and duration of activities. A question about intensity of the activity was asked for sports and exercise and for walking. Responses to the questions on occupational activity were taken into account in the estimation of the summary activity levels.

This chapter also includes an analysis of physical activity over time. These comparisons include Health Survey data from 1997, 1998, 2003, 2004, 2006, and 2008. It was not possible to include 1994 or earlier data due to important differences in the questions, which would limit the meaningfulness of these comparisons. In 2003 and 2004 the short version of the questionnaire was administered, and 1997, 1998, and 2006 results were recalculated in order to allow comparison. To enable continuation of these trend data, the same methods for analysis were used in 2008, as well as the more detailed definition possible for 2008 using the enhanced questionnaire.

In summary, the key differences between the physical activity questions in 2008 and previous years were that the lower duration limit for an activity (including walking) to be included was 10 minutes in 2008, 15 minutes in 1997, 1998 and 2006, and 30 minutes in 2003 and 2004; and that occupational activity was determined by a single question in 1999 to 2006 but by more detailed, though different, questions in 1998 and 2008.

### **Activity types, frequency, duration, and intensity**

Details about four main types of physical activity were included in the questionnaire. For most activities in which they had participated, respondents were asked on how many days in the last four weeks they had done the activity for at least 10 minutes, and the average length of time spent on those days.

1. Home activity consisted of housework and gardening/DIY/building that lasted 10 minutes or more. The lead-in question was *'Have you done any housework in the last four weeks?'* Participants were shown a card with a list of examples of light housework and were asked if they had done any of the listed activities. (The show cards are included in Volume 2 of this report, Methods and documentation). They were then asked about heavy housework by showing another card with higher intensity activities, for which frequency was assessed. A similar sequence of questions was asked for gardening/DIY/building work. Frequency of light home activity (i.e. those activities listed in the first set of show cards) was not assessed.<sup>37</sup>
2. Walks of 10 minutes or more. The key question was *'During the past four weeks, on how many days did you do a walk of least 10 minutes?'* Walking intensity was assessed by asking participants to rate their usual walking pace (slow / average / fairly brisk / fast).
3. Sports and exercise activities that lasted 10 minutes or more. For sports and exercise activities in the four weeks prior to interview, participants were asked *'Can you tell me on how many separate days did you do (name of specific sport and exercise activity) for at*

*least 10 minutes at a time during the past four weeks...?’*, followed by a question about the activity’s usual duration on these days. The intensity of these activities was assessed by asking participants whether or not the activity had made them *‘out of breath or sweaty’*.<sup>38</sup>

4. Occupational activities that lasted 10 minutes or more. After establishing whether participants did any paid or unpaid work in the last four weeks, the key question was *‘Which of these did you do whilst working? Sitting down or standing up; walking at work; climbing stairs or ladders; lifting, carrying or moving heavy loads’*, followed by a question about the time spent on that type of activity on these days. As in previous years, participants were also asked *‘Thinking about your job in general would you say that you are... very physically active; fairly physically active; not very physically active; not at all physically active?’*

### 2.2.2 Weighting

Trends in the proportion meeting the current physical activity recommendation were examined by comparing results from HSE 1997, 1998, 2003, 2004, 2006 and 2008. HSE data up to 2002 were unweighted; since 2003, HSE data have been weighted to adjust for non-response.

### 2.2.3 Definitions

#### *Summary activity levels*

The summary measure of physical activity levels groups participants according to the CMO’s physical activity guidelines, which are that adults should take part in activity of at least moderate intensity, of 30 minutes or more duration on five or more days per week.<sup>1</sup> The summary measure incorporates three basic dimensions (frequency, intensity, and duration) of the participants’ overall physical activity level.

The government’s recommendations changed in 1996<sup>16</sup> to allow daily activity to be accumulated in bouts of at least 10 minutes’ duration. The enhanced questionnaire has been amended for 2008 to catch shorter bouts of activity. However, the summary variable has included data only from activity spells of at least 30 minutes’ duration because of the difficulty in establishing the aggregated time on each individual day spent in different bouts of activity.

In 1998, 2003 and 2004, full time workers in manual occupations who reported being at least moderately active in their work were counted as having done 20 days’ activity in the last four weeks. Part time workers were counted as having done 12 days’ activity. Only one question relating to occupational activity was asked in 2006, whereas in 2008 participants were asked about four different types of activity at work (see 2.2.1). Participants’ activity at work was then classified by whether it was at least moderate according to their occupation, which was categorised using the Standard Occupational Classification 2000.<sup>39,40</sup> The summary variable reported in Tables 2.1 to 2.5 uses this extended occupational information. However, for comparison with earlier years, the summary variable in table 2.6 has been derived using only information available in previous years, i.e. only the original occupational question.

In 2008 the titles for the summary activity classifications have been changed to correspond better with what they actually measure, since the category previously labelled ‘high’ represents those who meet government (minimum) recommendations. ‘High’ is now referred to as ‘Meets recommendations’; ‘Medium’ is now ‘Some activity’; and ‘Low’ is ‘Low activity’.

The summary activity level classification is as follows:

#### *Meets recommendations*

20 or more occasions of moderate or vigorous activity of at least 30 minutes duration in the last four weeks (i.e. at least five occasions per week on average). This category

corresponds to the minimum activity level required to gain general health benefits (e.g. reduction in the relative risk for cardiovascular morbidity). However, it does not necessarily indicate the extent of activity required for optimal cardiovascular fitness or for optimal weight control.

### **Some activity**

Four to 19 occasions of moderate or vigorous activity of at least 30 minutes' duration in the last four weeks (i.e. at least one but fewer than five occasions per week on average).

### **Low activity**

Fewer than four occasions of moderate or vigorous activity of at least 30 minutes' duration in the last four weeks (i.e. less than once per week on average).

For comparisons of summary activity levels over time, HSE 2008 data have been analysed with the lower duration for activities set to 30 minutes, to be comparable with results obtained from the shorter questionnaire used in 2003 and 2004. 1997 and 1998 data were also reanalysed using this longer minimum duration, to enable data for the five years to be compared. In 2008 bouts of activity lasting at least 10 minutes counted towards meeting the recommendations. Therefore, three bouts of activity lasting at least 10 minutes each would be considered sufficient to meet the recommendations on that day. Because bouts of activity lasting a minimum of 30 minutes are being used for comparison with results from previous years, the results presented in this chapter are likely to be an underestimate of the proportion of the population that meets the revised recommendations.

### **Assumptions underlying the intensity level classification of physical activities**

All analyses presented in this chapter refer to physical activity of at least moderate intensity.

Walks at a 'fairly brisk' or 'fast pace' were classified as 'moderate'. Walks at a 'slow' or 'average' pace were classified as 'light'.

For home activity, (housework, manual/gardening/DIY) participants were given examples of types of housework/gardening/DIY that counted as 'heavy' and 'light'. Heavy housework and heavy gardening/DIY were classified as 'moderate', other gardening/DIY as 'light', and light housework only as 'inactive'.<sup>37</sup>

For sports and exercise, activities were classified according to the nature of the activity, and the participant's own assessment of the amount of effort involved in doing that activity. For example, cycling was counted as 'vigorous' if the effort was usually enough to make the participant 'out of breath or sweaty', otherwise as 'moderate'.<sup>41</sup>

The additional questions on occupational activity allow for the derivation of variables that measure the amount of time spent doing light, moderate and vigorous physical activity at work.

### **MVPA**

Moderate to vigorous physical activity (MVPA) was based on the MET (metabolic equivalent) intensities of different physical activities. MET intensity level is the ratio of the intensity of metabolic rate needed for a particular activity to the resting metabolic rate. MET levels can be linked to specific activities in various settings. MVPA includes moderate (3 – 6 METs) and vigorous (more than 6 METs) intensity activities, including occupational activities.<sup>38</sup>

In 2008, information on activity spells of at least 10 minutes' duration have been included in the tables showing participation, frequency, and duration of activity by type of activity.

### **Sedentary time**

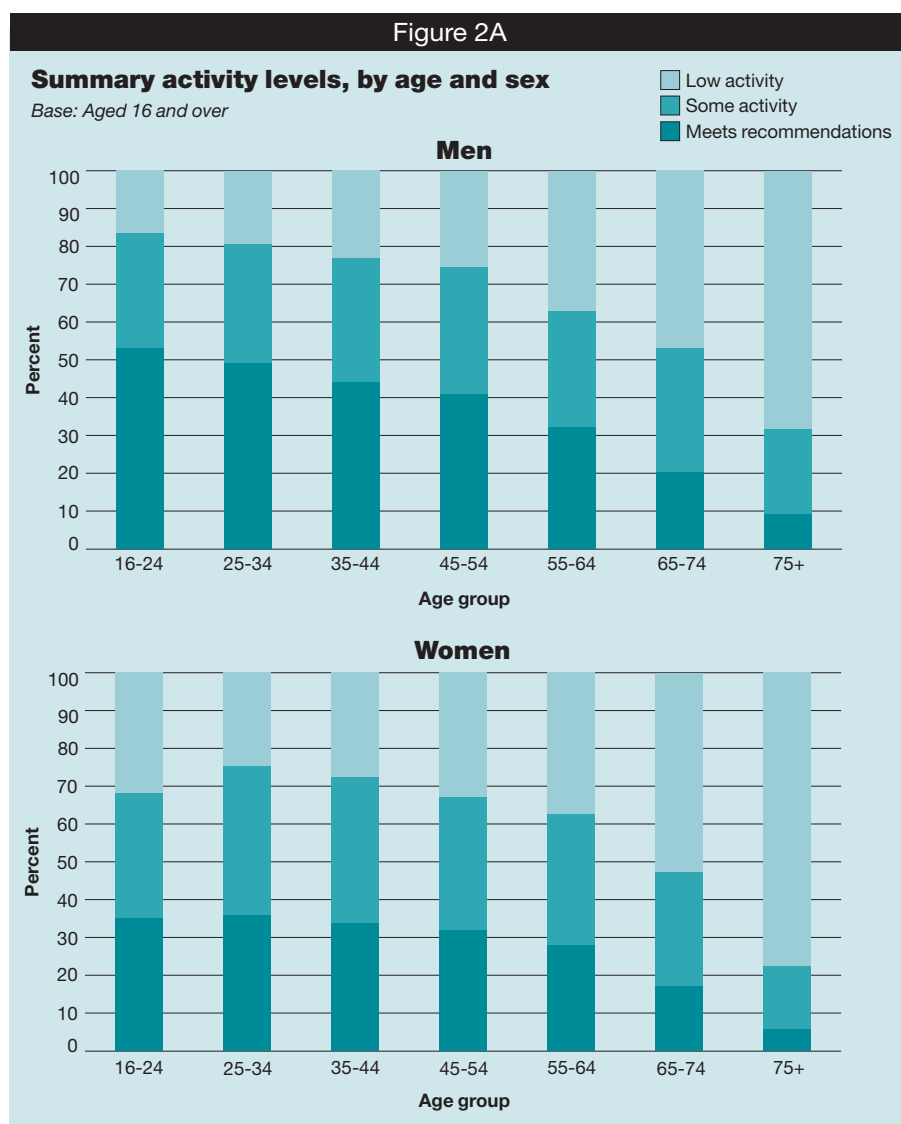
The section on sedentary time estimates how much time on average people spend watching television, as well as how much time on average people spend in other sedentary time, doing such things as reading, eating a meal/snack, studying, drawing, using a computer or playing video games. This is recorded both by weekday, weekend day, and combined. Total sedentary time is also estimated.

## 2.3 Self-reported summary activity levels

### 2.3.1 Summary activity levels, by age and sex in the population

A higher proportion of men (39%) than women (29%) met the weekly recommendations of physical activity of 30 minutes or more moderate or vigorous activity on at least five days per week. As Figure 2A shows, the proportion meeting the recommendations fell with age for both sexes. This decline was steeper in men; moreover, there was a decline across all age groups in men, whereas for women, this decline only became apparent beginning in those aged 45-54.

The proportion of adults in the 'low' activity level, defined as fewer than four occasions of 30 minutes or more of moderate or vigorous activity in the preceding 28 days, increased with age and was particularly high among men and women aged 75 or older.



The proportion of men and women who met the recommendations dropped slightly with the incorporation of the information from the new occupational activity questions into the new summary activity level (from 42% of men and 31% of women using the same occupational information as in previous years).<sup>14,20</sup> However, the overall pattern of activity is the same as in previous years.

**Table 2.1, Figure 2A**

The aspiration set out in 'Game Plan'<sup>11</sup> is to have 70% of adults undertaking 30 minutes of physical activity on at least five days a week by 2020 and 50% by 2011. This will require a considerable increase over the current level of 34%.

Two targets for 2012 outlined in *'Be active, be healthy: A plan for getting the nation moving'*<sup>22</sup> (and described in section 2.1 above) were to:

- Lift one million people out of inactivity by reducing the proportion of the population achieving 30 minutes of continuous physical activity on less than one day per week;
- Help 200,000 more people to realise the general health benefits of achieving 30 minutes of physical activity on five or more days per week.

So far this chapter has provided prevalence percentages. Translating the prevalence percentages of adults in each of these target groups into population numbers, Table 2A shows the current population numbers and the target population numbers for 2012. The aim is for almost 15.2 million adults to be in the group meeting recommendations, and fewer than 12.7 million in the 'low activity' group by 2012.

**Table 2A**

Table 2A			
<b>2012 target population numbers for meeting recommendations and low activity groups, based on 'Be active, be healthy'</b>			
Activity level	2008 prevalence in HSE	Estimated number of adults in England in 2008 <sup>a</sup>	Target for 2012
Meets recommendations (at least 30 mins MVPA <sup>b</sup> at least five times per week)	34%	14,961,000	15,161,000
Low activity: 30 mins MVPA less than once per week)	34%	13,669,000	12,669,000

<sup>a</sup> Based on HSE Population number estimate tables 2008 for adults aged 16 and over.<sup>42</sup>

<sup>b</sup> MVPA: moderate (3-6 METs) and vigorous (more than 6 METs) intensity activities.

### 2.3.2 Summary activity levels, by socio-economic characteristics

The proportion of adults doing the recommended amount of physical activity varied by Strategic Health Authority, but no particular region stood out.

**Table 2.2**

The proportion of participants meeting the physical activity recommendations varied by equalised household income, but the pattern was different for men and women. As shown in Figure 2B, for men, there was little variation with income in the top four quintiles, while men in the lowest income quintile were least likely to meet the targets (31%). For women, the proportion meeting the targets was highest in the top quintile (34%), and there was little variation in the lowest four. The proportion in the low activity group increased as income decreased, from 23% of men and 28% of women in the highest quintile to 46% of men and 45% of women in the lowest.

**Table 2.3, Figure 2B**

Men and women living in non-Spearhead PCTs<sup>43</sup> were more likely to meet the physical activity targets than those living in Spearhead PCTs.

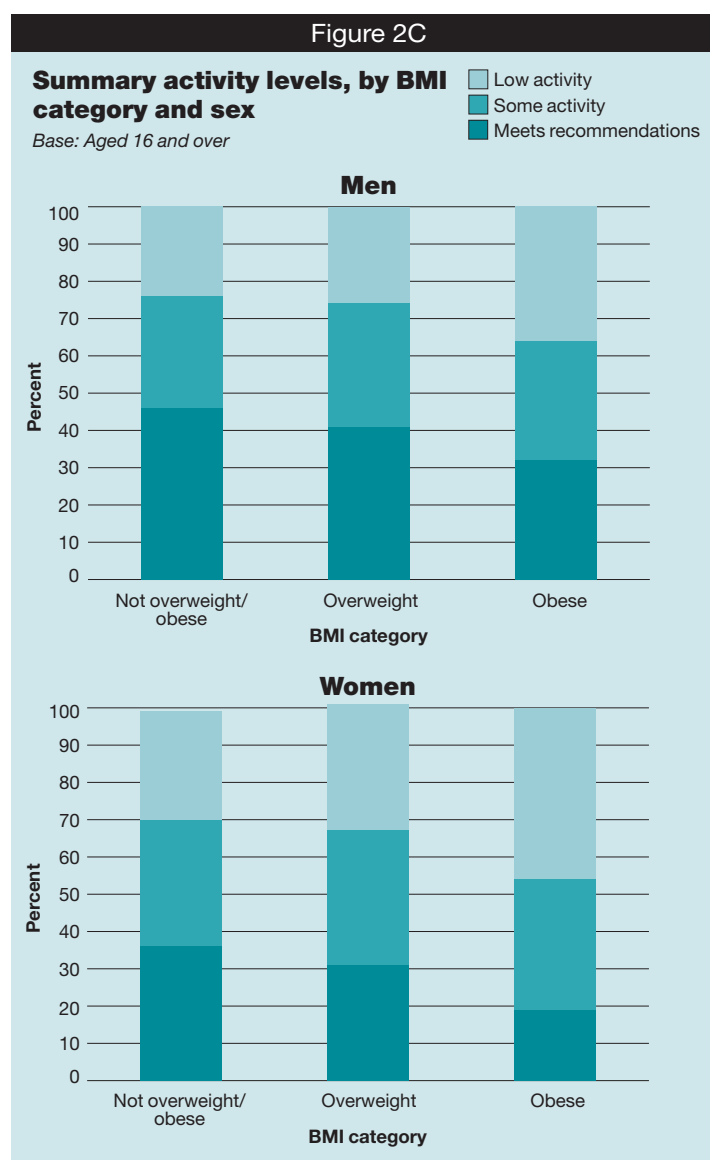
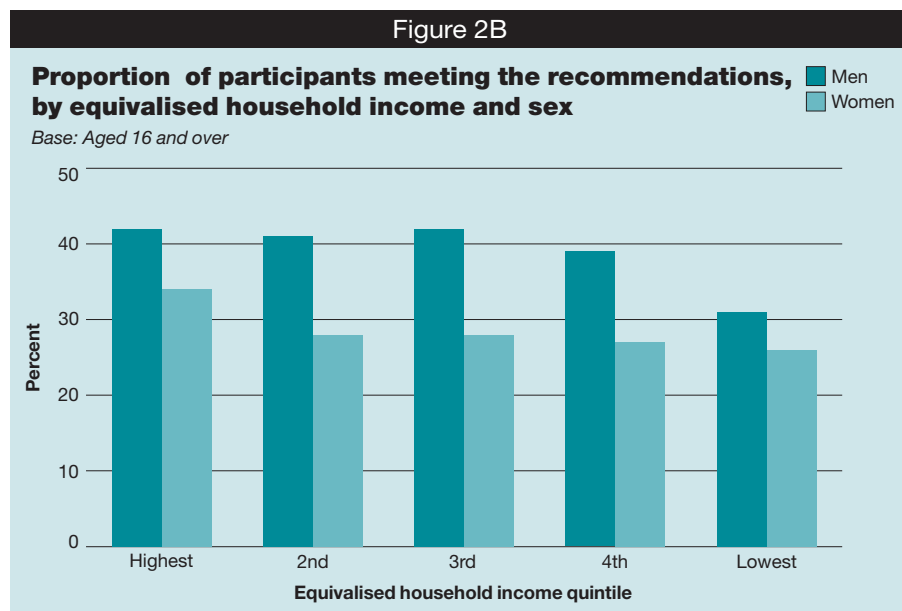
**Table 2.4**

### 2.3.3 Summary activity levels, by BMI categories

Figure 2C shows the proportions in each summary physical activity level by BMI category. Both men and women who were overweight (BMI 25 to less than 30 kg/m<sup>2</sup>) or obese (BMI 30 kg/m<sup>2</sup> or more) were less likely to meet the recommendations compared with men and women who were not overweight or obese (BMI less than 25 kg/m<sup>2</sup>). 46% of men who were not overweight or obese met the recommendations, compared with 41% of overweight men and 32% of obese men. A similar pattern emerged for women, with 36% of women who were not overweight or obese in category meeting recommendations, compared with 31% of overweight and 19% of obese women. Given these findings, it is not surprising that obese men and women had the highest rates of low activity (36% and 46% respectively).

**Table 2.5, Figure 2C**





### 2.3.4 Trends in summary activity levels

The proportion of adults meeting the physical activity recommendations has increased steadily since 1997 for men and 1998 for women. This increase has occurred across all age

groups, and was of similar magnitude in both sexes. In 1997, 32% of men met the recommendations, increasing to 42% in 2008. For women, 21% met the recommendations in 1997, increasing to 31% in 2008, based on information consistent with that used previously.

Table 2.6

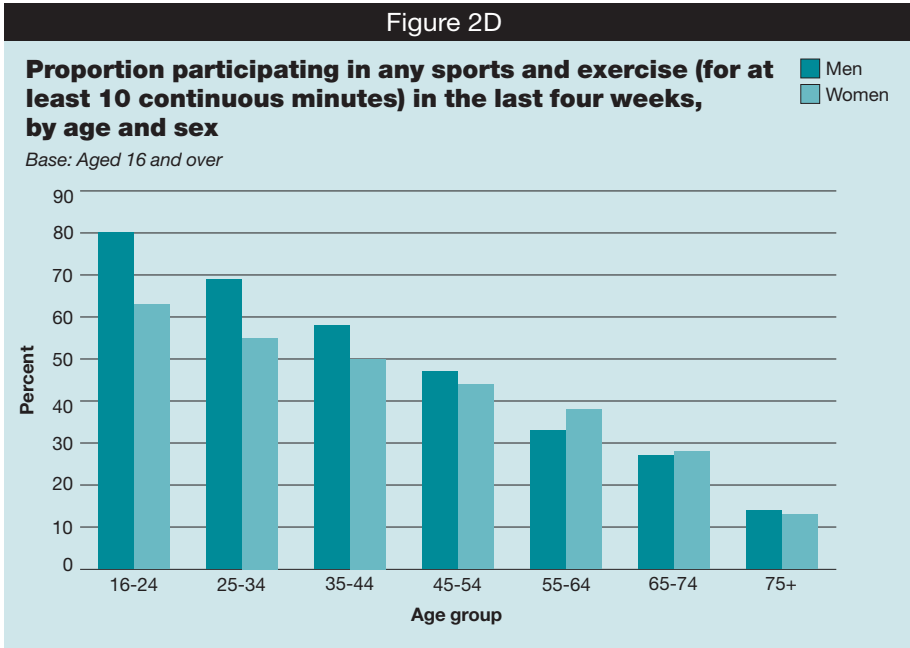
## 2.4 Self-reported participation in physical activities and sedentary time

### 2.4.1 Participation in different activities, by age and sex

Table 2.7 shows the number of days’ participation in different activities in the last four weeks. The most common type of activity for men was sports and exercise (51% had participated in the last four weeks) and least common was heavy manual/gardening/DIY activities (28% had participated in the last four weeks). For women, heavy housework was the most common activity (59%), while heavy manual/gardening/DIY activities were least common (12%). Men were generally more likely than women to have spent at least one day participating in sports and exercise, walking, and heavy manual/gardening/DIY activities, but women were more likely to have spent at least one day in heavy housework. Similarly, men averaged more days’ participation in each activity except heavy housework.

For both men and women, participation in walking and in sports and exercise generally fell with age. Men and women also had similar patterns by age in the number of days’ participation in heavy housework and heavy manual/gardening/DIY activities, with participation in these generally lowest in the youngest and oldest age groups.

It is important to note, however, that while the variation with age in terms of participation in these activities was similar for men and women, there were small yet significant differences for each activity. In most cases these small differences were due to either the relationship between the variable of interest increasing/decreasing at a steeper rate for one sex compared with the other (e.g. sports and exercise had a steeper decline with age for men than for women, as shown in Figure 2D), or due to variation in the age at which men’s and women’s participation in that particular activity peaked (e.g. the proportion of men participating in any leisure time physical activity peaked in those aged 16 to 34, whereas for women it peaked in those aged 25 to 44).

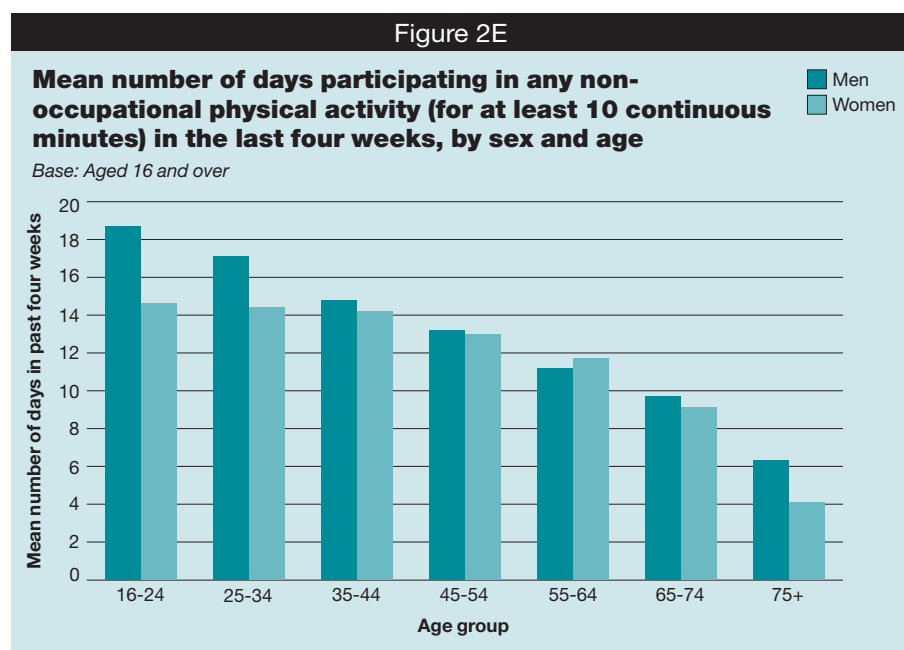


On average, men participated in non-occupational physical activity on 13.9 days in the past four weeks, compared with 12.2 days for women. 18% of men and 21% of women did not participate in any leisure time activities in the last four weeks. The average number of days’



participation declined with age, as shown in Figure 2E. It should be noted that unlike previous years, participation in ‘any physical activity’ reported in Tables 2.7 and 2.8 has been limited to non-occupational activity; occupational activity is presented separately in Table 2.9.

Table 2.7, Figures 2D, 2E



Results from Table 2.8, which displays the average time spent participating in different activities per week, were very similar to those from Table 2.7. Men spent more time on average than women in each activity, with the exception of heavy housework. Both men and women spent more time walking (2.2 and 1.9 hours respectively) than on any other non-occupational physical activity. Overall, men averaged 6.0 hours and women averaged 5.0 hours in any non-occupational physical activity per week.

For men, average hours spent in non-occupational activity per week peaked in those aged 16-24 (7.3 hours) and generally declined with age. For women, average hours spent in any activity was generally similar among most age groups, and highest for women aged 25-64 (ranging from 5.7 to 5.8 hours).

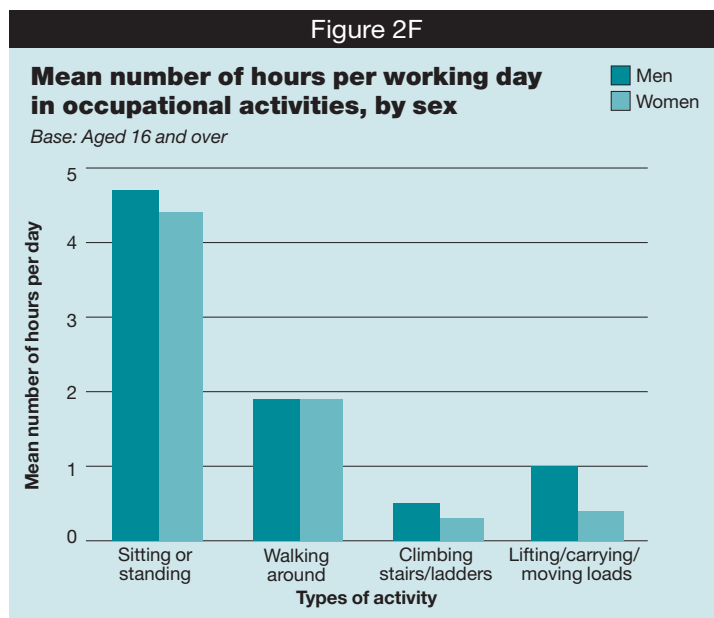
Time spent in heavy housework remained relatively stable for women aged 25-64 and men aged 25-74. Overall, women averaged 1.7 hours per week in heavy housework compared to only 0.9 hours for men.

A similar pattern emerged for average time spent in heavy manual/gardening/DIY activities except that men averaged more time per week than women (1.1 hours and 0.4 hours respectively). Average time spent in manual/gardening/DIY activities remained stable for men and women aged 35-74.

For both men and women, mean hours spent in sports and exercise peaked in those aged 16-24 before declining steadily with age. This decline was much sharper in men. **Table 2.8**

## 2.4.2 Occupational activity, by age and sex

The occupational activity results are based on adults aged 16-74 who reported working in the last four weeks, including unpaid work. The questions cover moderate intensity activity as well as low intensity or sedentary activity at work. As Figure 2F shows, men averaged significantly more time than women in terms of sitting or standing, climbing stairs or ladders, and lifting, carrying, or moving heavy loads (but men averaged more time at work overall and therefore would be expected to spend more time in each activity category). It should be noted that the majority of both sexes did not spend any time in these last two activities. Men and women spent similar amounts of time walking around.



Time spent in each type of occupational activity also varied by age. For the most part, men and women aged 16 to 24 were least likely to spend time sitting or standing, and most likely to spend time walking and lifting, moving or carrying heavy loads. Men aged 35-44 and women aged 45-54 were most likely to spend some time climbing stairs or ladders, although among those aged 16-64 the average number of hours spent climbing was similar within sex (0.4-0.5 hours for men, 0.3 hours for women). The pattern of activity by age was fairly similar for men and women, with the proportion spending time sitting or standing increasing after age 16 to 24, and then remaining fairly stable among older adults. The proportion who spent at least some time walking around or lifting, carrying, or moving heavy loads generally declined with age for both sexes.

Summary rows in Table 2.9 show the proportion of working adults aged 16-74 that spent at least 30 minutes per working day doing at least moderate intensity activity. An adult who did at least 30 minutes of moderate activity at work would meet the recommended target for that day. 24% of men and 11% of women spent, on average, 30 minutes in at least moderate activity at work per day. Men were more likely than women to meet the physical activity recommendations through work in every age group. Men aged 16-24 were most likely to spend at least 30 minutes per day in moderate activity at work (30%). The proportion of women meeting the recommendations through occupational activity did not vary much by age.

Most men (62%) and women (59%) considered themselves to be very or fairly physically active at work. Men were more likely to perceive themselves to be very or fairly physically active compared with women. Self-rated physical activity at work also varied by age, with men and women aged 16 to 24 being most likely to perceive themselves as very or fairly active at work. Interestingly, both men and women aged 55 to 74 were more likely to rate themselves as very or fairly physically active at work than those aged 25-54.

Table 2.9, Figure 2F

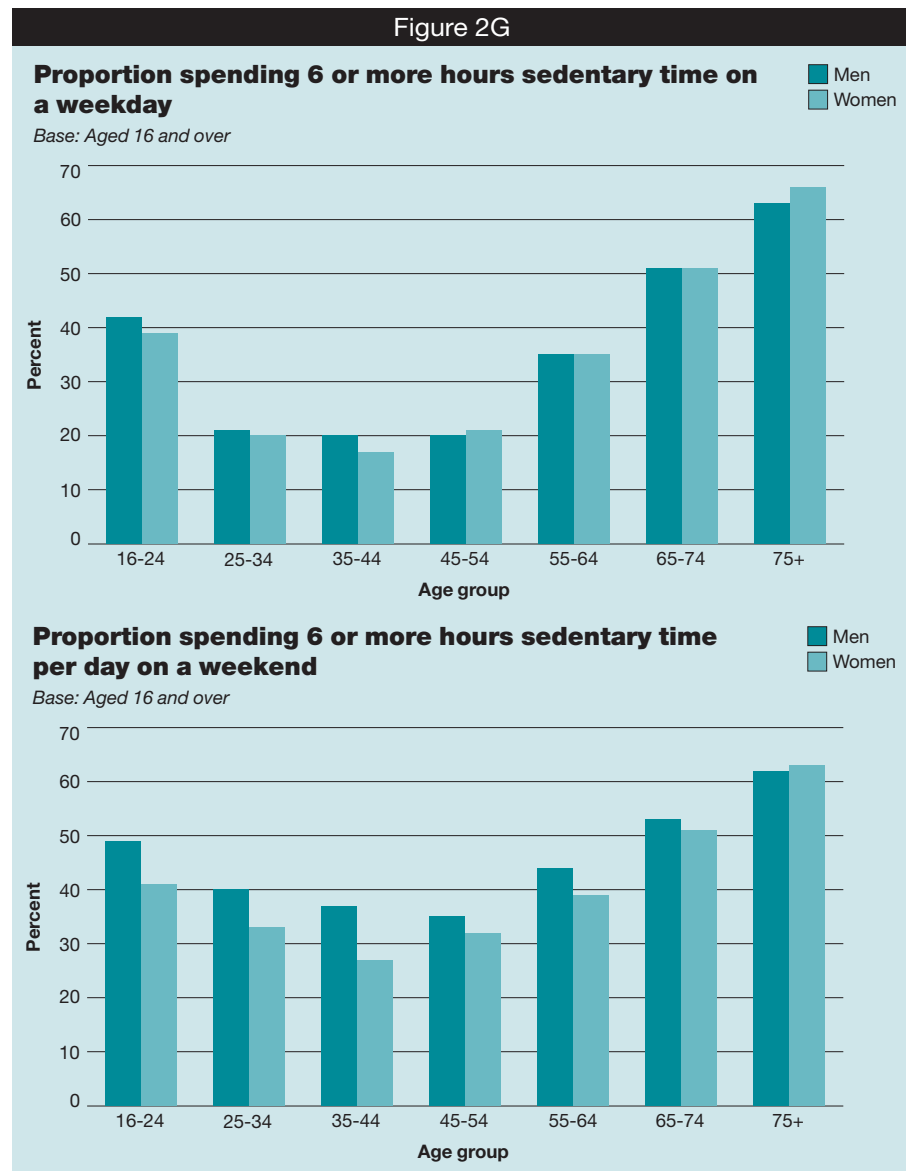
### 2.4.3 Sedentary time, by age and sex

#### Total sedentary time

Average total sedentary time combines both time spent watching TV and other sedentary time. The proportion averaging six or more hours of total sedentary time on weekdays was very similar for men and women (32% and 33% respectively); however, on weekend days men were more likely than women to average six or more hours of sedentary time (44% and 39% respectively).

There were variations by age, as shown in Figure 2G. On weekdays, those aged 16-24 were more likely than those aged 25-54 to have spent six or more hours sedentary time; from the age of 55 the proportion increased steadily to more than 60% of those aged 74 and over.

The pattern was similar for weekend days, although for those aged 16-64 the proportion in each age group was higher than for weekdays, and men in these age groups were more likely than women to spend at least six hours of sedentary time. For those aged 65 and over, the pattern of sedentary time was very similar for both weekdays and weekend days.



### Time spent watching TV

Both men and women averaged 2.8 hours watching TV per weekday; however, men averaged 3.2 hours compared with 3.0 hours for women per weekend day. Correspondingly, men were more likely than women to spend four or more hours watching TV at the weekend (36% and 32% respectively).

TV watching also varied by age for both men and women, as shown in Figure 2H. On weekdays, the proportion spending four or more hours watching TV decreased after age 24 into middle age and rose into older age among both men and women, although this pattern was much less pronounced than for total sedentary time. At weekends, there were generally similar proportions watching four or more hours of TV among those aged up to 54, and then increasing proportions among older adults.

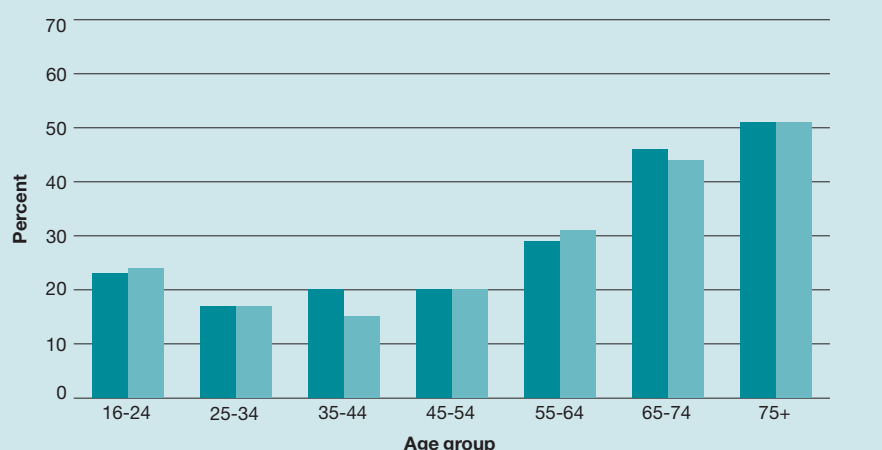
### Other sedentary time

Average hours spent in other sedentary (non TV) time was similar for both men and women for both weekdays and weekends, although men were more likely than women to average four or more hours in other sedentary time at the weekend (21% and 19% respectively).

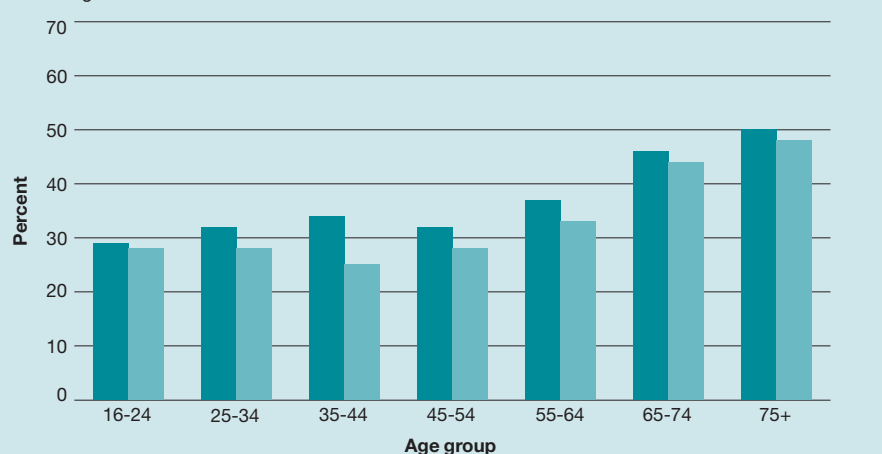
Figure 2H

**Proportion spending 4 or more hours watching TV on a weekday**

Base: Aged 16 and over

**Proportion spending 4 or more hours per day watching TV on a weekend**

Base: Aged 16 and over



However, there was marked variation by age. This generally followed the same U-shaped pattern as for total sedentary time (see Figure 2G) with more aged 16-24 or 65 and over, and fewer in the middle age groups spending at least four hours in other sedentary time. The pattern differed from that for total sedentary time in that men aged 16-24 were more likely than those aged 65 and over to have spent at least four hours in other sedentary time.

Men were generally more likely than women to spend four or more hours in other sedentary time, but this reversed in the two oldest age groups when women were more likely than men to spend four or more hours in other sedentary time on both weekdays and weekend days.

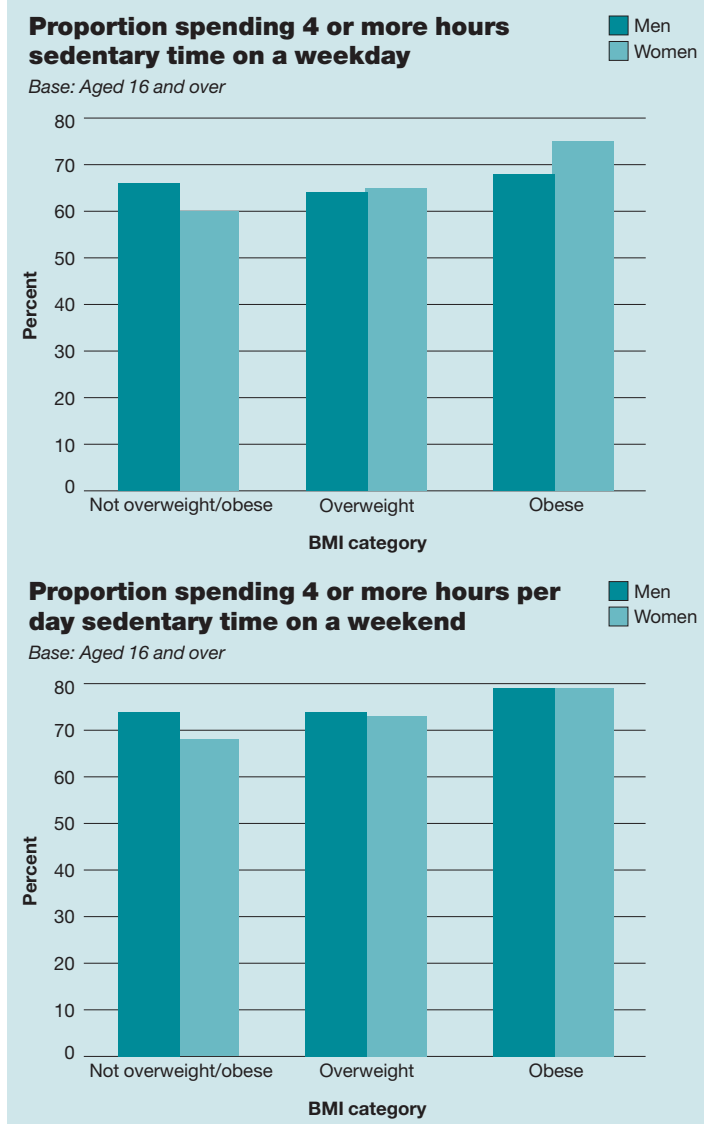
Table 2.10, Figures 2G, 2H

#### 2.4.4 Sedentary time, by BMI category

The majority of men and women spent four or more hours in sedentary time per weekday and per weekend day, regardless of their BMI category. However, the proportion spending four or more hours in sedentary time varied by BMI category for women on weekdays and weekend days, and for men on weekend days, as shown in Figure 2I, with this proportion increasing as BMI category increased. On weekdays, 75% of women who were obese, 65% who were overweight, and 60% who were neither overweight nor obese were sedentary for four or more hours. The equivalent figures for weekend days were 79%, 73% and 68%. On weekend days, 79% of both men and women who were obese spent four or more hours in sedentary time, whereas on weekdays more women than men did so (75% of women, 68% of men).

Table 2.11, Figure 2I

Figure 21



## 2.5 Discussion

### 2.5.1 Methodological issues

Unlike previous years, heavy manual/gardening/DIY activity reported in the tables was limited to non-occupational activity, as people who work now have the opportunity to report that activity as part of their occupational activity. Therefore, it is important to note that heavy manual/gardening/DIY activity appears to have fallen compared with previous years when, in fact, this is not the case. Instead, some of this activity has been captured by the new occupational activity questions from this year's enhanced questionnaire.

It should be noted that the number of days' participation classification probably overestimates the number of active days, as it assumes that each type of activity was done on a different day, when in fact, the questionnaire measures number of occasions rather than days. So, for example, if someone had participated in walking and in heavy manual/gardening/DIY activity on the same day, it would be counted as two days of activity. This also means that the number of people meeting the recommendations may be overestimated for people who do a lot of activity on one day, but not on enough days. On the other hand, it is not possible to aggregate the 10 minute bouts of data because it cannot be established which bouts occurred on the same day, so this may result in an underestimate of meeting the recommendations. The approach in 2008 is consistent with the way the information has been handled in previous years' reports.

### 2.5.2 Physical activity levels

The decline with age in the proportion of men and women meeting the physical activity recommendations begins at an older age for women, but activity levels in young women are substantially lower than in young men. This could have implications for strategies to achieve the targets set out in *'GamePlan'* and *'Be active, be healthy: A plan for getting the nation moving'*. For men, strategies might aim to help them maintain the level of activity they achieve at a younger age into middle age, whereas for women, strategies might be geared toward increasing their level of activity on the whole. The latter is particularly important, as activity levels in girls fall by the onset of adolescence (Chapter 5); the decline in activity levels in men between young adulthood and middle age may be equivalent to the decline that happens in girls before adulthood.

Among women, the likelihood of having only a low level of activity increased as equivalised household income decreased. Activity levels were also related to income quintile in men, but the pattern was less straightforward. However, men in the lowest income quintile were most likely to have a low level of activity. A Canadian study found that education and perceived barriers to activity affect women more than men, and suggests different physical activity promotion strategies be implemented for different sexes and socio-economic groups.<sup>44</sup> An Australian study found that self-belief and social support were the most important factors influencing the relationship between income and physical activity, and also called for multilevel intervention strategies for increasing leisure time physical activity.<sup>45</sup> Both education and factors associated with perceived barriers, such as social support and self-belief, could partially explain the differences in activity level by income in men and women.

It should be noted that the proportion of women in the highest income quintile who met the recommendations increased considerably since 2006 (from 28% to 34%).<sup>46</sup> It is too early to tell whether this is a chance finding or due to a real change. If it is a real change, it may mean that much of the increase in physical activity among women can be attributed to women in the highest income quintile.

Being overweight or obese was associated with being less likely to meet the physical activity recommendations. This is consistent with the findings in the literature that link obesity to physical inactivity.<sup>47</sup> Undertaking an adequate amount of physical activity is one of the keys to maintaining health, including a healthy weight.<sup>48</sup> Modifying energy expenditure through physical activity is linked to reducing body weight and BMI.<sup>49</sup> Increasing physical activity levels in the population as a means of curbing the obesity epidemic is supported by the findings in this report as well as those from many other studies.

Aside from gender differences in activity levels (i.e. men generally being more active than women), men and women also differed with respect to which activity they were most likely to do. The most common activity was heavy housework for women and sports and exercise for men. This reflects the pervasiveness of traditional gender roles and how it relates to physical activity, which may be important when promoting physical activity among women. This consideration is especially important given that recent research suggests domestic activity may not have the same impact on reducing cardiovascular risk compared with other types of physical activity, such as walking and sports and exercise.<sup>13,50</sup> However, this is not to say that participation in heavy housework is not beneficial, as it is associated with lower all-cause mortality.<sup>51</sup> In line with this discussion on domestic activity, it is also interesting that men were more likely to participate in heavy housework than in walking briskly.

### 2.5.3 Occupational activity

This year's enhanced questionnaire allowed for a closer examination of what type of activity people actually did at work, and how much time they spent doing each type of occupational activity. Comparing this new, more detailed information with the single occupational activity question from previous years' reports (see section 2.2.1) provides interesting insights into people's general perceptions about occupational activity compared with their actual

activity. Based on the single occupational activity question from previous years, most adults considered themselves as either very or fairly active at work. However, the results from the enhanced occupational activity questions suggest otherwise: most people who rated themselves as very or fairly active at work spent less than 30 minutes per day in moderate or vigorous activity while at work.

As has been established, self-reported physical activity measures are subject to recall limitations, social desirability bias, and lack of objectivity.<sup>27,30,31</sup> Perhaps this is even more true the more general the question. More specifically targeted questions may aid in reducing the effects of the limitations associated with self-reporting. Moreover, perceptions of what constitutes being very or fairly physically active at work seem to change with age for both sexes. Men and women aged 16 to 24 were most likely to consider themselves as fairly active, and this was confirmed by the more detailed questions. However, men and women aged 55 to 74 were more likely to perceive themselves as very or fairly active at work compared with men and women 25 to 54, but this was not confirmed by the newly available data.

#### **2.5.4 Sedentary time**

Finally, this year's enhanced questionnaire included questions on sedentary time, which is associated with increased risk of obesity and cardiovascular problems.<sup>13</sup> As was previously discussed, men are generally more active than women, but they also spend more time being sedentary than women. Interestingly, there was no difference between the sexes in average sedentary time per weekday; however, men spent significantly more time in sedentary time at the weekend. This difference was especially evident in men and women aged 25 to 54. It is possible that this difference corresponds with duties associated with traditional gender roles (i.e. women doing more housework and childcare). People generally spend more time at home on weekend days compared with weekdays. Environment and setting can facilitate or serve as a barrier to physical activity. While at home, people can generally choose between relaxing and doing work/chores. Therefore, environmental context and behaviour choices play a role in whether people are physical active or sedentary.<sup>52</sup> An American study found that women were more sedentary than men before age 30, and less so after age 60, with no significant difference in sedentary behaviour between 30 and 60 years of age. They speculated that this change may be partially attributed to domestic duties and responsibilities associated with having a family.<sup>53</sup>

Moreover, as one might expect, spending more time in sedentary behaviour was associated with being overweight or obese. This association has been confirmed in the Scottish population as well, and points to the need for guidelines on sedentary behaviour in addition to the existing guidelines on physical activity.<sup>13</sup>

#### **2.5.5 Trends and comparison in physical activity level over time**

Each year, since 1997 for men and 1998 for women, more adults are meeting the recommended amount of physical activity of 30 or more minutes of moderate or vigorous activity on at least 5 days a week. This increase has emerged in both sexes and across all age groups. It should be noted that the change from 15 minutes to 10 minutes in recognised bouts of physical activity will not affect trend data because the summary activity variable used for trends was limited to 30 minute bouts as in previous years. Perhaps messages regarding the importance of physical activity behaviour are reaching people, and perhaps the knowledge that 10 minute bouts of activity are beneficial to health makes doing physical activity seem less daunting and more possible to incorporate into daily life. A desire to incorporate physical activity into daily life, especially in shorter bouts, is highly likely given that the majority of men and women would like to do more physical activity, but cite not having enough time as one of the most common barriers to doing more.<sup>14</sup>

The results presented in this chapter, based on self-report to interview questions, will be compared in the following chapter with those recorded using accelerometry in a sub-sample of participants in HSE 2008.



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- 37 Home activities:

Examples of 'heavy' housework classified as moderate intensity:

Walking with heavy shopping for more than 5 minutes, moving heavy furniture, spring cleaning, scrubbing floors with a scrubbing brush, cleaning windows, or other similar heavy housework

Examples of 'heavy' gardening or DIY work classified as moderate intensity:

Digging, clearing rough ground, building in stone/bricklaying, mowing large areas with a hand mower, felling trees, chopping wood, mixing/laying concrete, moving heavy loads, refitting a kitchen or bathroom or any similar heavy manual work.

Examples of 'light' housework classified as 'inactive':

Hoovering, dusting, ironing, general tidying, washing floors and paintwork.

Examples of 'light' gardening or DIY work classified as light intensity:

Hoeing, weeding, pruning, mowing with a power mower, planting flowers/seeds, decorating, minor household repairs, car washing and polishing, car repairs and maintenance.

- 38 Ainsworth B, Haskell W, Whitt M et al. *Compendium of physical activities: an update of activity codes and MET intensities*. Med Sci Sport Exer. 2000;**32**:S498-S516.
- 39 Office for National Statistics. *Standard Occupational Classification 2000: User guide*. Office for National Statistics, London, 2000.
- 40 **Occupations requiring moderate level activity**

#### ***Walking:***

Farm managers; Natural environment and conservation managers; Managers in animal husbandry, forestry and fishing; Nurses, including auxiliaries and assistants; Sports players; Sports coaches, instructors and officials; Sports and fitness occupations; Conservation and environmental protection officers; Countryside and park rangers; Farmers; Gardeners and groundsman/groundswomen; Agricultural and fishing trades; Pest control officers; Road construction operatives; Rail construction operatives; Construction operatives; Farm workers; Forestry workers; Fishing and agriculture related occupations; Labourers in building and woodworking trades; Labourers in other construction trades; Stevedores, dockers and slingers; Other goods handling and storage occupations; Postal workers, mail sorters, messengers, couriers; Road sweepers; Cleaners, domestics; Refuse and salvage occupations; Elementary cleaning occupations.

#### ***Climbing stairs or ladders:***

Production, works and maintenance managers; Managers in construction; Managers in mining and energy; Chartered surveyors; Building inspectors; Fire service officers; Inspectors of factories, utilities and trading standards; Farmers; Horticultural trades; Gardeners and groundsman/groundswomen, Agricultural and fishing trades; Electricians, electrical fitters; Lines repairers and cable jointers; Roofers, roof tilers and slaters; Plasterers; Painters and decorators; Scaffolders, staggers, riggers; Farm workers; Forestry workers; Fishing and agriculture related occupations; Labourers in building and woodworking trades; Labourers in other construction trades; Labourers in foundries; Cleaners, domestics.

#### ***Lifting, carrying, or moving heavy loads:***

Paramedics; Fitness instructors; Sports and fitness occupations; Farmers; Horticultural trades; Gardeners and groundsman/groundswomen; Agricultural and fishing trades; Smiths and forge workers; Moulders, core makers, die casters; Sheet metal workers; Metal plate workers, shipwrights, riveters; Welding trades; Pipe fitters; Metal machining setters and setter-operators; Tool makers, tool fitters and markers-out; Metal working production and maintenance fitters; Precision instrument makers and repairers; Motor mechanics, auto engineers; Vehicle body builders and repairers; Steel erectors; Bricklayers, masons; Roofers, roof tilers and slaters; Plumbers, heating and ventilating engineers; Carpenters and joiners; Glaziers, window fabricators and fitters; Construction trades; Plasterers; Floorers and wall tilers; Butchers, meat cutters; Bakers, flour confectioners; Fishmongers, poultry dressers; Furniture makers, other craft woodworkers; Nursery nurses; Childminders and related occupations; Weighers, graders, sorters; Tyre, exhaust and windscreen fitters; Scaffolders, staggers, riggers; Road construction operatives; Rail construction and maintenance operatives; Construction

operatives; Farm workers; Forestry workers; Fishing and agriculture related occupations; Labourers in building and woodworking trades; Labourers in other construction trades; Labourers in foundries; Labourers in process and plant operations; Postal workers, mail sorters, messengers, couriers; Kitchen and catering assistants; Bar staff; Refuse and salvage occupations; Shelf fillers.

#### 41 Sports and exercise activities - Intensity classification

##### **Vigorous:**

- a) All occurrences of running/jogging, squash, boxing, kick boxing, skipping, trampolining.
- b) The following sports were coded as vigorous intensity if they had made the participant out of breath or sweaty, but were otherwise coded as moderate intensity including: cycling, aerobics, keep fit, gymnastics, dance for fitness, weight training, football, rugby, swimming, tennis, badminton.

##### **Moderate:**

- a) See 'vigorous' category (b).
- b) All occasions of a large number of activities including: basketball, canoeing, fencing, field athletics, hockey, ice skating, lacrosse, netball, roller skating, rowing, skiing, volleyball.
- c) The following sports were coded as moderate intensity if they had made the participant out of breath or sweaty, but were otherwise coded as light intensity, including: exercise (press-ups, sit-ups etc), dancing.

##### **Light:**

- a) See 'moderate' category (c).
- b) All occasions of a large number of activities including: abseiling, baseball, bowls, cricket, croquet, darts, fishing, golf, riding, rounders, sailing, shooting, snooker, snorkelling, softball, table tennis, yoga.

42 [www.ic.nhs.uk/pubs/hse08trends](http://www.ic.nhs.uk/pubs/hse08trends)

43 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

44 Pan SY, Cameron C, DesMeules M et al. *Individual, social, environmental, and physical environmental correlates with physical activity among Canadians: a cross-sectional study*. BMC Public Health. 2009;**9**:21.

45 Cerin E, Leslie E. *How socio-economic status contributes to participation in leisure-time physical activity*. Soc Sci Med. 2008;**66**:2596-2609.

46 Table from 2006 not included here, but is available from the 2006 Health Survey for England, Volume 1 Chapter 6 (see reference 20).

47 Astrup A. *Healthy lifestyles in Europe: prevention of obesity and type II diabetes by diet and physical activity*. Public Health Nutr. 2001;**4**:499-515.

48 Haskell WL, Lee I, Pate RR. *Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and American Heart Association*. Circulation. 2007;**116**:1081-1093.

49 McTiernan A, Sorensen B, Irwin ML. *Exercise effect on weight and body fat in men and women*. Obesity. 2007;**15**:1496-1512.

50 Stamatakis E, Hillsdon M, Primatesta P. *Domestic physical activity in relationship to multiple CVD risk factors*. Am J Prev Med. 2007;**32**:320-327.

51 Stamatakis E, Hamer M, Lawlor DA. *Physical activity, mortality, and cardiovascular disease: is domestic physical activity beneficial?* Am J Epidemiol. 2009;**169**:1191-1200.

52 Owen N, Leslie E, Salmon J et al. *Environmental determinants of physical activity and sedentary behavior*. Exerc Sport Sci Rev. 2000;**28**:153-158.

53 Matthews CE, Chen KY, Freedson PS, et al. *Amount of time spent in sedentary behaviors in the United States, 2003-2004*. Am J Epidemiol. 2008;**167**:875-881.

- 2.1 Self-reported summary activity levels (participation in at least moderate intensity activity), by age and sex
- 2.2 Self-reported summary activity levels (observed and age-standardised), by Strategic Health Authority and sex
- 2.3 Self-reported summary activity levels (age-standardised), by equivalised household income and sex
- 2.4 Self-reported summary activity levels (age-standardised), by Spearhead status and sex
- 2.5 Self-reported summary activity levels by BMI category, age and sex
- 2.6 Trends in the proportion meeting current physical activity recommendations (self-reported) 1997 - 2008, by age and sex
- 2.7 Number of days' participation in different activities in the last four weeks (self-reported), by age and sex
- 2.8 Average time spent participating in different activities per week (self-reported), by age and sex
- 2.9 Average time spent participating in occupational activities per day (self-reported), by age and sex
- 2.10 Average sedentary time per day (self-reported), by age and sex
- 2.11 Average sedentary time per day (self-reported), by BMI category, age and sex

Table 2.1

**Self-reported summary activity levels (participation in at least moderate intensity activity), by age and sex***Aged 16 and over*

2008

Self-reported summary activity level <sup>a,b</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Meets recommendations	53	49	44	41	32	20	9	39
Some activity	30	32	33	34	31	33	23	31
Low activity	16	19	23	25	37	47	68	30
<b>Women</b>								
Meets recommendations	35	36	34	32	28	17	6	29
Some activity	33	39	39	35	34	30	16	34
Low activity	32	25	28	33	37	53	78	38
<i>Bases (unweighted)</i>								
Men	771	952	1218	1095	1181	873	647	6737
Women	917	1215	1509	1370	1361	998	947	8317
<i>Bases (weighted)</i>								
Men	1133	1210	1411	1204	1084	724	538	7305
Women	1088	1212	1428	1230	1119	798	785	7660

<sup>a</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week).  
 Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week).  
 Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average). The definition includes activity at work (new questions).

<sup>b</sup> Episodes of activity of less than 30 minutes have been excluded. Summary activity levels include all physical activity recorded in the interview: sports and exercise; walking; heavy housework; heavy manual work including DIY and gardening; and occupational activity of at least moderate intensity (as detailed in endnote 40).

Table 2.2

**Self-reported summary activity levels (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex***Aged 16 and over*

2008

Self-reported summary activity level <sup>b,c</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Meets recommendations	35	40	41	37	37	38	41	38	43	42
Some activity	33	30	29	35	33	31	29	34	32	30
Low activity	33	30	31	29	30	31	30	28	25	28
<b>Standardised</b>										
Meets recommendations	33	39	40	38	38	38	38	38	41	44
Some activity	33	30	29	35	33	31	29	35	33	30
Low activity	34	31	31	27	29	30	33	27	26	26
<b>Women</b>										
<b>Observed</b>										
Meets recommendations	27	29	26	27	25	28	30	33	30	32
Some activity	33	34	34	33	32	37	32	35	33	32
Low activity	40	37	40	40	43	35	37	32	37	36
<b>Standardised</b>										
Meets recommendations	26	29	26	27	25	27	29	34	30	32
Some activity	32	34	34	33	32	37	31	35	32	33
Low activity	41	37	40	39	43	35	40	31	38	35
<i>Bases (unweighted)</i>										
<i>Men</i>	429	965	714	637	676	820	755	532	527	682
<i>Women</i>	523	1193	906	795	877	939	927	674	620	863
<i>Bases (weighted)</i>										
<i>Men</i>	399	968	736	636	769	841	1045	586	587	737
<i>Women</i>	402	1037	799	678	842	838	1047	630	583	804

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week).  
Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week).  
Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average). The definition includes activity at work (new questions).

<sup>c</sup> Episodes of activity of less than 30 minutes have been excluded. Summary activity levels include all physical activity recorded in the interview: sports and exercise; walking; heavy housework; heavy manual work including DIY and gardening; and occupational activity of at least moderate intensity (as detailed in endnote 40).

Table 2.3

**Self-reported summary activity levels (age-standardised), by equivalised household income and sex**

Aged 16 and over

2008

Self-reported summary activity level <sup>a,b</sup>	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Meets recommendations	42	41	42	39	31
Some activity	35	37	29	28	23
Low activity	23	23	29	33	46
<b>Women</b>					
Meets recommendations	34	28	28	27	26
Some activity	37	38	34	32	29
Low activity	28	35	38	41	45
<i>Bases (unweighted)</i>					
Men	1329	1180	1041	1046	854
Women	1313	1285	1310	1397	1274
<i>Bases (weighted)</i>					
Men	1440	1309	1102	1089	909
Women	1239	1211	1194	1245	1149

<sup>a</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week).

Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week).

Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average). The definition includes activity at work (new questions).

<sup>b</sup> Episodes of activity of less than 30 minutes have been excluded. Summary activity levels include all physical activity recorded in the interview: sports and exercise; walking; heavy housework; heavy manual work including DIY and gardening; and occupational activity of at least moderate intensity (as detailed in endnote 40).

Table 2.4

**Self-reported summary activity levels (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over

2008

Self-reported summary activity level <sup>b,c</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Meets recommendations	40	37
Some activity	31	32
Low activity	29	31
<b>Women</b>		
Meets recommendations	29	26
Some activity	34	32
Low activity	36	42
<i>Bases (unweighted)</i>		
Men	4225	2487
Women	5185	3099
<i>Bases (weighted)</i>		
Men	4645	2635
Women	4861	2769

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week).

Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week).

Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average). The definition includes activity at work (new questions).

<sup>c</sup> Episodes of activity of less than 30 minutes have been excluded. Summary activity levels include all physical activity recorded in the interview: sports and exercise; walking; heavy housework; heavy manual work including DIY and gardening; and occupational activity of at least moderate intensity (as detailed in endnote 40).

Table 2.5

**Self-reported summary activity levels , by BMI category, age and sex**

Aged 16 and over

2008

Self-reported summary activity level <sup>a,b</sup> within BMI category <sup>c</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	
Men								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)								
Meets recommendations	56	53	45	45	35	24	9	46
Some activity	30	27	34	31	30	43	19	30
Low activity	14	19	22	24	35	33	72	24
BMI 25 to less than 30 kg/m <sup>2</sup> (overweight)								
Meets recommendations	52	48	47	45	37	26	14	41
Some activity	33	33	34	34	32	34	27	33
Low activity	16	19	20	21	31	40	59	26
BMI 30 kg/m <sup>2</sup> or more (obese)								
Meets recommendations	48	47	43	36	26	13	7	32
Some activity	32	36	29	36	29	32	24	32
Low activity	20	16	28	29	45	56	69	36
Women								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)								
Meets recommendations	39	40	38	43	38	25	7	36
Some activity	32	39	38	35	33	36	19	34
Low activity	29	21	25	22	29	39	74	29
BMI 25 to less than 30 kg/m <sup>2</sup> (overweight)								
Meets recommendations	38	39	37	36	30	19	9	31
Some activity	33	40	39	39	38	32	21	36
Low activity	29	20	25	25	32	48	70	34
BMI 30 kg/m <sup>2</sup> or more (obese)								
Meets recommendations	22	29	26	18	19	11	5	19
Some activity	41	41	41	34	33	30	19	35
Low activity	36	30	33	48	48	59	75	46
Bases (unweighted)								
Men								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)	456	350	294	249	229	125	137	1840
BMI 25 kg/m <sup>2</sup> to less than 30 kg/m <sup>2</sup> (overweight)	182	347	502	419	467	371	241	2529
BMI 30 kg/m <sup>2</sup> or more (obese)	54	149	275	290	354	240	111	1473
Women								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)	515	548	572	431	376	233	227	2902
BMI 25 kg/m <sup>2</sup> to less than 30 kg/m <sup>2</sup> (overweight)	163	279	407	408	444	318	263	2282
BMI 30 kg/m <sup>2</sup> or more (obese)	107	195	326	334	370	276	171	1779
Bases (weighted)								
Men								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)	689	447	340	269	209	104	114	2173
BMI 25 kg/m <sup>2</sup> to less than 30 kg/m <sup>2</sup> (overweight)	256	432	577	463	427	304	202	2661
BMI 30 kg/m <sup>2</sup> or more (obese)	80	187	325	326	328	201	92	1539
Women								
BMI less than 25 kg/m <sup>2</sup> (not overweight or obese)	614	556	539	381	308	186	189	2773
BMI 25 kg/m <sup>2</sup> to less than 30 kg/m <sup>2</sup> (overweight)	190	270	386	369	369	255	219	2058
BMI 30 kg/m <sup>2</sup> or more (obese)	129	191	312	305	303	221	142	1601

<sup>a</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week).  
Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week).  
Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average). The definition includes activity at work (new questions).

<sup>b</sup> Episodes of activity of less than 30 minutes have been excluded. Summary activity levels include all physical activity recorded in the interview: sports and exercise; walking; heavy housework; heavy manual work including DIY and gardening; and occupational activity of at least moderate intensity (as detailed in endnote 40).

<sup>c</sup> BMI: Body mass index = Weight (kg) / Height squared (m<sup>2</sup>).



Table 2.6

# Trends in the proportion meeting current physical activity recommendations (self-reported) 1997- 2008, by age and sex

Aged 16 and over

1997, 1998, 2003, 2004, 2006, 2008

Proportion meeting current physical activity recommendations <sup>a,b</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
1997	49	41	37	32	23	12	7	32
1998	53	45	41	34	30	14	6	34
2003 <sup>c</sup>	52	44	41	38	32	17	8	36
2004	56	46	41	37	32	18	8	37
2006	53	52	46	38	35	21	9	40
2008	57	54	48	43	33	21	9	42
<b>Women</b>								
1997	26	26	29	24	19	8	5	21
1998	28	28	28	25	18	9	3	21
2003 <sup>c</sup>	30	29	30	31	23	13	3	24
2004	32	30	32	30	20	14	4	25
2006	33	36	35	34	27	16	4	28
2008	38	39	37	34	28	18	6	31
<b>Men</b>								
<i>Bases (unweighted)</i>								
1997	492	739	740	694	535	455	243	3898
1998	875	1338	1305	1289	987	837	562	7193
2003	744	1024	1260	1098	1097	807	551	6581
2004	291	446	535	439	508	378	276	2873
2006	649	860	1181	1049	1123	415	284	5561
2008	772	953	1218	1098	1184	874	648	6747
<i>Bases (weighted)<sup>c</sup></i>								
2003	1044	1272	1412	1180	1037	731	501	7177
2004	485	556	647	530	477	329	231	3256
2006	1040	1127	1354	1122	1012	694	496	6845
2008	1134	1211	1411	1207	1087	725	539	7314
<b>Women</b>								
<i>Bases (unweighted)</i>								
1997	560	916	833	806	585	545	439	4684
1998	1006	1630	1573	1484	1148	967	907	8715
2003	886	1279	1615	1278	1304	948	900	8210
2004	364	550	746	626	621	482	429	3818
2006	792	1146	1490	1279	1269	463	430	6869
2008	919	1220	1513	1371	1367	1000	947	8337
<i>Bases (weighted)<sup>c</sup></i>								
2003	1029	1279	1437	1199	1071	813	782	7611
2004	472	563	653	541	491	364	353	3436
2006	1011	1157	1375	1141	1050	768	798	7300
2008	1090	1216	1432	1230	1124	800	785	7678

<sup>a</sup> 30 minutes or more per day of at least moderate intensity on at least five days a week.

<sup>b</sup> To allow comparison with results from previous years, episodes of activity of less than 30 minutes have been excluded, and occupational activity has been included in the same way as in earlier years, i.e. without using the additional data from the enhanced HSE 2008 questionnaire. Results therefore differ from those presented in Table 2.1.

<sup>c</sup> Data from 2003 onwards have been weighted for non-response.



Table 2.7

# Number of days' participation in different activities in the last four weeks (self-reported), by age and sex

Aged 16 and over

2008

Days of participation in the last 4 weeks (at least 10 minutes)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
Men								
Heavy housework								
None	66	48	49	49	54	54	66	54
Any	34	52	51	51	46	46	34	46
1 to 3 days	18	26	24	24	20	20	13	22
4 to 11 days	14	23	24	23	21	21	17	21
12 to 19 days	1	1	1	2	2	3	3	2
20 days or more	1	1	2	2	2	2	1	2
Mean number of days <sup>a</sup>	1.5	2.1	2.3	2.4	2.3	2.4	1.9	2.2
Standard error of the mean	0.13	0.12	0.12	0.13	0.12	0.16	0.16	0.05
Heavy manual/gardening/DIY <sup>b</sup>								
None	86	76	66	66	67	67	80	72
Any	14	24	34	34	33	33	20	28
1 to 3 days	10	15	19	18	17	18	10	16
4 to 11 days	3	7	12	13	13	11	7	10
12 to 19 days	1	1	1	1	2	2	1	1
20 days or more	0	0	1	1	1	2	1	1
Mean number of days <sup>a</sup>	0.5	0.9	1.4	1.6	1.6	1.7	1.0	1.3
Standard error of the mean	0.08	0.08	0.09	0.11	0.10	0.14	0.13	0.04
Walking <sup>c</sup>								
None	46	47	54	60	66	77	90	59
Any	54	53	46	40	34	23	10	41
1 to 3 days	4	4	6	5	4	2	1	4
4 to 11 days	10	16	13	12	10	5	2	11
12 to 19 days	8	7	6	6	4	4	1	5
20 days or more	31	26	22	18	16	12	6	20
Mean number of days <sup>a</sup>	9.9	8.7	7.3	6.3	5.6	4.2	1.9	6.8
Standard error of the mean	0.51	0.40	0.30	0.31	0.30	0.31	0.25	0.15
Sports and exercise								
None	20	31	42	53	67	73	86	49
Any	80	69	58	47	33	27	14	51
1 to 3 days	8	12	12	10	6	6	1	9
4 to 11 days	24	20	19	18	12	10	6	17
12 to 19 days	16	15	10	8	6	4	2	10
20 days or more	32	22	17	12	8	7	6	16
Mean number of days <sup>a</sup>	12.5	9.5	7.2	5.5	3.8	3.0	2.1	6.8
Standard error of the mean	0.43	0.36	0.29	0.26	0.23	0.23	0.26	0.14
Any non-occupational physical activity <sup>b,d</sup>								
None	9	9	14	16	24	28	48	18
Any	91	91	86	84	76	72	52	82
1 to 3 days	5	7	9	9	12	15	10	9
4 to 11 days	15	18	23	25	22	23	20	21
12 to 19 days	13	16	13	14	12	11	8	13
20 days or more	58	50	42	35	29	23	15	39
Mean number of days <sup>a</sup>	18.7	17.1	14.8	13.2	11.2	9.7	6.3	13.9
Standard error of the mean	0.44	0.39	0.34	0.35	0.33	0.37	0.36	0.17
Bases (unweighted) <sup>e</sup>								
Men	772	953	1220	1098	1183	874	648	6748
Bases (weighted) <sup>e</sup>								
Men	1134	1211	1413	1207	1086	725	539	7316

<sup>a</sup> Mean is based on all participants interviewed including those who reported no participation.

<sup>b</sup> In 2008 new questions on occupational activity were introduced. In previous years, heavy manual/gardening/DIY included occupational activity, but in 2008 this table has been limited to non-occupational activity.

<sup>c</sup> Walking at a 'Fairly brisk' or 'Fast' pace.

<sup>d</sup> Includes Heavy housework; Heavy manual/gardening/DIY; Walking; Sports and exercise. Occupational activity is shown separately in Table 2.9.

<sup>e</sup> Bases vary but are of similar sizes; those shown are for any physical activity.

Continued...

Table 2.7 continued

Aged 16 and over

2008

Days of participation in the last 4 weeks (at least 10 minutes)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Women</b>								
<b>Heavy housework</b>								
None	51	33	30	35	37	46	70	41
Any	49	67	70	65	63	54	30	59
1 to 3 days	21	26	27	25	22	23	13	23
4 to 11 days	22	31	34	31	29	23	14	28
12 to 19 days	2	4	4	4	5	4	2	4
20 days or more	4	7	5	5	6	4	2	5
Mean number of days <sup>a</sup>	2.7	4.4	4.4	3.9	4.2	3.2	1.7	3.6
Standard error of the mean	0.18	0.18	0.16	0.17	0.17	0.18	0.13	0.07
<b>Heavy manual/gardening/DIY<sup>b</sup></b>								
None	96	89	84	84	83	87	95	88
Any	4	11	16	16	17	13	5	12
1 to 3 days	3	7	11	9	10	7	3	8
4 to 11 days	1	3	4	6	5	4	2	4
12 to 19 days	-	0	0	0	1	1	0	0
20 days or more	0	0	0	1	1	1	0	1
Mean number of days <sup>a</sup>	0.2	0.4	0.5	0.7	0.8	0.7	0.2	0.5
Standard error of the mean	0.05	0.06	0.05	0.07	0.08	0.09	0.06	0.03
<b>Walking<sup>c</sup></b>								
None	59	61	60	63	70	80	93	67
Any	41	39	40	37	30	20	7	33
1 to 3 days	3	3	3	3	2	1	1	2
4 to 11 days	7	9	10	10	6	4	2	7
12 to 19 days	7	6	6	5	5	4	1	5
20 days or more	24	22	22	19	16	11	4	18
Mean number of days <sup>a</sup>	7.4	7.0	7.1	6.4	5.4	3.7	1.2	5.8
Standard error of the mean	0.42	0.31	0.28	0.29	0.27	0.26	0.17	0.13
<b>Sports and exercise</b>								
None	37	45	50	56	62	72	87	56
Any	63	55	50	44	38	28	13	44
1 to 3 days	12	11	12	10	9	6	2	10
4 to 11 days	22	21	18	16	16	11	6	16
12 to 19 days	12	11	10	7	6	5	1	8
20 days or more	16	12	10	9	8	6	3	10
Mean number of days <sup>a</sup>	7.6	6.3	5.5	4.8	3.9	2.9	1.5	4.9
Standard error of the mean	0.32	0.27	0.22	0.22	0.21	0.22	0.17	0.11
<b>Any non-occupational physical activity<sup>b,d</sup></b>								
None	15	12	12	15	21	32	59	21
Any	85	88	88	85	79	68	41	79
1 to 3 days	9	10	11	12	13	13	11	11
4 to 11 days	21	26	26	26	23	23	17	24
12 to 19 days	12	12	13	13	12	10	4	11
20 days or more	42	40	39	34	31	23	9	33
Mean number of days <sup>a</sup>	14.6	14.4	14.2	13.0	11.7	9.1	4.1	12.2
Standard error of the mean	0.41	0.32	0.30	0.30	0.29	0.34	0.26	0.15
<b>Bases (unweighted)<sup>e</sup></b>								
Women	918	1220	1512	1371	1367	999	947	8334
<b>Bases (weighted)<sup>e</sup></b>								
Women	1089	1216	1431	1230	1124	799	785	7675

<sup>a</sup> Mean is based on all participants interviewed including those who reported no participation.

<sup>b</sup> In 2008 new questions on occupational activity were introduced. In previous years, heavy manual/gardening/DIY included occupational activity, but in 2008 this table has been limited to non-occupational activity.

<sup>c</sup> Walking at a 'Fairly brisk' or 'Fast' pace.

<sup>d</sup> Includes Heavy housework; Heavy manual/gardening/DIY; Walking; Sports and exercise. Occupational activity is shown separately in Table 2.9.

<sup>e</sup> Bases vary but are of similar sizes; those shown are for any physical activity.

Table 2.8

**Average time spent participating in different activities per week (self-reported), by age and sex**

Aged 16 and over

2008

Average time spent per week (at least 10 minutes a day)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>Heavy housework</b>								
No time	66	48	49	49	54	54	66	54
Less than 1 hour	18	25	23	23	21	23	19	22
1 to less than 3 hours	10	18	19	18	16	13	9	15
3 to less than 5 hours	3	5	5	5	5	5	3	4
5 to less than 7 hours	2	2	2	2	2	2	1	2
7 hours or more	1	2	2	3	3	3	2	2
Mean number of hours <sup>a</sup>	0.6	1.0	0.9	1.1	0.9	1.0	0.6	0.9
Standard error of the mean	0.07	0.10	0.06	0.09	0.07	0.10	0.07	0.03
Median <sup>a</sup>	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
<b>Heavy manual/gardening/DIY<sup>b</sup></b>								
No time	86	76	66	66	67	67	80	72
Less than 1 hour	6	6	9	7	6	7	5	7
1 to less than 3 hours	4	9	10	11	12	12	9	10
3 to less than 5 hours	2	4	6	7	5	5	2	5
5 to less than 7 hours	0	1	3	4	3	3	1	2
7 hours or more	2	3	5	6	7	6	3	5
Mean number of hours <sup>a</sup>	0.5	0.8	1.3	1.6	1.5	1.4	0.8	1.1
Standard error of the mean	0.09	0.11	0.11	0.13	0.11	0.14	0.13	0.05
Median <sup>a</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Walking<sup>c</sup></b>								
No time	46	47	54	60	66	77	90	59
Less than 1 hour	8	11	11	8	7	3	1	8
1 to less than 3 hours	18	18	14	13	10	5	3	13
3 to less than 5 hours	14	9	8	6	6	3	2	7
5 to less than 7 hours	4	5	3	3	3	2	0	3
7 hours or more	11	10	10	10	8	9	3	9
Mean number of hours <sup>a</sup>	2.7	2.6	2.6	2.2	1.8	2.1	0.6	2.2
Standard error of the mean	0.26	0.23	0.26	0.20	0.17	0.24	0.13	0.09
Median <sup>a</sup>	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0
<b>Sports and exercise</b>								
No time	22	32	43	53	67	73	86	49
Less than 1 hour	13	16	17	13	10	10	4	13
1 to less than 3 hours	21	22	19	18	11	9	6	16
3 to less than 5 hours	15	13	9	9	5	4	2	9
5 to less than 7 hours	10	6	5	3	3	2	1	5
7 hours or more	20	12	7	4	4	3	1	8
Mean number of hours <sup>a</sup>	3.8	2.7	1.8	1.3	1.0	0.7	0.4	1.9
Standard error of the mean	0.17	0.15	0.09	0.09	0.08	0.07	0.06	0.05
Median <sup>a</sup>	2.3	1.1	0.4	0.0	0.0	0.0	0.0	0.1
<b>Any non-occupational physical activity<sup>b,d</sup></b>								
No time	9	10	14	16	24	28	48	18
Less than 1 hour	8	9	12	11	13	16	15	11
1 to less than 3 hours	15	17	19	20	17	17	16	17
3 to less than 5 hours	16	17	14	14	11	10	7	13
5 to less than 7 hours	14	13	11	11	9	6	4	11
7 hours or more	38	34	31	28	25	22	10	29
Mean number of hours <sup>a</sup>	7.3	6.9	6.5	6.1	5.1	5.2	2.4	6.0
Standard error of the mean	0.31	0.30	0.28	0.29	0.23	0.31	0.22	0.12
Median <sup>a</sup>	5.1	4.5	3.8	3.3	2.1	1.5	0.2	3.3
<b>Bases (unweighted)<sup>e</sup></b>								
Men	773	951	1219	1098	1183	874	648	6746
<b>Bases (weighted)<sup>e</sup></b>								
Men	1136	1209	1412	1207	1086	725	539	7315

<sup>a</sup> Mean and median are based on all participants interviewed including those who reported no participation.

<sup>b</sup> In 2008 new questions on occupational activity were introduced. In previous years, heavy manual/gardening/DIY included occupational activity, but in 2008 this table has been limited to non-occupational activity.

<sup>c</sup> Walking at a 'Fairly brisk' or 'Fast' pace.

<sup>d</sup> Includes Heavy housework; Heavy manual/gardening/DIY; Walking; Sports and exercise. Occupational activity is shown separately in Table 2.9.

<sup>e</sup> Bases vary but are of similar sizes; those shown are for any physical activity.

Continued...

Table 2.8 continued

Aged 16 and over

2008

Average time spent per week (at least 10 minutes a day)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Women</b>								
<b>Heavy housework</b>								
No time	51	33	30	35	37	46	70	41
Less than 1 hour	22	21	24	22	20	24	16	21
1 to less than 3 hours	15	25	24	22	21	15	9	20
3 to less than 5 hours	6	9	11	9	9	7	3	8
5 to less than 7 hours	2	4	5	4	4	3	1	3
7 hours or more	4	8	7	7	8	5	1	6
Mean number of hours <sup>a</sup>	1.1	2.1	2.1	1.9	2.2	1.5	0.5	1.7
Standard error of the mean	0.09	0.12	0.11	0.10	0.14	0.12	0.05	0.05
Median <sup>a</sup>	0.0	0.6	0.8	0.5	0.5	0.2	0.0	0.3
<b>Heavy manual/gardening/DIY<sup>b</sup></b>								
No time	96	89	84	84	83	87	95	88
Less than 1 hour	2	4	6	4	6	5	2	4
1 to less than 3 hours	1	3	5	6	5	4	2	4
3 to less than 5 hours	0	2	2	3	3	2	1	2
5 to less than 7 hours	0	0	1	1	2	1	0	1
7 hours or more	0	1	1	2	2	1	1	1
Mean number of hours <sup>a</sup>	0.1	0.3	0.4	0.5	0.5	0.5	0.2	0.4
Standard error of the mean	0.03	0.07	0.05	0.05	0.06	0.08	0.05	0.02
Median <sup>a</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Walking<sup>c</sup></b>								
No time	59	61	59	63	70	80	93	67
Less than 1 hour	7	6	7	6	4	3	1	5
1 to less than 3 hours	12	11	11	11	8	5	2	9
3 to less than 5 hours	10	9	8	7	5	4	1	7
5 to less than 7 hours	4	3	3	3	3	3	0	3
7 hours or more	8	9	11	10	10	6	3	8
Mean number of hours <sup>a</sup>	1.9	1.9	2.4	2.3	2.3	1.2	0.4	1.9
Standard error of the mean	0.20	0.13	0.26	0.20	0.26	0.13	0.06	0.09
Median <sup>a</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Sports and exercise</b>								
No time	38	45	50	57	62	72	87	56
Less than 1 hour	19	18	17	15	13	10	6	15
1 to less than 3 hours	21	22	19	18	15	11	5	17
3 to less than 5 hours	10	8	8	6	6	3	1	6
5 to less than 7 hours	5	4	3	2	2	1	0	3
7 hours or more	8	4	3	3	2	2	1	3
Mean number of hours <sup>a</sup>	2.1	1.4	1.2	1.0	0.9	0.6	0.2	1.1
Standard error of the mean	0.14	0.08	0.06	0.07	0.07	0.06	0.04	0.03
Median <sup>a</sup>	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0
<b>Any non-occupational physical activity<sup>b,d</sup></b>								
No time	15	12	12	15	21	32	59	21
Less than 1 hour	13	11	13	13	14	16	16	13
1 to less than 3 hours	19	23	22	22	20	19	12	20
3 to less than 5 hours	18	16	13	13	12	9	5	13
5 to less than 7 hours	11	10	11	10	7	6	2	9
7 hours or more	25	28	29	26	27	18	6	24
Mean number of hours <sup>a</sup>	5.1	5.7	5.8	5.7	5.7	3.8	1.3	5.0
Standard error of the mean	0.23	0.22	0.22	0.23	0.26	0.21	0.11	0.10
Median <sup>a</sup>	3.1	3.4	3.3	2.9	2.3	1.0	0.0	2.3
<b>Bases (unweighted)<sup>e</sup></b>								
Women	920	1220	1513	1369	1367	999	947	8335
<b>Bases (weighted)<sup>e</sup></b>								
Women	1091	1216	1432	1229	1124	799	785	7676

<sup>a</sup> Mean and median are based on all participants interviewed including those who reported no participation.

<sup>b</sup> In 2008 new questions on occupational activity were introduced. In previous years, heavy manual/gardening/DIY included occupational activity, but in 2008 this table has been limited to non-occupational activity.

<sup>c</sup> Walking at a 'Fairly brisk' or 'Fast' pace.

<sup>d</sup> Includes Heavy housework; Heavy manual/gardening/DIY; Walking; Sports and exercise. Occupational activity is shown separately in Table 2.9.

<sup>e</sup> Bases vary but are of similar sizes; those shown are for any physical activity.

Table 2.9

# Average time spent participating in occupational activities per day (self-reported), by age and sex

Aged 16-74 who reported working in the last four weeks, including unpaid work

2008

Average time spent per week (at least 10 minutes a day) <sup>a</sup>	Age group						Total
	16-24	25-34	35-44	45-54	55-64	65-74	
	%	%	%	%	%	%	%
<b>Men</b>							
<b>Sitting or standing<sup>b</sup></b>							
No time	24	12	13	12	12	19	14
Any time	76	88	87	88	88	81	86
Less than 1 hour	3	2	2	4	2	5	3
1 to less than 3 hours	15	12	12	13	13	24	13
3 to less than 5 hours	15	13	15	14	17	18	15
5 to less than 7 hours	19	23	24	24	25	18	23
7 hours or more	24	38	34	34	31	15	33
Mean number of hours <sup>c</sup>	3.8	5.0	4.9	4.9	4.8	3.3	4.7
Standard error of the mean	0.15	0.11	0.10	0.10	0.11	0.20	0.06
Median <sup>c</sup>	4.0	6.0	6.0	5.5	5.0	3.0	5.0
<b>Walking around at work<sup>b</sup></b>							
No time	36	47	41	40	42	45	41
Any time	64	53	59	60	58	55	59
Less than 1 hour	8	7	6	6	7	8	7
1 to less than 3 hours	17	20	23	26	24	21	22
3 to less than 5 hours	19	12	14	12	13	11	14
5 to less than 7 hours	13	8	9	10	9	7	10
7 hours or more	7	6	6	7	6	7	6
Mean number of hours <sup>c</sup>	2.3	1.7	1.9	2.0	1.8	1.8	1.9
Standard error of the mean	0.12	0.08	0.08	0.09	0.09	0.19	0.04
Median <sup>c</sup>	1.0	0.5	1.0	1.0	1.0	0.5	1.0
<b>Climbing stairs or ladders<sup>b</sup></b>							
No time	64	59	56	58	59	65	59
Any time	36	41	44	42	41	35	41
Less than 1 hour	16	23	23	22	24	20	22
1 to less than 3 hours	15	14	17	17	15	13	16
3 to less than 5 hours	4	3	3	2	2	2	3
5 to less than 7 hours	1	1	1	1	0	1	1
7 hours or more	1	1	0	0	-	-	0
Mean number of hours <sup>c</sup>	0.5	0.4	0.5	0.4	0.4	0.3	0.5
Standard error of the mean	0.05	0.04	0.03	0.03	0.03	0.05	0.02
Median <sup>c</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Lifting, carrying, or moving heavy loads<sup>b</sup></b>							
No time	47	59	55	56	62	69	57
Any time	53	41	45	44	38	31	43
Less than 1 hour	10	11	12	12	12	8	11
1 to less than 3 hours	24	16	19	19	16	15	18
3 to less than 5 hours	8	7	8	7	6	4	7
5 to less than 7 hours	6	4	3	3	1	2	3
7 hours or more	5	3	3	3	2	2	3
Mean number of hours <sup>c</sup>	1.4	1.0	1.0	1.0	0.7	0.7	1.0
Standard error of the mean	0.10	0.07	0.06	0.06	0.06	0.12	0.03
Median <sup>c</sup>	0.3	0.0	0.0	0.0	0.0	0.0	0.0
<b>Moderate or vigorous occupational activity<sup>d</sup></b>							
At least 30 minutes per day	30	21	25	26	22	24	24
<b>Self-rated physical activity at work<sup>e</sup></b>							
Very or fairly physically active	73	57	61	59	64	67	62
Not very, not at all physically active	27	43	39	41	36	33	38
<b>Bases (unweighted)<sup>f</sup></b>							
Men	456	844	1070	937	767	173	4247
<b>Bases (weighted)<sup>f</sup></b>							
Men	658	1077	1237	1037	711	144	4864

<sup>a</sup> Average over preceding four weeks.<sup>b</sup> All self-reported activity at work has been included in these categories, regardless of the person's occupation, and therefore the likely intensity of the activity.<sup>c</sup> Mean and median are based on all participants aged 16-74 who reported working in the last four weeks, including those in unpaid work.<sup>d</sup> Occupational activity has been classified as being of moderate or vigorous intensity based on the participant's occupation (as detailed in endnote 40).<sup>e</sup> Based on all participants who reported working in the last four weeks, including those in unpaid work.<sup>f</sup> Bases vary but are of similar sizes; those shown are for self-rated physical activity at work.

Continued...

Table 2.9 continued

Aged 16-74 who reported working in the last four weeks, including unpaid work

2008

Average time spent per week (at least 10 minutes a day) <sup>a</sup>	Age group						Total
	16-24	25-34	35-44	45-54	55-64	65-74	
	%	%	%	%	%	%	%
<b>Women</b>							
<b>Sitting or standing<sup>b</sup></b>							
No time	19	10	11	11	15	18	13
Any time	81	90	89	89	85	82	87
Less than 1 hour	5	1	3	3	3	3	3
1 to less than 3 hours	15	12	15	14	14	26	15
3 to less than 5 hours	18	15	20	22	21	28	19
5 to less than 7 hours	18	27	26	26	26	17	25
7 hours or more	25	35	24	23	20	8	25
Mean number of hours <sup>c</sup>	3.8	5.0	4.4	4.4	4.1	3.1	4.4
Standard error of the mean	0.13	0.10	0.09	0.09	0.10	0.18	0.05
Median <sup>c</sup>	4.0	6.0	5.0	4.5	4.0	3.0	5.0
<b>Walking around at work<sup>b</sup></b>							
No time	35	43	42	39	40	50	40
Any time	65	57	58	61	60	50	60
Less than 1 hour	7	9	7	7	8	8	7
1 to less than 3 hours	19	20	24	26	23	22	23
3 to less than 5 hours	16	12	13	14	15	16	14
5 to less than 7 hours	11	9	7	9	9	3	9
7 hours or more	11	8	6	5	5	3	7
Mean number of hours <sup>c</sup>	2.4	1.9	1.8	1.9	1.8	1.3	1.9
Standard error of the mean	0.12	0.09	0.08	0.07	0.09	0.16	0.04
Median <sup>c</sup>	1.5	0.5	1.0	1.0	1.0	0.2	1.0
<b>Climbing stairs or ladders<sup>b</sup></b>							
No time	66	67	68	62	65	83	66
Any time	34	33	32	38	35	17	34
Less than 1 hour	20	23	20	26	25	13	23
1 to less than 3 hours	10	9	11	12	9	4	10
3 to less than 5 hours	3	1	1	1	1	-	1
5 to less than 7 hours	0	0	0	0	0	-	0
7 hours or more	0	0	0	0	-	-	0
Mean number of hours <sup>c</sup>	0.3	0.3	0.3	0.3	0.3	0.1	0.3
Standard error of the mean	0.04	0.02	0.02	0.02	0.02	0.03	0.01
Median <sup>c</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Lifting, carrying, or moving heavy loads<sup>b</sup></b>							
No time	61	75	74	71	77	79	72
Any time	39	25	26	29	23	21	28
Less than 1 hour	16	11	12	12	10	11	12
1 to less than 3 hours	14	10	10	12	9	9	11
3 to less than 5 hours	6	3	3	3	2	1	3
5 to less than 7 hours	2	1	1	1	1	1	1
7 hours or more	1	1	0	1	1	-	1
Mean number of hours <sup>c</sup>	0.6	0.4	0.4	0.4	0.3	0.2	0.4
Standard error of the mean	0.06	0.04	0.04	0.03	0.04	0.06	0.02
Median <sup>c</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Moderate or vigorous occupational activity<sup>d</sup></b>							
At least 30 minutes per day	11	9	12	12	13	13	11
<b>Self-rated physical activity at work<sup>e</sup></b>							
Very or fairly physically active	70	54	54	58	63	60	59
Not very, not at all physically active	30	46	46	42	37	40	41
<b>Bases (unweighted)<sup>f</sup></b>							
Women	550	823	1081	1023	699	151	4327
<b>Bases (weighted)<sup>f</sup></b>							
Women	661	840	1029	918	584	120	4151

<sup>a</sup> Average over preceding four weeks.<sup>b</sup> All self-reported activity at work has been included in these categories, regardless of the person's occupation, and therefore the likely intensity of the activity.<sup>c</sup> Mean and median are based on all participants aged 16-74 who reported working in the last four weeks, including those in unpaid work.<sup>d</sup> Occupational activity has been classified as being of moderate or vigorous intensity based on the participant's occupation (as detailed in endnote 40).<sup>e</sup> Based on all participants who reported working in the last four weeks, including those in unpaid work.<sup>f</sup> Bases vary but are of similar sizes; those shown are for self-rated physical activity at work.

Continued...

Table 2.10

**Average sedentary time per day (self-reported), by age and sex***Aged 16 and over**2008*

Average sedentary time per weekday, and weekend day	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>Watching TV</b>								
<b>Weekday</b>								
Less than 2 hours	34	34	32	28	22	13	13	27
2 to less than 4 hours	43	49	48	52	48	41	37	47
4 hours or more	23	17	20	20	29	46	51	26
Mean number of hours <sup>a</sup>	2.5	2.3	2.5	2.6	3.0	3.6	3.9	2.8
Standard error of the mean	0.08	0.06	0.06	0.06	0.06	0.07	0.09	0.03
Median <sup>a</sup>	2.0	2.0	2.0	2.0	3.0	3.0	4.0	2.0
<b>Weekend day</b>								
Less than 2 hours	30	23	22	20	19	14	13	21
2 to less than 4 hours	41	44	44	47	43	40	37	43
4 hours or more	29	32	34	32	37	46	50	36
Mean number of hours <sup>a</sup>	2.7	3.0	3.1	3.1	3.3	3.7	3.8	3.2
Standard error of the mean	0.08	0.07	0.06	0.06	0.07	0.08	0.09	0.03
Median <sup>a</sup>	2.0	3.0	3.0	3.0	3.0	3.0	3.5	3.0
<b>Other sedentary time</b>								
<b>Weekday</b>								
Less than 2 hours	32	50	56	57	45	35	26	45
2 to less than 4 hours	34	39	35	35	40	44	46	38
4 hours or more	34	12	9	8	16	20	28	17
Mean number of hours <sup>a</sup>	3.1	2.0	1.8	1.8	2.2	2.5	2.9	2.2
Standard error of the mean	0.11	0.06	0.04	0.05	0.05	0.07	0.09	0.03
Median <sup>a</sup>	2.5	2.0	1.5	1.5	2.0	2.0	2.0	2.0
<b>Weekend day</b>								
Less than 2 hours	27	35	44	45	40	33	25	37
2 to less than 4 hours	39	44	41	42	41	47	46	42
4 hours or more	33	21	15	13	19	20	29	21
Mean number of hours <sup>a</sup>	3.1	2.4	2.1	2.0	2.3	2.5	3.0	2.4
Standard error of the mean	0.09	0.07	0.05	0.05	0.06	0.06	0.09	0.03
Median <sup>a</sup>	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
<b>Total sedentary time</b>								
<b>Weekday</b>								
Less than 2 hours	4	6	7	5	4	2	1	5
2 to less than 4 hours	23	39	39	38	25	11	9	29
4 to less than 6 hours	31	34	34	37	36	35	27	34
6 hours or more	42	21	20	20	35	51	63	32
Mean number of hours <sup>a</sup>	5.6	4.3	4.3	4.4	5.2	6.2	6.8	5.0
Standard error of the mean	0.11	0.09	0.07	0.08	0.08	0.10	0.11	0.04
Median <sup>a</sup>	5.0	4.0	4.0	4.0	4.6	6.0	6.4	4.5
<b>Weekend day</b>								
Less than 2 hours	7	5	6	5	4	3	2	5
2 to less than 4 hours	20	22	25	24	21	12	8	20
4 to less than 6 hours	24	33	33	36	31	33	28	31
6 hours or more	49	40	37	35	44	53	62	44
Mean number of hours <sup>a</sup>	5.8	5.4	5.1	5.1	5.6	6.2	6.8	5.6
Standard error of the mean	0.13	0.10	0.09	0.09	0.09	0.10	0.12	0.04
Median <sup>a</sup>	5.5	5.0	5.0	4.5	5.0	6.0	6.5	5.0
<b>Bases (unweighted)<sup>b</sup></b>								
<i>Men</i>	771	954	1218	1098	1183	875	647	6746
<b>Bases (weighted)<sup>b</sup></b>								
<i>Men</i>	1133	1212	1411	1207	1086	726	538	7313

<sup>a</sup> Mean and median are based on all participants interviewed including those who reported no participation.

<sup>b</sup> Bases vary but are of similar sizes; those shown are for watching TV, weekday.

Continued...



Table 2.10 continued

Aged 16 and over

2008

Average sedentary time per weekday, and weekend day	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Women</b>								
<b>Watching TV</b>								
<b>Weekday</b>								
Less than 2 hours	31	33	36	30	21	12	13	27
2 to less than 4 hours	45	50	48	50	48	44	36	47
4 hours or more	24	17	15	20	31	44	51	27
Mean number of hours <sup>a</sup>	2.6	2.4	2.3	2.5	3.0	3.6	3.9	2.8
Standard error of the mean	0.07	0.04	0.05	0.05	0.05	0.06	0.07	0.02
Median <sup>a</sup>	2.0	2.0	2.0	2.0	3.0	3.0	4.0	2.5
<b>Weekend day</b>								
Less than 2 hours	28	24	26	24	19	14	13	22
2 to less than 4 hours	44	49	49	48	48	41	39	46
4 hours or more	28	28	25	28	33	44	48	32
Mean number of hours <sup>a</sup>	2.7	2.8	2.7	2.7	3.1	3.5	3.8	3.0
Standard error of the mean	0.07	0.05	0.05	0.05	0.05	0.07	0.08	0.02
Median <sup>a</sup>	2.0	2.5	2.0	2.5	3.0	3.0	3.5	3.0
<b>Other sedentary time</b>								
<b>Weekday</b>								
Less than 2 hours	34	50	56	53	43	33	27	44
2 to less than 4 hours	40	40	36	38	41	46	42	40
4 hours or more	26	10	8	9	16	22	31	16
Mean number of hours <sup>a</sup>	2.8	1.9	1.8	1.8	2.2	2.6	3.1	2.2
Standard error of the mean	0.10	0.04	0.04	0.04	0.05	0.06	0.08	0.03
Median <sup>a</sup>	2.0	1.8	1.5	1.5	2.0	2.0	2.5	2.0
<b>Weekend day</b>								
Less than 2 hours	34	41	48	41	38	32	26	38
2 to less than 4 hours	41	43	41	46	45	45	42	43
4 hours or more	26	16	11	13	18	23	32	19
Mean number of hours <sup>a</sup>	2.7	2.1	1.9	2.1	2.3	2.6	3.1	2.3
Standard error of the mean	0.10	0.05	0.04	0.05	0.05	0.06	0.08	0.03
Median <sup>a</sup>	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.0
<b>Total sedentary time</b>								
<b>Weekday</b>								
Less than 2 hours	4	7	9	7	3	1	2	5
2 to less than 4 hours	22	38	42	36	25	13	9	29
4 to less than 6 hours	35	34	31	35	38	35	23	33
6 hours or more	39	20	17	21	35	51	66	33
Mean number of hours <sup>a</sup>	5.4	4.3	4.0	4.3	5.2	6.1	6.9	5.0
Standard error of the mean	0.11	0.07	0.06	0.06	0.07	0.09	0.10	0.03
Median <sup>a</sup>	5.0	4.0	3.5	4.0	5.0	6.0	6.5	4.5
<b>Weekend day</b>								
Less than 2 hours	6	7	7	5	3	2	2	5
2 to less than 4 hours	23	24	30	27	20	15	10	23
4 to less than 6 hours	29	36	35	37	37	32	25	34
6 hours or more	41	33	27	32	39	51	63	39
Mean number of hours <sup>a</sup>	5.4	4.9	4.6	4.9	5.3	6.1	6.9	5.3
Standard error of the mean	0.12	0.08	0.07	0.07	0.07	0.09	0.10	0.04
Median <sup>a</sup>	5.0	4.5	4.0	4.5	5.0	6.0	6.5	5.0
<b>Bases (unweighted)<sup>b</sup></b>								
Women	919	1219	1512	1374	1367	1000	945	8336
<b>Bases (weighted)<sup>b</sup></b>								
Women	1090	1215	1431	1233	1124	800	784	7677

<sup>a</sup> Mean and median are based on all participants interviewed including those who reported no participation.

<sup>b</sup> Bases vary but are of similar sizes; those shown are for watching TV, weekday.



Table 2.11

**Average sedentary time per day (self-reported), by BMI category, age and sex***Aged 16 and over with both valid height and weight measurements*

2008

Average sedentary time per weekday, and weekend day within BMI category <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</b>								
Weekday: Less than 4 hours	23	45	48	47	33	14	10	34
Weekday: 4 hours or more	77	55	52	53	67	86	90	66
Weekend day: Less than 4 hours	25	25	35	33	27	13	12	26
Weekend day: 4 hours or more	75	75	65	67	73	87	88	74
<b>BMI 25 to less than 30 kg/m<sup>2</sup> (overweight)</b>								
Weekday: Less than 4 hours	28	48	47	46	30	15	8	36
Weekday: 4 hours or more	72	52	53	54	70	85	92	64
Weekend day: Less than 4 hours	27	29	28	32	25	18	9	26
Weekend day: 4 hours or more	73	71	72	68	75	82	91	74
<b>BMI 30 kg/m<sup>2</sup> or more (obese)</b>								
Weekday: Less than 4 hours	45	40	42	40	24	12	9	32
Weekday: 4 hours or more	55	60	58	60	76	88	91	68
Weekend day: Less than 4 hours	31	22	27	22	21	10	12	21
Weekend day: 4 hours or more	69	78	73	78	79	90	88	79
<b>Women</b>								
<b>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</b>								
Weekday: Less than 4 hours	28	48	57	51	35	21	15	40
Weekday: 4 hours or more	72	52	43	49	65	79	85	60
Weekend day: Less than 4 hours	30	32	42	38	28	23	17	32
Weekend day: 4 hours or more	70	68	58	62	72	77	83	68
<b>BMI 25 to less than 30 kg/m<sup>2</sup> (overweight)</b>								
Weekday: Less than 4 hours	26	48	52	46	28	16	10	35
Weekday: 4 hours or more	74	52	48	54	72	84	90	65
Weekend day: Less than 4 hours	28	31	35	31	24	18	12	27
Weekend day: 4 hours or more	72	69	65	69	76	82	88	73
<b>BMI 30 kg/m<sup>2</sup> or more (obese)</b>								
Weekday: Less than 4 hours	21	39	40	33	17	10	6	25
Weekday: 4 hours or more	79	61	60	67	83	90	94	75
Weekend day: Less than 4 hours	25	24	27	24	20	11	8	21
Weekend day: 4 hours or more	75	76	73	76	80	89	92	79

<sup>a</sup> BMI: Body mass index = Weight (kg) / Height squared (m<sup>2</sup>).

Continued...

Table 2.11 continued

Aged 16 and over with both valid height and weight measurements

2008

Average sedentary time per weekday, and weekend day within BMI category <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<i>Bases (unweighted)</i>								
<i>Men</i>								
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	457	350	294	250	230	125	137	1843
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	184	348	502	419	469	372	241	2535
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	54	150	275	290	354	240	112	1475
<i>Women</i>								
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	516	550	574	431	377	234	227	2909
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	163	280	408	410	446	318	263	2288
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	108	196	327	335	373	276	171	1786
<i>Bases (weighted)</i>								
<i>Men</i>								
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	691	447	340	270	210	104	114	2178
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	258	433	577	463	429	305	202	2667
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	80	188	325	326	328	201	93	1541
<i>Women</i>								
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	615	558	541	381	309	187	189	2779
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	190	271	387	371	371	255	219	2063
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	130	191	313	305	305	221	142	1607

<sup>a</sup> BMI: Body mass index = Weight (kg) / Height squared (m<sup>2</sup>).

# Accelerometry in adults

# 3

Moushumi Chaudhury, Dale Esliger<sup>1</sup>

## Summary

- This chapter focuses on the use of accelerometry to measure physical activity and sedentary behaviour in the adult population in England. The 2008 HSE is the first time objective measures of physical activity were used in a national general population survey based in people's homes.
- Increasing physical activity has become a global health priority, so researchers have been developing practical tools that measure physical activity more precisely and accurately than self-report surveys. The use of accelerometry has become the most common method applied to assess physical activity in free-living individuals. To date, a large number of studies, including general population surveys, have investigated the validity of accelerometry under both field and laboratory conditions.
- In the 2008 HSE, 1,998 men and 2,509 women aged 16 and over were selected for the accelerometry sample. 21% of men and 20% of women declined to wear an accelerometer. 53% of men and 51% of women provided eligible data for at least one day, while 49% of men and 46% of women wore the accelerometer for at least four days for at least 10 hours per day.
- Overall, men had significantly longer periods of sedentary time per day on average than women (595 minutes and 584 minutes respectively), and longer periods of moderate intensity activity (30 minutes and 23 minutes respectively). The reverse was true for light physical activity, where women averaged more time per day than men (212 minutes among men, 231 minutes among women). Among both men and women, an average of only one minute per day was spent in vigorous activity.
- While men spent an average of 31 minutes in moderate or vigorous activity (MVPA) in total per day, and women an average of 24 minutes, most of this was sporadic activity, and only about a third was accrued in bouts of at least 10 minutes. Government recommendations specify that physical activity should be in 10 minute bouts to count towards meeting the targets.
- Average daily minutes of MVPA declined with age; this applied to all MVPA, and to MPVA in bouts of 10 minutes or more. Sedentary time per day was similar among men up to the age of 54, and then increased with age, while among women the number of minutes of sedentary time was lowest between the ages of 35-54, and increased with age from the age of 55 in the same way as for men.
- There were variations in average daily sedentary time and in time spent doing light physical activity by equivalised household income. Average sedentary time was higher in the highest income tertile than in the middle or lowest tertiles. Conversely, those in the middle and lowest income tertiles spent more time on average doing light physical activity than those in the highest tertile.
- Those who were not overweight or obese spent fewer minutes on average in sedentary time (591 minutes for men, 577 minutes for women) than those who were obese (612 minutes for men, 585 minutes for women). Similarly, those not overweight or obese spent more MVPA minutes than those who were overweight or obese.

- Based on accelerometry, only 6% of men and 4% of women met the government's current recommendations for physical activity, by achieving at least 30 minutes of moderate or vigorous activity on at least five days in the week of accelerometer wear, accumulated in bouts of at least 10 minutes. Men were less likely than women to be in the low activity category (50% and 58% respectively), defined as doing less than 30 minutes of moderate or vigorous activity (accumulated in 10 minute bouts) on all days day in the week of accelerometer wear.
- Men and women aged 16-34 were most likely to have met the recommendations (11% and 8% respectively); the proportion of both men and women meeting the recommendations fell in the older age groups. Similarly, the proportion in the low activity category increased with age for both sexes.
- Among those whose self-reported activity level corresponded with meeting the recommendations, only 10% of men and 8% of women also met the recommendations based on accelerometry. Just under half were in the intermediate category (49% of men, 48% of women), and 41% of men and 44% of women were actually in the low activity category.
- Logistic regression was used to identify the risk factors associated with being in the low activity group. Two risk factors emerged as being highly significant predictors of low activity levels. These were age, and the health risk posed by a combination of overweight or obesity and raised waist circumference. Odds of being in the low activity group were significantly higher in older adults compared with those aged 16-34. Adults in the higher health risk categories also had higher odds of being in the low physical activity group than those with no increased health risk.

### 3.1 Introduction

The health benefits of physical activity are well documented, especially if activity is undertaken at moderate intensity or higher.<sup>2</sup> Moderate intensity activity includes both planned exercise and normal daily activities, for example brisk walking, mowing the lawn, etc.

Data from the HSE are used to obtain estimates of the percentage of the population meeting the government recommendations for physical activity. The importance of physical activity, the current recommendations, and the difficulties of subjective assessment of physical activity have been discussed in Chapter 2. Most large population studies use self-reported measures to collect data on physical activity. The challenge of balancing feasibility with measurement accuracy<sup>3</sup> is further complicated by the well-documented issues of reactivity (changes in physical activity behaviour as a result of the measurement process), recall bias and social desirability bias<sup>4</sup> (see section 2.1, Chapter 2). This chapter presents the findings of using an objective measure of physical activity (accelerometry), for the first time in the HSE series, to measure physical activity and sedentary behaviour in the adult population in England; Chapter 6 presents findings for children aged 4-15.

Self-reported (subjective) physical activity measures, such as the questionnaire, are well known to have limitations in the scope of their measurement.<sup>5</sup> These include not only difficulties in assessing both the frequency and duration of activity, but in particular, assessment of the intensity of the exercise. For example, routine activities (such as domestic activity including housework or gardening), categorised as 'lifestyle' activities by the Chief Medical Officer, do contribute to overall activity levels but are difficult to put in context and therefore difficult to recall accurately; furthermore it is very difficult to report the intensity of such activities accurately. A possible solution to this in population studies is the introduction of objective measures such as accelerometers, which measure movement in one or more planes. Objective measurement of physical activity can supplement self-reported data with more accurate information on the frequency, intensity, and duration of free-living (i.e. everyday lifestyle) physical activity.<sup>6</sup> A systematic review of objective versus self-report measures for assessing physical activity in adults found that correlations between self-report and direct measures were generally low-to-moderate, and that results varied depending on the methods of measurements used.<sup>7</sup>

Accelerometry-based devices, such as the Actigraph, are becoming more commonly used methods of objective measurement of physical activity in free-living populations,<sup>8</sup> capable of capturing a wide range of different movements. Accelerometric devices have been available for over 25 years; however their use has dramatically increased in more recent years.<sup>9</sup> The Actigraph has become the favoured choice of many investigators in physical activity research due to its small size, robust design features and relatively modest running cost.

The advantage of accelerometry is that it provides objective information on the frequency, intensity, and duration of both physical activity and sedentary behaviour. Sedentary behaviours are important as they are independently associated with an increase in many chronic conditions and diseases (e.g. obesity and obesity-related diseases) and decreased longevity.<sup>10,11,12</sup>

Using an accelerometer to collect activity data has the advantages of being objective and providing standardised measures, unlike self-report of activity. Direct monitoring reduces recall bias and other problems of subjectivity. In 2007, a small-scale HSE validation study was conducted to compare self-reported and objectively measured physical activity and to validate the self-reported methods; this study demonstrated that participants responding to the questionnaire overestimated their physical activity levels compared with the accelerometry data.<sup>13</sup> A further advantage of objective measurement is that data can have greater precision, so the same statistical power can be obtained with smaller sample sizes. However, participants' co-operation is required to wear the monitor during waking hours and to keep a record of activities when the monitor is not worn, for example while swimming.

The accuracy of accelerometry depends on the type of activity being measured. Accelerometers are very good at recording time spent being sedentary and time spent on ambulatory activity, such as walking or running. Accelerometer counts (see Table 3A in section 3.2.5) increase consistently with ambulatory speed, a finding replicated in studies conducted at different times, in different places, using different methods and on different populations.<sup>14</sup> However, they are less good at recording activity undertaken while sitting, such as cycling and rowing, and have difficulty quantifying some types of activity (e.g. load carriage, walking/running uphill). A further potential limitation of accelerometry can be the lack of contextual information (the type or purpose of the activity); however, this was not an issue in the HSE 2008, as a physical activity questionnaire was also administered to assess physical activity, whether or not survey participants were asked to wear an accelerometer.

A large scale general population study in the United States, National Health and Nutrition Examination Survey (NHANES),<sup>15</sup> demonstrated that it is feasible to monitor and measure physical activity objectively in such a survey. NHANES used accelerometers among 15,000 participants aged 6 and over. Similarly the Canadian Health Measures Survey collected data on 5,000 participants in 2008/09. The HSE 2008 used accelerometers in a sub-sample of 2,480 adult participants.

The inclusion of accelerometry in the 2008 HSE had two aims:

1. To provide an objective measure of physical activity and sedentary behaviour and to supplement self-reported data for adults (see Chapter 2) and children (see Chapters 5 and 6).
2. To provide a benchmark against which the validity and reliability of the self-reported physical activity questions could be assessed (on a larger scale than the validation study conducted in 2007).

This chapter reports the results of these objective measures of physical activity in adults aged 16 and over. In addition to presenting the direct results of activity levels, it includes comparisons of subjective (questionnaire) and objective (accelerometry) measures. The chapter does not report on the second aim, which will be reported elsewhere in due course.<sup>16</sup>

## 3.2 Methods and definitions

### 3.2.1 Choice of accelerometer

The objective physical activity measurements were obtained through the use of a device called an *accelerometer*. The particular accelerometer used, the Actigraph (model GT1M), is the most utilised accelerometer world-wide and was the preferred tool for HSE 2008. The feasibility of using the Actigraph in the HSE was assessed as part of the pilot study to validate the extended questionnaire (see Chapter 2, section 2.2.1); it performed well during that testing in the field.<sup>13</sup> The accelerometer provides a measure of the frequency, intensity, and duration of physical activity and allows classification of activity levels as sedentary, light, moderate and vigorous.

A brief description of the methods used for data collection and processing is given here, with additional detail provided in Appendix A to this volume.

### 3.2.2 Data collection

#### *Exclusion criteria*

Children aged 4-15 and adults aged 16 and over were eligible to be in the accelerometry sub-sample; there was no upper age limit. To keep household burden to a reasonable level, a maximum of two adults per household or one adult and one child per household were invited to wear an accelerometer.

Before participants were asked to wear an accelerometer, eligibility was checked, and the following exclusion criteria were applied:

- Younger than 4 at the initial interview;
- Pregnant (known by the participant), since HSE convention is to take no measurements from pregnant women;
- Confined to bed or in a wheelchair;
- Recent abdominal surgery or health problem that would make a belt round the waist uncomfortable;
- Latex allergy (the belt on which the accelerometer was worn contained latex).

### Equipment

The objective physical activity measurements were taken using the Actigraph model GT1M, a small and lightweight device around the size of a matchbox that is worn on the waist using a belt (Figure 3A). The Actigraph GT1M is a digital uni-axial accelerometer<sup>17</sup> that records movement on the vertical axis and is also capable of recording step counts, but that functionality was not used in HSE 2008.

Figure 3A: The Actigraph Model GT1M



### Fieldwork procedure

4,507 adults (and 1,707 children aged 4-15) were asked to participate in the accelerometry sub-study. A sub-sample of HSE participants was randomly selected (see Chapter 1, section 1.4.4 of this volume for brief description and Volume 2, Methods and documentation, Chapter 2 for full description of the sample design).

Participants were asked to wear the accelerometer during waking hours for seven consecutive full days. At the end of the initial interview, interviewers obtained agreement for participation in this element of the study, provided the accelerometers and explained procedures. The protocols used for the placement are provided in Volume 2, Appendix B.

A log book was provided to participants to record some details of their accelerometer wear. As well as recording the time that participants started and stopped wearing the accelerometer each day, they recorded any periods when they took the accelerometer off (for instance to go swimming, or for contact sports such as rugby or martial arts) or any periods of cycling or rowing, since it is known that the uni-axial accelerometer may under-represent the intensity of activity for these pursuits. The log book data have not been used in the analyses presented in this report, since subjective interpretation of logbook data is required; however the data have been processed and will be available for future analyses.

Participants were given an information leaflet (with separate versions for adults and children) and provided with an opportunity to ask any questions. They were given a telephone number to call if they had any queries during the period of measurement. The interviewer obtained verbal consent from the participant as part of the placement procedure.

For participants in the core sample, accelerometers were collected as part of the nurse visit which followed the interview. For those who refused a nurse visit or those in the child boost sample where there was no nurse visit, the interviewer returned to collect the accelerometer.

Due to the added burden of having to wear an accelerometer for a week participants were offered a £20 high street voucher to thank them for their participation.



### 3.2.3 Data processing

The raw accelerometry data were analysed using specialist software<sup>18</sup> to produce a series of standardised outcome variables.<sup>19,20</sup> The main variables of interest were average minutes of sedentary, light, moderate, and vigorous intensity physical activity per day; a summary variable of moderate to vigorous activity (MVPA) is also provided since it is this level of activity that is required to meet government recommendations. In this chapter, intensity variables were analysed to provide daily averages; they have also been analysed to provide averages for weekdays and weekend days.

For a day to be 'valid' for inclusion in the analyses, participants had to have worn the accelerometer for a minimum of 600 minutes (10 hours). Participants with at least four days of valid wear have been included in the analyses to provide average daily estimates. For analyses of summary physical activity levels, including whether participants had met government recommendations for weekly activity, only those with seven valid days were included.

In tables presenting average daily time in the various physical activity intensities (sedentary, light, moderate, vigorous and MVPA), an adjustment has been made for average wear time using regression techniques (taking into account the complex survey design). This allows comparisons between groups after adjusting for any differences in their average wear time.

### 3.2.4 Weighting and analysis

Only a sub-sample of the adult participants in the HSE 2008 were eligible to be included in the accelerometry sub-study. Accelerometry weights were therefore derived to allow for non-response at each stage, for use when analysing accelerometry data.

The scope for detailed analysis breakdowns is limited, because of the size of the sub-sample. Broader age ranges have been used than in other chapters, and tertiles rather than quintiles of equivalised household income. The sample size is not large enough to allow analysis by Strategic Health Authority.

### 3.2.5 Definitions

#### *Recommended targets for physical activity levels*

The summary measure of physical activity levels groups participants according to the Chief Medical Officer's physical activity guidelines, which are that adults should take part in activity of at least moderate intensity, of 30 minutes or more duration on five or more days per week.<sup>21</sup> The summary measure incorporates three basic dimensions (intensity, duration and frequency) of the participants' overall physical activity level.

The government's recommendations changed in 1996<sup>16</sup> to allow daily activity to be accumulated in bouts of at least 10 minutes' duration. The enhanced questionnaire for self-reported activity was amended for 2008 to catch shorter bouts of activity (see Chapter 2, section 2.2.1). However, the summary variable based on the self-reported data in Chapter 2, and compared with the objective measurement in Tables 3.10 and 3.11, includes data only from activity spells of at least 30 minutes' duration; this is because of the difficulty in establishing the aggregated time on each individual day spent in different activities (see Chapter 2, section 2.2.3 for definitions and further explanation).

The summary variable based on accelerometry data is able to allocate activity bouts to specific days and therefore includes days in which 30 minutes of at least moderate activity was accumulated in bouts of at least 10 minutes' duration. The summary activity level classification for accelerometry data, for participants with seven valid days of data, is as follows:

*Meets recommendations:* moderate or vigorous activity of at least 30 minutes duration per day in total, accumulated in bouts of at least 10 minutes' duration, on at least five of the seven days.

*Some activity:* 30 minutes or more of moderate or vigorous activity on one to four days.



Low activity: lower levels of activity.

### Definitions of accelerometry activity levels

Table 3A gives the definitions of physical activity intensity categories, based on metabolic equivalents (METs) and the counts per minute recorded by the accelerometer that represent these levels. MET intensity level is the ratio of the intensity of metabolic rate needed for a particular activity to the resting metabolic rate. The same MET thresholds are used as for defining moderate and vigorous activity in adults in Chapter 2 (section 2.2.3). Sedentary time is also defined in the table.

Table 3A		
Categories of physical activity intensity and cutpoints based on accelerometry		
Physical activity intensity	Counts per minute (cpm)	Metabolic Equivalents (METS)
Sedentary	0-199	0 to below 1.5
Light	200-2,019	1.5 to below 3
Moderate (MPA)	2,020-5,998	3 to below 6
Vigorous (VPA)	More than 5,998	6 or more
Moderate and vigorous (MVPA)	2,020 or more	3 or more

In 2008, information on activity bouts of at least 10 minutes' duration have been included in the tables showing participation, frequency, and duration of activity by type of activity. For summary measures in relation to the government recommendations, bouts have been included but not sporadic activity (see definitions below). However, when assessing the mean total time spent in each category of activity from light to vigorous, sporadic activity has also been included.

### Sporadic activity

Activity of less than 10 minutes' duration

### Bouts of activity

Activity of at least 10 minutes' duration (allowing a maximum of two minutes' inactivity within the 10 minute bout).

### BMI categories

Body mass index (BMI) is weight in kilograms divided by height in metres squared (see Chapter 7). The BMI categories used were:

Not overweight or obese: Less than 25kg/m<sup>2</sup>  
 Overweight: 25kg/m<sup>2</sup> to less than 30kg/m<sup>2</sup>  
 Obese: 30kg/m<sup>2</sup> or more.

### NICE health risk categories based on BMI and waist circumference

National Institute of Health and Clinical Excellence (NICE)<sup>22</sup> guidelines use combined categories of BMI and waist circumference to assess risk of co-morbidities of obesity and overweight. The NICE categories are defined as follows (see Chapter 7):

Table 3B			
NICE health risk categories			
BMI classification	Waist circumference		
	Low	High	Very high
Normal weight	No increased risk	No increased risk	Increased risk
Overweight (25 to less than 30kg/m <sup>2</sup> )	No increased risk	Increased risk	High risk
Obesity I (30 to less than 35kg/m <sup>2</sup> )	Increased risk	High risk	Very high risk
Obesity II (35 to less than 40kg/m <sup>2</sup> )	Very high risk	Very high risk	Very high risk
Obesity III (40kg/m <sup>2</sup> or more)	Very high risk	Very high risk	Very high risk

For men, low waist circumference is defined as less than 94cm, high as 94–102cm, and very high as greater than 102cm. For women, low waist circumference is less than 80cm, high is 80–88cm and very high is greater than 88cm.

### 3.3 Response to accelerometry

Table 3.1 presents response rates of accelerometer wear by age and sex. 4,507 adults aged 16 and over were selected for accelerometry in the households identified for the accelerometer sub-sample. Among this group, 21% of men and 20% of women declined to participate in the accelerometry element of the 2008 HSE, and 4% of men and 6% of women were ineligible.

Although a significant proportion of participants agreed to wear the accelerometer, a fault with the device meant that there were unusable data for 18% of men and 20% of women selected for accelerometry. In a small number of cases some data were recorded, but the results were spurious.

Overall, 49% of men and 46% of women selected wore an accelerometer for at least 600 minutes (ten hours) per day on at least four days, and therefore provided sufficient data to be included in the analyses of daily average wear. The majority of these included at least one weekend day (47% and 43% respectively). 53% of men and 51% of women provided at least one valid day of wear. The proportion wearing the accelerometer for the full seven days was 31% among men and 27% among women.

Younger participants were the least likely to wear the accelerometer for seven days (11% of men and 13% of women aged 16–24). The proportion doing so increased with age to the highest level among those aged 55–74, and dropped slightly among those aged 75 and over. There was a similar pattern for at least four days' valid wear, with highest compliance among those aged 45–74.

Men wore the accelerometer for an average of 849 minutes per day (14 hours 9 minutes), while women averaged 830 minutes (13 hours 50 minutes). The average wear time was shortest for the youngest and oldest age groups, but in all cases was more than 13 hours.

**Table 3.1**

### 3.4 Objective measures of physical activity

#### 3.4.1 Average daily physical activity profile by age and sex

Table 3.2 shows the average daily minutes spent in different categories of intensity of activity; the data have been adjusted to allow comparisons between groups with different average daily wear time.

Overall, men had significantly longer periods of sedentary time per day than women (595 minutes and 584 minutes respectively), and longer periods of moderate intensity activity (30 minutes and 23 minutes respectively). The reverse was true for light physical activity, where women averaged more time per day than men (212 minutes among men, 231 minutes among women). Among both men and women, an average of only one minute per day was spent in vigorous activity.

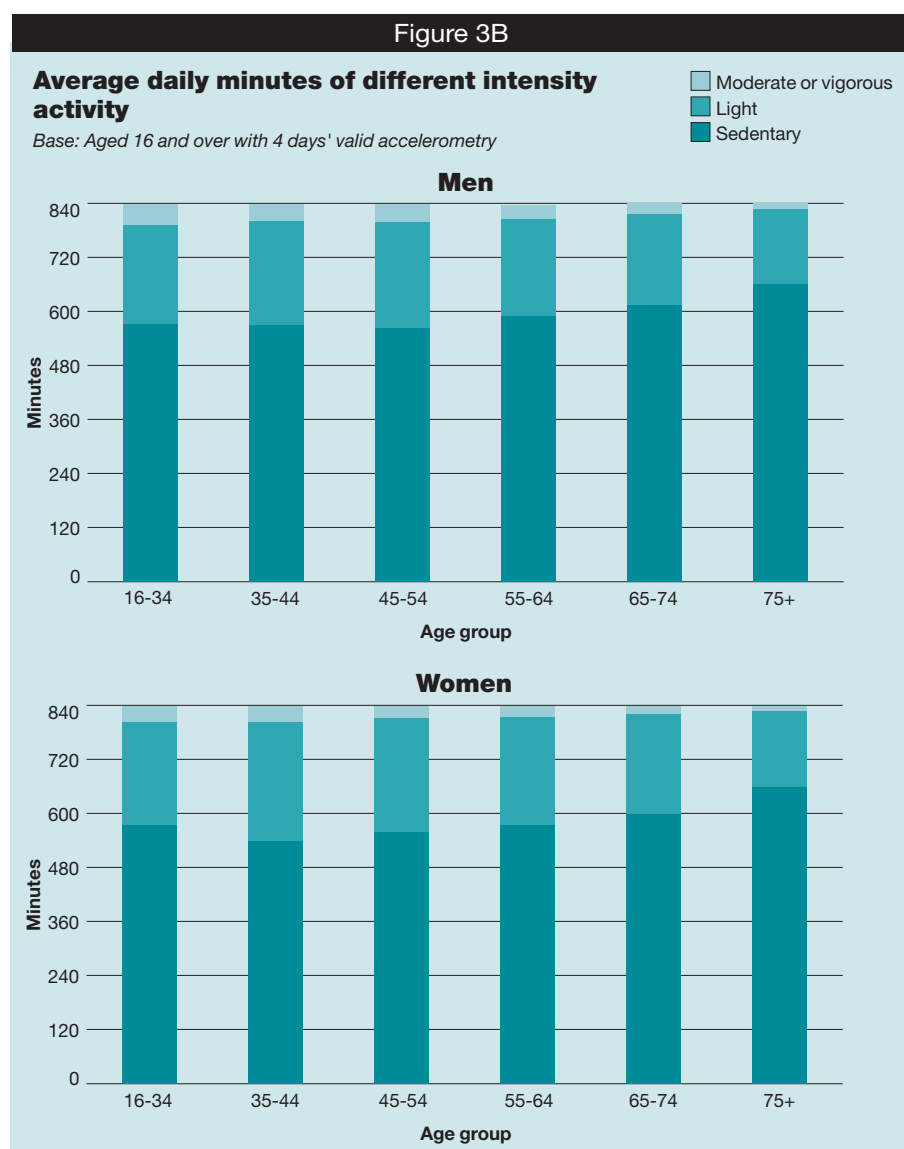
While men spent an average of 31 minutes in MVPA in total per day, and women an average of 24 minutes, most of this was sporadic activity, and only about a third was accrued in bouts of at least 10 minutes. Thus men averaged 11 minutes per day, and women 8 minutes per day of MVPA that would count towards meeting government recommendations.

Figure 3B shows variation in sedentary, light and MVPA time by age; the MVPA time here is all MVPA time, not just in 10 minute bouts. The average number of minutes per day decreased with age, from 45 minutes for men and 34 minutes for women aged 16–34, to 12 minutes for men and 9 minutes for women aged 75 and over. Average daily MVPA<sub>10+</sub> (in

bouts of 10 minutes or more) also declined with age. The decline was similar in men and women, from 17 minutes in men aged 16-34 to 5 minutes in men aged 75+ and from 14 minutes in women aged 16-34 to 2 minutes in women aged 75 and over.

Sedentary time per day was similar among men up to the age of 54 and then increased with age, while among women the number of minutes of sedentary time was lowest between the ages of 35-54, and increased with age from the age of 55 in the same way as for men. Between the ages of 35-74, women consistently averaged around 20-30 minutes more light activity per day than men, while for ages below 35 and above 74, the average minutes of light activity were similar between the sexes.

Table 3.2, Figure 3B



### 3.4.2 Average daily physical activity profile on weekdays and weekend days

Table 3.3 shows the profile of activity for weekdays and weekend days.

The average period of wear was around 50 minutes lower on weekend days than on weekdays. Because of this difference in average wear time, a direct comparison of the number of minutes at a particular intensity on weekdays and weekend days will reflect the difference in the total waking time, as well as any change in the relative balance between intensity categories. If the pattern of activity was exactly the same on weekdays and weekends, then the average minutes at each intensity would be scaled down proportionately for weekend days; this would mean around 35 minutes less time in sedentary pursuits, 13-14 minutes less in light activity and 1-2 minutes less in MVPA.

Among men, in fact there were similar reductions in sedentary time and light activity between weekdays and weekends (21 minutes and 24 minutes respectively, compared with the predicted 35 minutes and 13 minutes), indicating that men typically did less light activity on weekend days. Men also did five minutes less MVPA on weekend days, compared with a predicted reduction of around two minutes, again suggesting that the amount of MVPA was slightly less at weekends. However, there was no significant difference between weekdays and weekends in the MVPA carried out in 10 minute bouts, suggesting that proportionally more MVPA time at the weekends is in sustained periods rather than sporadic. There were some significant differences by age, with men aged 16-34 spending less sedentary time rather than light activity or MVPA at the weekends, while those aged 45 and over on average spent less time in light activity and MVPA at the weekends.

There was a similar overall pattern among women, with slightly less light activity or MVPA, and slightly more sedentary time on weekend days than on weekdays. Those aged 45 and over were the most likely to be undertaking light activity at weekends. As with men, the overall average time spent in MVPA was slightly reduced at weekends, but the MVPA in 10 minute bouts was unchanged.

**Table 3.3**

### **3.4.3 Average daily physical activity profile, by equivalised household income and sex**

There were variations in average daily sedentary time and in time spent doing light physical activity by equivalised household income. Those in the highest income tertile spent more sedentary time (591 minutes for men, 585 minutes for women) than those in the middle or lowest tertiles (around 570 minutes). Conversely, those in the middle and lowest income tertiles spent more time on average doing light physical activity (around 225 minutes for men, 240 minutes for women) compared with those in the highest tertile (208 minutes for men, 225 minutes for women).

No significant differences by equivalised income were found in average daily time spent in moderate or vigorous physical activity.

**Table 3.4**

### **3.4.4 Average daily physical activity profile, by Spearhead status**

There was no variation in the average daily physical activity profile of men and women in Spearhead<sup>23</sup> and non-Spearhead PCTs.

**Table 3.5**

### **3.4.5 Average daily sedentary time and MVPA, by BMI category, age and sex**

Table 3.6 shows the average number of minutes per day in sedentary time and all MVPA by BMI category, and Figure 3C shows the data for MVPA time. Those who were not overweight or obese spent fewer minutes on average in sedentary time (591 minutes for men, 577 minutes for women) than those who were obese (612 minutes for men, 585 minutes for women). Similarly, those not overweight or obese spent more MVPA minutes than those who were overweight or obese.

Within each BMI category, there were the expected gradients with age, with younger participants averaging more minutes of MVPA time, and fewer minutes of sedentary time, than older participants.

**Table 3.6, Figure 3C**

### **3.4.6 Objectively measured summary activity levels, by age and sex**

Objectively measured summary activity levels were calculated for those participants that wore the accelerometer for 10 or more hours on seven days. The results show that only 6% of men and 4% of women met the government's current recommendations for physical activity, by achieving at least 30 minutes of moderate or vigorous activity on at least five days in the week of accelerometer wear, accumulated in bouts of at least 10 minutes. Men were less likely than women to be in the low activity category (50% and 58% respectively), defined as doing less than 30 minutes of moderate or vigorous activity (accumulated in 10 minute bouts) on all days in the week of accelerometer wear.

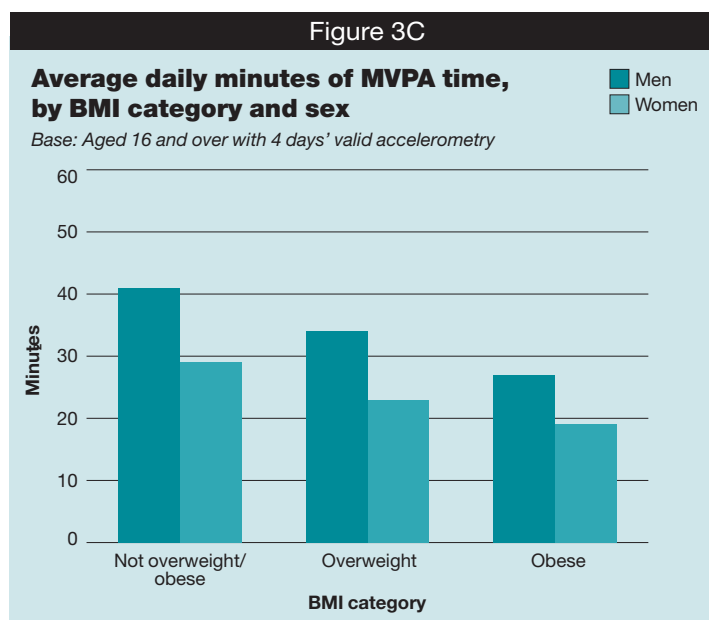
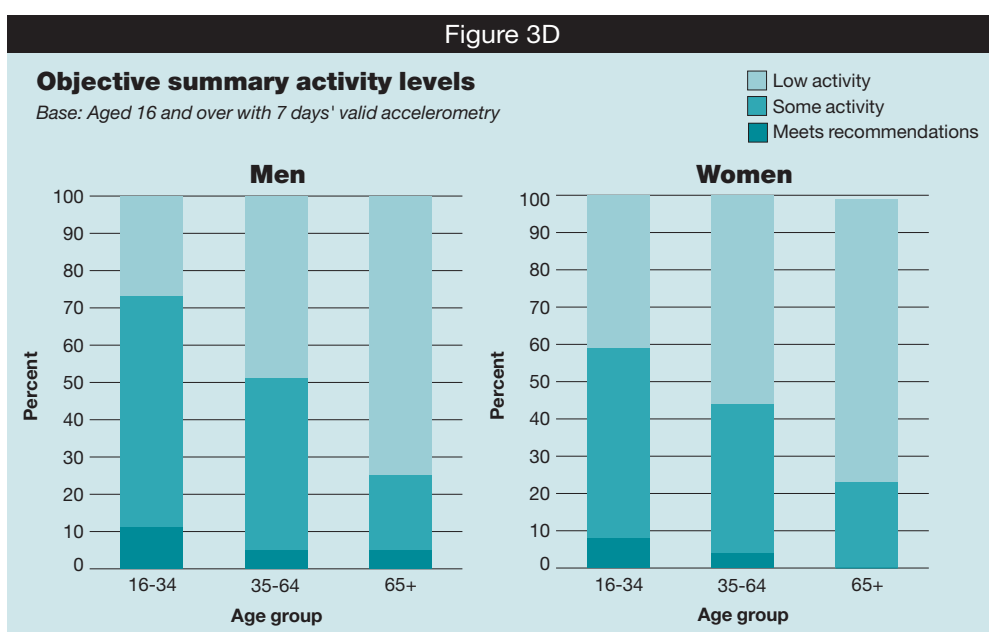


Figure 3D shows the objectively measured summary activity levels by age group. Men and women aged 16-34 were most likely to have met the recommendations (11 % and 8% respectively), and the proportion of both men and women meeting the recommendations fell in the older age groups. Similarly, the proportion in the low activity category increased with age for both sexes, from around a quarter of men and a third of women aged 16-34 (27% and 41% respectively), to around three quarters of both men and women aged 65 and over (75% and 76% respectively).

Table 3.7, Figure 3D



### 3.4.7 Objectively measured summary activity levels, by equivalised household income, and by Spearhead status

Objective summary activity levels varied by equivalised household income, although the pattern across income tertiles was not clear.

Table 3.8

There was no statistically significant difference in objectively measured summary activity levels between Spearhead and non-Spearhead PCTs.

Table 3.9

3.5 Comparison of objective measurement and self-reported physical activity levels

Table 3.10 shows objectively measured summary activity levels by self-reported summary activity level, among those participants for whom both measures were available. Based on self-reported data, 39% of men and 29% of women aged 16 and over met the Chief Medical Officer’s minimum recommendations for physical activity in adults (see Chapter 2). These were substantially higher than the proportions found using the accelerometer as an objective measure (6% of men, 4% of women). This suggests that the self-report method tended to over-estimate the amount of MVPA done by both men and women, although there were also some instances where the self-reported method under-represented the level of activity recorded through accelerometry. It should be remembered that the periods of data collection were not the same: the self-reported data were based on an average of the four weeks before the interview, while the accelerometer was usually worn in the week following the interview. It is possible that for a small number of participants one of the measurement periods was out of line with their usual pattern of activity, leading to a discrepancy, but this is unlikely to be a common situation.

Among those whose self-reported activity level corresponded with meeting the recommendations, only 10% of men and 8% of women also met the recommendations based on accelerometry. Just under half were in the intermediate category ‘some activity’ (49% of men, 48% of women), and 41% of men and 44% of women were actually in the low activity category. However, a high proportion of men and women who were in the low activity group based on self-report were also in this group based on accelerometry (71% of men and 73% of women). A large proportion of both men and women in the self-reported ‘some activity’ group (30 minutes or more of MVPA on one to four days in the week) were only achieving a low activity level based on objective data (46% of men, 58% of women).

Table 3.10

Table 3.11 displays both the objective and self-reported summary activity levels by age. Unlike the results shown in Table 3.9, the self-reported summary levels are based on all participants with valid self-report data, rather than only those who had both accelerometry and self-report data.

Despite the discrepancies between the proportions in each activity level using the two methods, both the subjective and objective measure found similar patterns of variation in summary activity levels by age, and by sex. In both cases, the proportion of men and women achieving the recommended amount of physical activity declined with age, and correspondingly, the proportion in the low activity category increased with age. Moreover, both measures also indicated that women were generally more likely than men to be in the low activity category, regardless of age.

There was less discrepancy in the profile of activity levels based on the two methods for adults aged 65 and over than for younger adults. Among those aged 65 and over, only a small minority met recommendations whether measured by self-report or objectively (16% self-reported and 5% by accelerometry for men, 12% and less than 0.5% respectively for women). A substantial majority were in the low activity group in either case (56% self-reported, 75% by accelerometry for men, 65% and 76% respectively for women aged 65 and over). Among those aged 16-34, around half of men and more than a third of women met recommendations according to self-report (51% and 36% respectively), compared with only around one in ten according to accelerometry (11% and 8% respectively).

It is also interesting to note that the gap between men and women in terms of meeting the recommendations was much smaller using the accelerometry data (only two percentage points difference between the sexes) compared with the self-reported data (a difference of ten percentage points).

Table 3.11

Table 3.12 compares the average daily minutes spent in MVPA according to objective measurement and self-report. In each case, only MVPA in bouts of at least ten minutes is included. Reflecting the much higher proportions classified as meeting the government

recommendations, the average minutes of MVPA per day were much higher based on self-report (73 minutes for men, 50 minutes for women) than based on accelerometry (11 minutes and 8 minutes respectively).

Figure 3E shows how the average daily minutes of MVPA vary by age. Accelerometry data showed that the average number of daily minutes of MVPA time decreased across age groups, for both men and women, ranging from 17 minutes for men aged 16-34 to 5 minutes for men aged 75 and over, and from 14 minutes to 2 minutes for women in the same age groups. Based on self-reported data, among men daily MVPA time was at a similar level between the ages of 16-54 (more than 80 minutes), and began to decline from the age of 55, dropping to 21 minutes for men 75 and over. For women, on the other hand, self-reported MVPA time increased from 54 minutes at age 16-34 to around 60 minutes at age 35-64, before decreasing to 11 minutes in the oldest age group.



It should be noted that it is not possible to make direct comparisons between objective and self-reported measures of sedentary time. This is because the accelerometry measured all activity in waking hours, whatever the context, while for the self-reported measures, participants were only asked about their sedentary leisure time, and sedentary time at work was not separately identified.

**Table 3.12, Figure 3E**



3.6 Predictors of low activity levels

Multivariate logistic regression was used to explore associations between low activity levels and possible risk factors, using forward stepwise regression. The outcome was being in the low activity group, defined as those who did not do 30 minutes of moderate or vigorous activity (made up in bouts of at least 10 minutes) on any day in the week of accelerometer wear. This group represents one of the targets identified in ‘Be active, be healthy: A plan for getting the nation moving’,<sup>37</sup> where the intention is to help 200,000 more people to realise the general health benefits of achieving 30 minutes of physical activity on five or more days per week.

The regression technique adjusts for several explanatory variables simultaneously. The following explanatory variables were included in the initial models:

- Socio-demographic: age, equivalised household income tertile, NS-SEC,<sup>24</sup> employment status, tertile of Index of Multiple Deprivation (IMD)
- Health-related: limiting longstanding illness, non-limiting and no longstanding illness
- Measurements: BMI and waist circumference (NICE health risk category),<sup>22</sup> hypertension category.<sup>25</sup>

Initial analyses identified variables with no significant link to the outcome of interest and these were excluded from the final regression models. These were income tertile, NS-SEC, employment status, tertile of Index of Multiple Deprivation (IMD), limiting longstanding illness, hypertension category.

Table 3.13 presents a model of the risk factors associated with low activity levels; the odds ratios presented are after adjustment for the other risk factors. Although the model was run separately for men and women, all variables of significance in the model for one sex were included in the models for both sexes. The final model made statistical adjustment for the complex survey design.

The risk factors indicate associations, not causes. These variations in risk are expressed as odds ratios, the degree to which the probability of the key outcome increases or decreases relative to the reference category. Odds ratios greater than 1 indicate an increased risk compared with the reference category; odds ratios less than 1 indicate a decreased risk. 95% confidence intervals are shown; odds are significantly different from the reference category if the limits of the confidence interval do not include 1.

Two risk factors emerged as being highly significant predictors of low activity levels. These were age and the health risk posed by a combination of BMI and waist circumference.

Odds of being in the low activity group were significantly higher in older adults compared with those aged 16-34, the reference category. Men aged 35-64 had odds of 1.96, and men aged 65 and over had odds of 6.37. Among women, those aged 65 and over had significantly greater odds of being in the low activity group, 4.10.

Adults in the higher health risk categories (due to raised BMI and/or raised waist circumference, as defined in section 3.2.5) had higher odds of being in the low physical activity group than those with no increased health risk. Men in the high risk group and men and women in the very high risk groups had significantly higher odds of being in the low activity group (2.33, 3.16 and 2.94 respectively).

Table 3.13

3.7 Discussion

3.7.1 Methodological issues

Advantages of accelerometry

Accelerometers are commonly used because they provide a direct, objective measure of physical activity.<sup>26</sup> Waist-mounted accelerometers provide an accurate estimate of physical activity within a given day or over several days by measuring bodily accelerations at the hip,

and recording the varying levels of intensity of activity.<sup>27</sup> Accelerometry offers some key advantages in comparison with self-report methods of data collection, including the fact that they are not subject to the biases of self-report. In particular they provide real time data storage, and therefore do not rely on recall of activity; while regular, formal exercise or sporting activities may be relatively easily remembered, it is much more difficult to recall everyday routine activity with great accuracy. Objective measures also avoid any issues relating to the social desirability of reported activity. Furthermore, there is no requirement for participants to make any estimate of the intensity of exertion required for their activity, nor for those analysing the data to assume given levels of intensity for particular activities.

### **Limitations of accelerometry**

While the objective measures obtained from accelerometry offer many advantages over self-reported measures of physical activity, they do have their own limitations as they are subject to measurement error.<sup>28,29,30</sup> They do not capture all types of physical activity with equal precision. Uni-axial accelerometers, such as the one used in this survey, collect data on acceleration in the vertical plane and are precise in their ability to assess ambulatory activities such as walking, running and jogging. However, these types of accelerometers are less successful at capturing other lifestyle physical activities, such as gardening, playing with children or housework. They also tend to underestimate physical activity for specific activities, both non-ambulatory activity<sup>31</sup> such as cycling, and activities when the effort expended is greater than the simple movement suggests, such as carrying heavy loads or walking up stairs or a slope; this in turn results in the underestimation of total energy expenditure.<sup>32</sup>

There are major costs involved in carrying out accelerometry in large scale surveys. The devices themselves are relatively expensive pieces of equipment, and there are associated disposables such as belts. Participant incentives are usually essential to maintain high rates of cooperation. Careful administration is required to ensure that accelerometers are recovered from participants after their period of wear. Therefore, even when a lengthy questionnaire is used to capture self-reported information, the costs and time involved will generally be considerably lower than for using accelerometry.

It should also be noted that accelerometry does not provide any qualitative detail about the types or modes of activity being undertaken, nor does it provide insight as to the context of the physical activity (e.g., work, school, leisure). This information is important in providing a detailed picture of physical activity.<sup>33</sup>

For all these reasons self-reports of physical activity, such as those captured in the HSE 2008 questionnaire, are still considered of value for larger population surveillance of these types of activity.

### **Interpretation of accelerometer data**

Accelerometers are not normally used for 24 hours a day, and it is therefore important to identify and consider the time when the accelerometer is not worn. It is possible, for instance, that participants may choose not to wear the accelerometer for certain types of activity; as well as contact sports such as rugby or martial arts, where there is the possibility of injury from the accelerometer (or damage to it), there may be formal or social occasions where the accelerometer is not worn.

The cutpoint values selected for moderate and vigorous activity for accelerometry (shown in Table 3A in section 3.2.5) are currently based on limited data.<sup>34</sup> In physical activity analyses in adults, the use of a single cutpoint may lead to an underestimation of moderate intensity activity for older adults by not taking into account the decline in exercise levels with age.<sup>30</sup>

For self-reported data, there may also be misclassification of activity intensity. Given the far greater proportions assumed to be meeting government recommendations using the self-report method rather than accelerometry, it is likely that self-reported data usually overestimate the intensity. For some activities, participants are asked to indicate whether the activity made them 'out of breath or sweaty' to give an indication of the intensity involved, but even so actual intensity of activity is likely to vary from individual to individual.

Assumptions are also made in analysis, so that for instance all periods playing hockey are assumed to be moderate intensity activity, while all running or playing squash is assumed to be vigorous activity; activities such as table tennis may be classified as light or moderate activity depending on whether or not the participant was out of breath. Again, these assumptions may not apply uniformly to all participants, nor to all of the period for which the activity was undertaken.

Self-reported data may over-state the amount of time spent on activities, as well as the intensity. Participants are asked, for each activity they mention, on how many days in the last four weeks they have undertaken it, and on each day how long they usually spent. There are therefore difficulties associated with recall, particularly assessing a 'typical' length of time if it varies from occasion to occasion, and participants may 'round up' their estimates. In addition, within a reported half hour of a particular activity, there may have been several minutes of warming up, resting or cooling down, rather than carrying out the activity at full intensity for the entire period.

Nevertheless, in some instances the self-reported activity may be more accurate than that measured through accelerometry, and the differences between the two methods may sometimes be attributable to certain types of activity, such as cycling or swimming.<sup>34</sup>

### 3.7.2 Findings

The HSE 2008 accelerometry data are the first objective measurements of physical activity in a nationally representative cross sectional health survey in the UK. The data were collected during a seven day period.

#### *Time spent in different levels of activity, based on accelerometry*

The great majority of the waking day for most adults was spent in sedentary time (just under 10 hours on average). Most of the remaining time was spent in light activity. On average men spent slightly more time in sedentary pursuits, while women spent more time on light activity. In an average day men did 31 minutes of MVPA, and women did 24 minutes; however most of this was sporadic activity and only around a third of the MVPA was done in bouts of at least 10 minutes, as required to count towards meeting the government recommendations.

The amount of time spent on sedentary behaviours has been linked to various adverse health outcomes such as increased risks of weight gain, diabetes and heart disease.<sup>12,35</sup> Sedentary behaviour is also associated with lower levels of energy expenditure.<sup>34</sup> It has emerged in recent years that a focus on sedentary behaviour is an important target for health promotion and the prevention of obesity and disease. Findings from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) in the USA<sup>36</sup> showed that sedentary behaviour increased with age among adults, as was found in the HSE 2008. NHANES reported that females were more sedentary than males throughout youth and early adulthood, but the pattern reversed after the age of 60. More men than women demonstrated increased levels of sedentary behaviour at this point. In the HSE 2008, the pattern was somewhat different: the average amount of sedentary time was similar among younger men and women (572 minutes per day for men, 575 for women aged 16-34), and among those in the oldest age group (661 minutes for men, 658 minutes for women aged 75 and over). However, from the age of 35-74 men generally recorded greater average sedentary time than women.

A recent study on Swedish adults has shown that the association between BMI and physical activity (measured by accelerometry) differed between a group of severely obese individuals (average BMI 42.7 kg/m<sup>2</sup>) and a group who were not obese. The study reported a highly significant association with measures of physical activity (minutes per day in different intensities of activity, activity counts per day and steps per day) in the obese individuals. In contrast the association between BMI and physical activity was weaker in non-obese individuals.<sup>37</sup> The HSE 2008 results showed a relationship between BMI and proportions of time spent in sedentary and MVPA time, although the sample sizes were not

sufficient to identify whether there were differential effects depending on the levels of obesity.

### **Compliance with current physical activity recommendations by accelerometry**

Based on accelerometry in the 2008 HSE, 6% of men and 4% of women in England met the physical activity recommendations of at least 30 minutes of moderate or vigorous activity on at least five days per week, accumulated in at least 10 minute bouts. This may be a small under-estimate of the true prevalence of compliance, because accelerometry will have under-represented activity for a small number of individuals who met the current recommendations partially or wholly through swimming, cycling or use of a rowing machine, or other sports undertaken when not wearing the accelerometer.

As was mentioned in Chapter 2, the Department of Culture, Media and Sports set out an aspirational target in the *'Game Plan: A Strategy for Delivering the Government's Sports and Physical Activity Objectives'*<sup>38</sup> to have 70% of adults undertaking 30 minutes of physical activity on at least five days a week by 2020, with an intermediate target of 50% by 2011. It is likely that the target was set based on previous estimates of compliance based on self-reported data. The results from accelerometry in the HSE 2008 show that in fact the base line for the target is much lower than has so far been assumed. This will require a considerable increase over the current level of 5% of adults as reported by accelerometry and 34% as reported by the self reported levels of physical activity (Chapter 2) in this survey.

### **Comparison between subjective and objective assessment of activity**

After comparing the subjective and objective assessments of physical activity, it is clear that the subjective self-reported method resulted in substantially higher levels of activity. Despite this, the results from the objective accelerometer data corroborate self-report findings across sex and age. Specifically, both the subjective and objective measurements found that men do more activity than women, and that physical activity decreases with age. Both of these findings are similar to that found in a similar American study published in 2008.<sup>34</sup> The researchers in this study emphasise the need for caution when interpreting self-reported physical activity across a range of domains, including clinical practice, public health campaigns, and research. The same is true when interpreting self-reported physical activity estimates from the population in England, which are known to be biased. Objective measures provide more accurate data and should be increasingly used instead of self-reported measures when available.

## **References and notes**

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- 23 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 24 NS-SEC is a social classification system that attempts to classify groups on the basis of employment relations, based on characteristics such as career prospects, autonomy, mode of payment and period of notice. It was introduced in 2001. It has similarities to Registrar General's Social Class. Participants are assigned to an NS-SEC category based on the current or former occupation of the household reference person (the person in whose name the accommodation is held; if more than one, the person with the highest income; and if more than one, the oldest).  
For a full explanation of NS-SEC and its derivation see the Glossary in Volume 2 of this report and *The National Statistics Socio-economic Classification User Manual 2002*. ONS 2002.
- 25 Hypertension categories are defined as follows (see Chapter 8):
 

Normotensive untreated	SBP below 140 mmHg and DBP below 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat high blood pressure
Hypertensive controlled	SBP below 140 mmHg and DBP below 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive uncontrolled	SBP at least 140 mmHg or DBP at least 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive untreated	SBP at least 140 mmHg or DBP at least 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat their high blood pressure
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- 3.1 Response to accelerometer measurement, by age and sex
- 3.2 Average daily physical activity profile, by age and sex
- 3.3 Average daily physical activity profile for weekdays and weekend days, by age and sex
- 3.4 Average daily physical activity profile (age-standardised), by tertile of equivalised household income and sex
- 3.5 Average daily physical activity profile (age standardised), by Spearhead status and sex
- 3.6 Average daily sedentary time and MVPA time, by BMI category, age and sex
- 3.7 Objective summary activity levels, by age and sex
- 3.8 Objective summary activity levels (age-standardised), by tertile of equivalised household income and sex
- 3.9 Objective summary activity levels (age-standardised), by Spearhead status and sex
- 3.10 Prevalence of objective summary activity levels by self-reported summary activity levels and sex
- 3.11 Comparison of self-reported and objective measurement of activity, by age and sex
- 3.12 Comparison of self-reported and objective average daily MVPA<sub>10+</sub> time, by age and sex
- 3.13 Estimated odds ratios for being in the low physical activity group (measured by accelerometry), by associated risk factors and sex



Table 3.1

Response to accelerometer measurement, by age and sex								
Aged 16 and over								2008
Response/accelerometer wear <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Ineligible	1	2	2	2	6	4	13	4
Declined accelerometry	25	22	22	20	20	22	22	21
Spurious/unusable data <sup>a</sup>	23	21	22	16	17	17	12	18
7 valid days <sup>b</sup>	11	22	27	35	41	38	33	31
6 valid days	12	14	8	12	9	10	9	10
5 valid days	6	7	5	6	2	4	4	5
4 valid days	4	3	3	2	1	2	2	2
3 valid days	6	3	3	2	1	1	2	2
2 valid days	4	2	2	1	1	1	1	2
1 valid day	3	0	1	3	1	1		1
0 valid days	5	5	4	1	1	1	3	3
Any days of valid wear	46	50	50	60	56	56	51	53
4 or more valid days	33	45	44	55	54	53	48	49
4 or more days of valid wear including at least one weekend day	31	43	40	52	53	52	47	47
Average daily wear (minutes) <sup>c</sup>	822	849	864	862	868	829	814	849
<b>Women</b>								
Ineligible	1	4	5	4	4	8	13	6
Declined accelerometry	17	17	19	19	16	23	28	20
Spurious/unusable data <sup>a</sup>	20	29	24	19	20	16	14	20
7 valid days <sup>b</sup>	13	17	26	26	40	35	24	27
6 valid days	12	11	11	14	9	9	8	10
5 valid days	10	5	5	6	4	5	3	5
4 valid days	6	4	4	3	2	1	2	3
3 valid days	4	3	2	3	1	1	2	2
2 valid days	3	3	1	2	1	1	3	2
1 valid day	7	3	2	1	1	1	1	2
0 valid days	6	4	2	2	3	1	2	3
Any days of valid wear	55	46	51	56	57	52	43	51
4 or more valid days	41	38	45	50	54	49	37	46
4 or more days of valid wear including at least one weekend day	38	34	43	47	52	48	36	43
Average daily wear (minutes) <sup>c</sup>	804	826	827	846	844	834	797	830
<b>Bases (unweighted)</b>								
<i>Selected for accelerometer sample</i>								
Men	166	273	331	311	377	301	239	1998
Women	217	349	389	387	457	362	348	2509
<i>4 days of valid accelerometer wear</i>								
Men	55	124	145	170	202	160	114	970
Women	90	131	176	195	249	176	128	1145

<sup>a</sup> Some accelerometers failed to record data and so no usable results were obtained; spurious data were recorded in a small number of cases, with implausibly high readings.

<sup>b</sup> Days were included as valid if the accelerometer was worn for at least 600 minutes (10 hours).

<sup>c</sup> This outcome variable was calculated for participants with 4 or more valid days.

Table 3.2

**Average daily physical activity profile<sup>a</sup>, by age and sex***Aged 16 and over with 4 days' valid accelerometry data*

2008

Average daily minutes spent in each intensity category <sup>b</sup>	Age group						Total
	16-34	35-44	45-54	55-64	65-74	75+	
Men							
Sedentary time	572	569	564	590	616	661	595
Standard error of the mean	6.60	6.33	8.24	7.12	6.59	6.24	2.68
Light PA	221	233	236	216	200	166	212
Standard error of the mean	5.31	5.70	7.59	5.86	5.57	5.49	2.35
Moderate PA	42	35	37	31	23	12	30
Standard error of the mean	2.51	2.14	1.97	2.10	2.16	1.34	0.80
Vigorous PA	3	2	2	1	1	0	1
Standard error of the mean	0.49	0.37	0.34	0.23	0.28	0.05	0.50
MVPA <sub>All</sub>	45	37	39	31	23	12	31
Standard error of the mean	2.63	2.28	2.09	2.06	2.27	1.36	0.83
MVPA <sub>10+</sub>	17	13	11	11	9	5	11
Standard error of the mean	1.20	0.96	0.91	0.91	1.02	0.66	0.57
Women							
Sedentary time	575	538	558	574	598	658	584
Standard error of the mean	5.24	6.06	6.42	4.28	5.10	5.60	2.41
Light PA	229	266	255	241	224	171	231
Standard error of the mean	4.74	5.30	5.69	3.83	4.75	5.28	2.19
Moderate PA	32	33	24	23	16	9	23
Standard error of the mean	1.92	1.73	1.60	1.23	0.90	0.82	0.64
Vigorous PA	2	1	1	0	0	0	1
Standard error of the mean	0.26	0.19	0.18	0.14	0.04	0.05	0.07
MVPA <sub>All</sub>	34	34	25	24	16	9	24
Standard error of the mean	2.01	1.80	1.62	1.27	0.91	0.84	0.66
MVPA <sub>10+</sub>	14	10	8	8	6	2	8
Standard error of the mean	1.20	0.98	0.83	0.85	0.90	0.64	0.50
Bases (unweighted)							
Men	179	145	170	202	160	114	970
Women	221	176	195	249	176	128	1145
Bases (weighted)							
Men	282	195	180	167	110	82	1016
Women	275	196	179	172	120	107	1050

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light physical activity (PA): 1.5 to below 3 METs

Moderate physical activity (MPA): 3 to below 6 METs

Vigorous physical activity (VPA): 6 or more METs

MVPA<sub>All</sub> All activity at 3 or more METs

MVPA<sub>10+</sub> Activity at 3 or more METs in bouts of ten minutes or more.

Table 3.3

### Average daily physical activity profile<sup>a</sup> for weekdays and weekend days, by age and sex

Aged 16 and over with 4 days' valid accelerometry data

2008

Average daily minutes spent in each intensity category <sup>b</sup>	Age group						Total
	16-34	35-44	45-54	55-64	65-74	75+	
Men							
Weekdays							
Sedentary time	587	566	569	591	615	670	600
Standard error of the mean	5.42	5.27	6.85	5.34	5.03	4.80	3.20
Light PA	218	245	244	227	211	164	218
Standard error of the mean	4.60	4.60	6.35	4.63	4.55	4.28	2.83
Moderate PA	42	35	40	32	24	13	31
Standard error of the mean	2.57	2.42	2.20	2.35	2.33	1.61	0.86
Vigorous PA	4	2	2	1	1	0	2
Standard error of the mean	0.49	0.46	0.46	0.28	0.28	0.05	0.13
MVPA <sub>All</sub>	46	37	42	33	24	13	33
Standard error of the mean	2.70	2.61	2.36	2.27	2.46	1.63	0.89
MVPA <sub>10+</sub>	17	13	11	11	9	5	11
Standard error of the mean	1.24	1.08	0.91	0.98	1.12	0.75	0.61
Weekend days							
Sedentary time	541	543	561	582	599	646	579
Standard error of the mean	7.04	7.02	7.66	6.55	6.52	5.97	2.63
Light PA	218	221	208	191	181	147	194
Standard error of the mean	5.18	5.95	6.47	5.38	5.66	5.69	2.27
Moderate PA	39	35	31	27	20	7	26
Standard error of the mean	3.57	2.44	2.28	2.17	2.00	0.90	0.95
Vigorous PA	3	2	1	1	0	0	1
Standard error of the mean	0.70	0.41	0.29	0.32	0.32	0.08	0.15
MVPA <sub>All</sub>	42	37	32	27	20	8	28
Standard error of the mean	3.79	2.52	2.37	2.20	2.08	0.94	0.99
MVPA <sub>10+</sub>	16	14	13	13	8	4	11
Standard error of the mean	1.89	1.30	1.24	1.19	1.03	0.74	0.75
Bases (unweighted)							
Men							
Weekdays	179	145	170	202	160	114	970
Weekend days	180	145	164	200	163	116	968
Bases (weighted)							
Men							
Weekdays	282	195	180	167	110	82	1016
Weekend days	286	192	172	164	111	83	1008

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light physical activity (PA): 1.5 to below 3 METs

Moderate physical activity (MPA): 3 to below 6 METs

Vigorous physical activity (VPA): 6 or more METs

MVPA<sub>All</sub>: All activity at 3 or more METs

MVPA<sub>10+</sub>: Activity at 3 or more METs in bouts of ten minutes or more.

Continued...

Table 3.3 continued

Aged 16 and over with 4 days' valid accelerometry data

2008

Average daily minutes spent in each intensity category <sup>b</sup>	Age group						Total
	16-34	35-44	45-54	55-64	65-74	75+	
Women							
Weekdays							
Sedentary time	580	558	561	583	607	663	592
Standard error of the mean	4.79	5.36	6.31	4.83	5.23	4.78	2.71
Light PA	235	261	260	244	227	180	235
Standard error of the mean	4.25	4.69	5.77	4.20	4.75	4.31	2.49
Moderate PA	34	33	25	24	17	10	24
Standard error of the mean	1.90	1.77	1.69	1.24	0.95	0.83	0.64
Vigorous PA	2	2	1	0	0	0	1
Standard error of the mean	0.32	0.23	0.20	0.17	0.05	0.05	0.08
MVPA <sub>All</sub>	35	35	25	24	17	10	24
Standard error of the mean	2.04	1.84	1.71	1.28	0.96	0.84	0.66
MVPA <sub>10+</sub>	14	10	8	8	6	2	8
Standard error of the mean	1.19	1.05	0.86	0.90	1.03	0.69	0.51
Weekend days							
Sedentary time	546	512	544	551	587	640	563
Standard error of the mean	6.09	6.31	5.65	5.14	5.03	5.47	2.33
Light PA	224	257	232	227	200	154	216
Standard error of the mean	5.29	5.73	5.02	4.41	4.75	5.25	2.08
Moderate PA	29	30	23	22	13	7	21
Standard error of the mean	2.70	2.60	1.91	1.76	1.05	0.87	0.84
Vigorous PA	1	1	1	0	0	0	1
Standard error of the mean	0.23	0.16	0.30	0.13	0.03	0.03	0.07
MVPA <sub>All</sub>	30	31	24	22	13	7	21
Standard error of the mean	2.74	2.63	2.00	1.82	1.05	0.88	0.87
MVPA <sub>10+</sub>	13	10	9	9	5	1	8
Standard error of the mean	1.80	1.39	1.18	1.15	0.86	0.69	0.67
Bases (unweighted)							
Women							
Weekdays	221	176	195	249	176	128	1145
Weekend days	218	174	188	243	179	136	1138
Bases (weighted)							
Women							
Weekdays	275	196	179	172	120	107	1050
Weekend days	272	192	171	168	122	113	1038

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light physical activity (PA): 1.5 to below 3 METs

Moderate physical activity (MPA): 3 to below 6 METs

Vigorous physical activity (VPA): 6 or more METs

MVPA<sub>All</sub>: All activity at 3 or more METs

MVPA<sub>10+</sub>: Activity at 3 or more METs in bouts of ten minutes or more.

Table 3.4

**Average daily physical activity profile<sup>a</sup> (age-standardised), by tertile of equivalised household income and sex**

Aged 16 and over with 4 days' valid accelerometry data

2008

Average daily minutes spent in each intensity category <sup>b</sup>	Equivalised household income tertile		
	Highest	Middle	Lowest
<b>Men</b>			
Sedentary time	591	573	575
Standard error of the mean	4.88	4.31	6.43
Light PA	208	227	223
Standard error of the mean	3.76	3.64	5.64
Moderate PA	35	34	36
Standard error of the mean	1.72	1.61	2.15
Vigorous PA	2	2	2
Standard error of the mean	0.38	0.27	0.34
MVPA <sub>All</sub>	37	36	38
Standard error of the mean	1.91	1.68	2.24
MVPA <sub>10+</sub>	14	13	13
Standard error of the mean	1.23	0.96	1.29
<b>Women</b>			
Sedentary time	585	567	569
Standard error of the mean	4.54	4.37	4.60
Light PA	225	243	240
Standard error of the mean	3.83	3.70	4.04
Moderate PA	26	25	27
Standard error of the mean	1.31	1.45	1.83
Vigorous PA	1	1	1
Standard error of the mean	0.24	0.21	0.22
MVPA <sub>All</sub>	27	25	28
Standard error of the mean	1.40	1.53	1.92
MVPA <sub>10+</sub>	10	8	9
Standard error of the mean	0.93	0.87	1.11
<b>Bases (unweighted)</b>			
Men	350	278	200
Women	330	324	307
<b>Bases (weighted)</b>			
Men	346	312	204
Women	279	320	291

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.  
 Sedentary: below 1.5 METs  
 Light physical activity (PA): 1.5 to below 3 METs  
 Moderate physical activity (MPA): 3 to below 6 METs  
 Vigorous physical activity (VPA): 6 or more METs  
 MVPA<sub>All</sub> All activity at 3 or more METs  
 MVPA<sub>10+</sub> Activity at 3 or more METs in bouts of ten minutes or more.

Table 3.5

**Average daily physical activity profile<sup>a</sup> (age-standardised), by Spearhead status<sup>b</sup> and sex**

Aged 16 and over with 4 days' valid accelerometry data

2008

Average daily minutes spent in each intensity category <sup>c</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Sedentary time	583	584
Standard error of the mean	3.63	4.14
Light PA	218	217
Standard error of the mean	2.98	3.56
Moderate PA	34	34
Standard error of the mean	1.32	1.27
Vigorous PA	2	2
Standard error of the mean	0.20	0.22
MVPA <sub>All</sub>	36	36
Standard error of the mean	1.37	1.36
MVPA <sub>10+</sub>	13	13
Standard error of the mean	0.83	0.93
<b>Women</b>		
Sedentary time	575	577
Standard error of the mean	3.08	3.82
Light PA	235	234
Standard error of the mean	2.75	3.44
Moderate PA	26	25
Standard error of the mean	0.90	1.43
Vigorous PA	1	1
Standard error of the mean	0.13	0.16
MVPA <sub>All</sub>	27	26
Standard error of the mean	0.94	1.50
MVPA <sub>10+</sub>	9	9
Standard error of the mean	0.57	1.11
<b>Bases (unweighted)</b>		
Men	617	351
Women	704	433
<b>Bases (weighted)</b>		
Men	688	326
Women	686	358

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>c</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.  
 Sedentary: below 1.5 METs  
 Light physical activity (PA): 1.5 to below 3 METs  
 Moderate physical activity (MPA): 3 to below 6 METs  
 Vigorous physical activity (VPA): 6 or more METs  
 MVPA<sub>All</sub> All activity at 3 or more METs  
 MVPA<sub>10+</sub> Activity at 3 or more METs in bouts of ten minutes or more.

Table 3.6

### Average daily sedentary time and MVPA<sup>a</sup> time, by BMI category, age and sex

Aged 16 and over with 4 days' valid accelerometry data

2008

Average daily minutes spent in each intensity category <sup>b</sup> within BMI category <sup>c</sup>	Age group			Total
	16-34	35-64	65+	
Men				
Not overweight or obese				
Sedentary time	576	570	[628]	591
Standard error of the mean	6.87	7.09	[7.59]	5.35
MVPA time	50	44	[28]	41
Standard error of the mean	3.07	2.41	[2.85]	2.3
Overweight				
Sedentary time	582	576	634	597
Standard error of the mean	8.79	5.26	5.58	4.72
MVPA time	43	37	21	34
Standard error of the mean	2.57	1.54	1.63	1.21
Obese				
Sedentary time	d	591	649	612
Standard error of the mean	d	6.54	7.44	6.56
MVPA time	d	30	14	27
Standard error of the mean	d	1.55	2.09	1.72
Women				
Not overweight or obese				
Sedentary time	568	549	615	577
Standard error of the mean	6.61	4.23	5.89	4.42
MVPA time	37	32	17	29
Standard error of the mean	2.58	1.45	1.30	1.53
Overweight				
Sedentary time	567	549	614	577
Standard error of the mean	5.28	4.23	5.00	3.31
MVPA time	31	26	12	23
Standard error of the mean	1.95	1.19	0.97	0.96
Obese				
Sedentary time	[576]	557	623	585
Standard error of the mean	6.53]	5.11	5.65	4.57
MVPA time	[27]	22	8	19
Standard error of the mean	[2.07]	1.26	1.19	1.14
Men Bases (unweighted)				
Not overweight or obese	91	101	48	240
Overweight	58	237	117	412
Obese	22	142	77	241
Men Bases (weighted)				
Not overweight or obese	156	98	32	286
Overweight	81	253	82	417
Obese	33	156	57	245
Women Bases (unweighted)				
Not overweight or obese	110	200	85	395
Overweight	62	206	105	373
Obese	35	166	75	276
Women Bases (weighted)				
Not overweight or obese	142	178	67	388
Overweight	72	188	74	334
Obese	41	134	55	231

Table 3.7

### Objective summary activity levels, by age and sex

Aged 16 and over with 7 days' valid accelerometry data

2008

Objective summary activity level <sup>a</sup>	Age group			Total
	16-34	35-64	65+	
	%	%	%	%
<b>Men</b>				
Meets recommendations	11	5	5	6
Some activity	62	46	20	43
Low activity	27	49	75	50
<b>Women</b>				
Meets recommendations	8	4	0	4
Some activity	51	40	23	38
Low activity	41	56	76	58
<b>Bases (unweighted)</b>				
Men	78	353	192	623
Women	89	384	209	682
<b>Bases (weighted)</b>				
Men	114	366	130	610
Women	112	320	154	586

<sup>a</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear  
Some activity: 30 minutes or more of moderate or vigorous activity on one to four days  
Low activity: no days with 30 minutes or more of moderate or vigorous activity.

<sup>a</sup> MVPA: moderate to vigorous physical activity.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.  
Sedentary: below 1.5 METs  
MVPA<sub>All</sub>: activity at 3 or more METs

<sup>c</sup> BMI categories:  
Not overweight or obese: Less than 25 kg/m<sup>2</sup>  
Overweight: 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup>  
Obese: 30 kg/m<sup>2</sup> or more.

<sup>d</sup> Data not shown because the base is too small (below 30).

[ ] Results in brackets should be treated with caution because of the small unweighted base (below 50).

Table 3.8

**Objective summary activity levels (age-standardised), by tertile of equivalised household income and sex**

Aged 16 and over with 7 days' valid accelerometry data

2008

Objective summary activity level <sup>a</sup>	Equivalised household income tertile		
	Highest %	Middle %	Lowest %
<b>Men</b>			
Meets recommendations	12	4	9
Some activity	46	49	49
Low activity	43	46	42
<b>Women</b>			
Meets recommendations	4	3	6
Some activity	48	36	38
Low activity	48	60	57
<i>Bases (unweighted)</i>			
Men	224	187	120
Women	193	200	172
<i>Bases (weighted)</i>			
Men	211	192	112
Women	156	188	151

<sup>a</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear  
Some activity: 30 minutes or more of moderate or vigorous activity on one to four days  
Low activity: no days with 30 minutes or more of moderate or vigorous activity.

Table 3.9

**Objective summary activity levels (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over with 7 days' valid accelerometry data

2008

Objective summary activity level <sup>a</sup>	Spearhead status	
	Non-Spearhead PCT %	Spearhead PCT %
<b>Men</b>		
Meets recommendations	7	10
Some activity	45	46
Low activity	48	44
<b>Women</b>		
Meets recommendations	4	6
Some activity	40	38
Low activity	56	56
<i>Bases (unweighted)</i>		
Men	398	223
Women	430	245
<i>Bases (weighted)</i>		
Men	412	196
Women	387	193

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear  
Some activity: 30 minutes or more of moderate or vigorous activity on one to four days  
Low activity: no days with 30 minutes or more of moderate or vigorous activity.



Table 3.10

### Prevalence of objective summary activity levels by self-reported summary activity levels and sex

Aged 16 and over with 7 days' valid accelerometry data

2008

Objective summary activity levels (accelerometry) <sup>a</sup>	Self-reported summary activity levels <sup>b</sup>		
	Meets recommendations	Some Activity	Low activity
	%	%	%
<b>Men</b>			
Meets recommendations	10	3	5
Some activity	49	51	24
Low activity	41	46	71
<b>Women</b>			
Meets recommendations	8	3	1
Some activity	48	39	26
Low activity	44	58	73
<i>Bases (unweighted)</i>			
Men	175	223	225
Women	175	223	225
<i>Bases (weighted)</i>			
Men	156	216	238
Women	179	220	187

<sup>a</sup> Accelerometry:

Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear

Some activity: 30 minutes or more of moderate or vigorous activity on one to four days

Low activity: no days with 30 minutes or more of moderate or vigorous activity.

<sup>b</sup> Self-reported (see Chapter 2 for detailed definitions):

Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week)

Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week)

Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average).

The definition includes activity at work (new questions).

Episodes of activity of less than 30 minutes have been excluded.

Table 3.11

### Comparison of self reported and objective measurement of activity, by age and sex

Aged 16 and over with 7 days' valid accelerometry data (accelerometry)/ aged 16 and over (self-reported)

2008

Prevalence of meeting recommendations, accelerometry and self-reported data	Age group			Total %
	16-34	35-64	65+	
	%	%	%	
Men				
Accelerometry <sup>a</sup>				
Meets recommendations	11	5	5	6
Some activity	62	46	20	43
Low activity	27	49	75	50
Self-reported <sup>b</sup>				
Meets recommendations	51	40	16	39
Some activity	31	32	28	31
Low activity	18	28	56	30
Women				
Accelerometry <sup>a</sup>				
Meets recommendations	8	4	0	4
Some activity	51	40	23	38
Low activity	41	56	76	58
Self-reported <sup>b</sup>				
Meets recommendations	36	32	12	29
Some activity	36	36	23	34
Low activity	28	32	65	38
Bases (unweighted)				
Accelerometry				
Men	78	353	192	623
Women	89	384	209	682
Self-reported				
Men	1723	3494	1520	6737
Women	2132	4240	1945	8317
Bases (weighted)				
Accelerometry				
Men	114	366	130	610
Women	112	320	154	586
Self-reported				
Men	2343	3699	1262	7305
Women	2299	3777	1584	7660

<sup>a</sup> Accelerometry:

Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear

Some activity: 30 minutes or more of moderate or vigorous activity on one to four days

Low activity: no days with 30 minutes or more of moderate or vigorous activity.

<sup>b</sup> Self-reported (see Chapter 2 for detailed definitions):

Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week)

Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week)

Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks (less than once per week on average).

The definition includes activity at work (new questions). Episodes of activity of less than 30 minutes have been excluded.

Table 3.12

**Comparison of self-reported and objective average daily MVPA<sub>10+</sub> time,<sup>a</sup> by age and sex**

*Aged 16 and over with 4 days' valid accelerometry data (accelerometry)/  
aged 16 and over (self-reported)*

2008

Average daily minutes spent in MVPA time	Age group						Total
	16-34	35-44	45-54	55-64	65-74	75+	
Men							
Accelerometry							
MVPA <sub>10+</sub>	17	13	11	11	9	5	11
Standard error of the mean	1.20	0.96	0.91	0.91	1.02	0.66	0.57
Self-reported							
MVPA (in 10 minute bouts)	85	82	83	65	50	21	73
Standard error of the mean	2.51	3.23	3.36	2.84	2.89	1.93	1.41
Women							
Accelerometry							
MVPA <sub>10+</sub>	14	10	8	8	6	2	8
Standard error of the mean	1.20	0.98	0.83	0.85	0.90	0.64	0.50
Self-reported							
MVPA (in 10 minute bouts)	54	60	61	57	34	11	50
Standard error of the mean	1.67	2.16	2.48	2.49	1.89	0.94	1.17
Bases (unweighted)							
Accelerometry							
Men	179	145	170	202	160	114	970
Women	221	176	195	249	176	128	1145
Self-reported							
Men	1722	1219	1095	1180	873	647	6736
Women	2133	1509	1368	1361	997	947	8315
Bases (weighted)							
Accelerometry							
Men	282	195	180	167	110	82	1016
Women	275	196	179	172	120	107	1050
Self-reported							
Men	2343	1412	1204	1083	724	538	7305
Women	2301	1428	1228	1119	797	785	7659

<sup>a</sup> MVPA: moderate to vigorous physical activity

MVPA<sub>10+</sub>: Activity at 3 or more METs in bouts of ten minutes or more.

Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate, 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Table 3.13

**Estimated odds ratios for being in the low physical activity group (measured by accelerometry), by associated risk factors<sup>a</sup> and sex**

Aged 16 and over with 7 days' valid accelerometry reading

2008

Variable	N	Odds ratio	95% C.I. <sup>b</sup>	Variable	N	Odds ratio	95% C.I. <sup>b</sup>
<b>Men</b> <i>Weighted Base</i>	610			<b>Women</b> <i>Weighted Base</i>	586		
<b>Age (p&lt; 0.001)</b>				<b>Age (p&lt; 0.001)</b>			
16-34	114	1		16-34	112	1	
35-64	366	1.96	(1.05-3.67)	35-64	320	1.62	(0.93-2.82)
65+	130	6.37	(3.28-12.36)	65+	154	4.10	(2.44-6.90)
<b>Health risk category<sup>c</sup> (p=0.001)</b>				<b>Health risk category<sup>c</sup> (p=0.010)</b>			
No increased risk	227	1		No increased risk	254	1	
Increased risk	134	1.64	(0.98-2.73)	Increased risk	106	1.04	(0.64-1.70)
High risk	107	2.33	(1.40-3.88)	High risk	112	1.40	(0.85-2.29)
Very high risk	134	3.16	(1.79-5.57)	Very high risk	110	2.94	(1.60-5.40)
Not measured	8	3.58	(0.51-25.34)	Not measured	5	4.14	(0.45-38.33)

<sup>a</sup> Variables entered into the initial models but not significant in men or in women, and therefore excluded from the final models shown were: equivalised household income tertile, NS-SEC, employment status, tertile of Index of Multiple Deprivation (IMD); limiting longstanding illness, non-limiting and no longstanding illness; and hypertension categories.

<sup>b</sup> Confidence interval.

<sup>c</sup> NICE categories of health risk based on overweight/obesity and waist circumference (see Section 3.2.5).

# Physical fitness in adults

# 4

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## Summary

- This chapter focuses on cardiovascular fitness in the adult population in England. Information was collected using a step test and monitoring participants' heart rate during and after the test.
- Low levels of cardiovascular fitness are associated with all-cause, cardiovascular and cancer mortality and many chronic diseases, including hypertension (high blood pressure), stroke, diabetes, and metabolic syndrome. Fitness levels are generally higher in men than women, and decline with age. Regular physical activity can slow down the rate of this decline. Low fitness levels were common in the population in England in 1990.
- Of 1,635 men and 2,010 women selected for the test, 41% of men and 45% of women were not eligible, and a further 3% of men and women refused. Of the 914 men and 1,055 women who started the test, 92% completed at least four minutes, providing usable data. 69% of men and 46% of women completed the full eight minutes of the test. The most common reason for stopping the test early was the heart rate exceeding a safe age-specific level.
- The average level of maximal oxygen uptake ( $VO_{2max}$ ) was 36.3 ml  $O_2$ /min/kg for men and 32.0 ml  $O_2$ /min/kg for women, showing a significant difference in cardiovascular fitness. In both sexes, the mean  $VO_{2max}$  decreased with age.
- Virtually all participants were deemed able to walk at 3mph on the flat but 84% of men and 97% of women would require moderate exertion for this activity. 32% of men and 60% of women were not fit enough to sustain walking at 3mph up a 5% incline. Lack of fitness increased significantly with age; only 32% of men and 12% of women aged 55-74 would find that this exercise required only moderate exertion.
- Physical fitness did not vary by tertile of equivalised household income or by Spearhead status.
- Physical fitness was related to self-reported physical activity. Average  $VO_{2max}$  decreased, and the proportion classified unfit increased, as activity level decreased.
- Overall, mean  $VO_{2max}$  decreased substantially with age within each objective physical activity level in both sexes. 75% of men and 96% of women aged 55-74 years who would be considered to be 'unfit' were in the low physical activity category.
- Cardiovascular fitness was lower on average among those who were obese (32.3 ml  $O_2$ /min/kg among men, 28.1 ml  $O_2$ /min/kg among women) than among those who were neither overweight nor obese (38.8 ml  $O_2$ /min/kg and 33.9 ml  $O_2$ /min/kg respectively).
- Logistic regression was used to identify the risk factors associated with lack of fitness. Lack of fitness was positively associated with age; with increased, high and very high health risk based on obesity and raised waist circumference (defined according to NICE guidance); and longstanding illness in both men and women. Additionally, men living in the most deprived areas, and women in routine and manual households, also had relatively high odds of being unfit.

## 4.1 Introduction

This chapter focuses on physical fitness in the adult population in England aged 16 and over. It describes current cardiovascular fitness levels, compares these with both subjective and objective measures of physical activity, examines the relationship between physical fitness and obesity, and examines the associations between a range of factors and fitness.

The importance of physical activity for health is described in Chapter 2. Physical fitness, also called functional capacity, is the ability of an individual to perform work. The most common form of work capacity assessed is the aerobic component, measured by the maximal oxygen uptake ( $VO_{2max}$ ). Oxygen uptake refers to the use of oxygen by the body's cells. Oxygen uptake rises rapidly on starting exercise and reaches a plateau (steady state  $VO_2$ ) by three to five minutes of steady exercise. Maximal oxygen uptake is reached when oxygen uptake does not increase despite further increase in intensity of the exercise (e.g. running faster or up a steeper incline), although not everyone has such a plateau.<sup>1</sup>  $VO_{2max}$  is typically achieved by exercise that involves only about half the total body musculature.<sup>2</sup>

$VO_{2max}$  is probably limited by maximal cardiac output rather than peripheral factors.<sup>3</sup> Cardiovascular fitness is dependent on a number of factors, not only activity levels. Aerobic capacity generally declines with age in non-athletic people, because of a decrease in stroke volume (the volume of blood pumped from one ventricle of the heart with each beat), maximal heart rate, blood flow to skeletal muscle, and skeletal muscle function. The rate of decline in fitness increases from 3% to 6% per decade in young adults in their 20s and 30s to 20% per decade in those aged 70 and above.<sup>4</sup> The difference by sex is small in the early teens but among adults,  $VO_{2max}$  in men is 10-20% greater than that in women, because of a higher haemoglobin concentration, a larger proportion of muscle mass, and a greater stroke volume in men. Although increased physical activity levels, particularly regular activity, increase fitness levels,<sup>5</sup> there is great variation in the fitness response to physical activity, as documented in the HERITAGE intervention study.<sup>6</sup>

Greater physical fitness is associated with lower mortality in the general population<sup>7</sup> and among men with type 2 diabetes,<sup>8</sup> and mitigates the effect of metabolic syndrome<sup>9</sup> on all-cause and cardiovascular death.<sup>10</sup> Lack of fitness affects deaths from all causes, cardiovascular disease, and cancers<sup>7,11</sup> and has as great an effect on all-cause and cardiovascular mortality as do raised systolic blood pressure, smoking, obesity, and diabetes.<sup>12</sup> For example, lean but unfit men have a higher risk for cardiovascular disease and death than obese men who are fit.<sup>5,13,14</sup> Higher fitness levels are also associated with reduced risks of developing hypertension,<sup>15</sup> stroke,<sup>16</sup> diabetes, and metabolic syndrome,<sup>17,18</sup> adjusting for other cardiovascular risk factors. Physical activity that increases physical fitness also increases cognitive capacity.<sup>19</sup>

There are indications that measures of fitness may show more discrimination than measures of physical activity on some aspects of health. Studies that have measured physical fitness have found a larger reduction in cardiovascular and all-cause mortality as fitness levels increased, compared with studies using self-reported activity levels to examine the association between activity and mortality.<sup>20</sup> It is unclear whether the difference is between objective and subjective measurements (see Chapter 3) or between activity and fitness per se,<sup>21</sup> as few studies have considered the relative importance of physical fitness and activity levels, even when both were measured. However, increasing activity levels increases fitness (as well as reducing obesity and risks of diseases associated with inactivity, low fitness levels, or obesity), so the public health message to be active is unaffected by this lack of knowledge.

Measuring fitness at the population level is not straightforward. Functional capacity, exercise capacity, and exercise tolerance (also called endurance fitness, aerobic fitness, cardiovascular fitness, or stamina) are generally considered synonymous and imply that a maximal exercise test has been performed and that maximal effort has been given by the individual. However, these terms are also used occasionally to express an individual's ability to perform submaximal activities in a test. It is therefore important that the type of exercise

evaluation is specifically described. Estimated and directly measured  $\text{VO}_2$  should also be distinguished.<sup>3</sup>

Physical fitness has been measured only once before on a nationally-representative sample in England. The Allied Dunbar National Fitness Survey (ADNFS) was conducted in 1990, using measures of  $\text{VO}_{2\text{max}}$  from testing participants' fitness on a treadmill.<sup>22</sup> It differed from the HSE in a number of ways (discussed in more detail in section 4.5), but it resembled the HSE in the age group studied and in monitoring heart rate in sub-maximal exercise and extrapolating, to obtain an indirect estimate of  $\text{VO}_{2\text{max}}$ . ADNFS is the only source of comparable data.

Low fitness levels were found to be very common in the ADNFS. In 1990, nearly one third of men and over two thirds of women aged 16-74 found walking up a 5% gradient at a steady 3mph unaccustomed exertion; the average man over 55 years and the average woman over 35 years found this demanding and would have been unable to maintain that walking pace. Although the decline with age of aerobic fitness is inevitable, many ADNFS participants aged 55 and over and some aged 65 and over had higher fitness levels than the least fit participants aged 16-24. More than one-third of women aged 16-34 and most women aged 45 and over found it impossible to walk up a 5% gradient at 3mph. Less demanding activity also caused problems. Almost one third of men and more than half of women aged 55-74 found it impossible to walk at this speed on the flat.

This chapter describes the results of testing physical fitness among adults aged 16-74 using a step test to provide an objective measure of physical fitness. The method was developed from that devised by researchers in the MRC Epidemiology Unit at Cambridge,<sup>23</sup> using information from a variety of studies. These included a step test field pilot on the Health Survey for England in 2005,<sup>24</sup> and again in 2007 using the protocol to be used in the main HSE 2008. Previous research had demonstrated that the step was suitable for use in a general population household survey. In 2005 the HSE feasibility study found that it was practical to administer the test, once the step was in the participant's home, and that the participants enjoyed the test.

## 4.2 Methods and definitions

### 4.2.1 The step test

#### *Choice of step test*

An indirect method of measuring physical fitness was chosen because of the survey design of conducting the tests in participants' homes; direct measurement of oxygen consumption was therefore not possible. The decision to use a step test rather than a treadmill or cycle ergometer was also made for practical reasons. A single step was chosen as this was easier for the nurses to transport to participants' homes than the double step that was piloted with considerable problems in 2005.<sup>24</sup>

#### *Outline of step test used in HSE 2008*

The physical fitness test consisted of the step test originally developed by researchers at MRC Cambridge. The test involved the subject stepping up and down a single step. The pace was given digitally by the nurse's laptop and the stepping lasted a maximum of eight minutes. The pace of stepping increased through the duration of the test. The participant stepped up and down first at a slow pace for one minute, at a rate of one leg movement per second. This equates to one body lift (i.e. the respondent stepping up and back down from the step) over four seconds. Then the stepping pace gradually increased over the next seven minutes until, by the end of the eighth minute, the frequency was 33 body lifts per minute (i.e. one body lift in just under two seconds).

The participant's heart rate was the primary outcome measure of the step test. The heart rate was recorded at 30 second intervals during the test and at 15 second intervals for two minutes after the step test ended. The participant wore a Polar heart rate monitor round the

chest which transmitted the heart rate to a receiver worn on the participant's wrist. Using a stop watch to mark the time intervals, the nurse recorded the heart rate detected by the monitor. These heart rate measurements were then combined with the resting heart rate obtained earlier during blood pressure measurement to determine the submaximal relationship between heart rate and oxygen uptake. This relationship was then extrapolated up to age-predicted maximal heart rate<sup>25</sup> to provide an estimate of the individual's maximal oxygen uptake ( $VO_{2max}$ ), the overall level of fitness.

### **Inclusion criteria**

Within the overall HSE 2008 sample, a sub-sample of households was identified from which individuals were selected for the accelerometer sub-sample and the step test sub-sample. To keep household burden to a reasonable level, a maximum of two adults per household or one adult and one child per household, were invited to wear the accelerometer (see Chapters 3 and 6). In all households where accelerometers were offered, all adults aged 16-74 who had a nurse visit were also invited to take part in the step test. This included all adults in the age range who had at least one day of valid accelerometry (approximately 2,087 adults aged 16 and over, of whom 1,873 had four valid days of wear), as well as other eligible household members. Over the course of the year it was originally estimated that around 3,000 adults would be asked to take part in the step test, although in fact fewer actually took part in the test.

### **Exclusion criteria**

The test was administered only to adults aged 16 to 74. This was the first time a large study of physical fitness was conducted in a national, general population sample in their own homes rather than in a well-staffed laboratory or healthcare facility. Because of safety concerns, a series of strict exclusion criteria were agreed. It was known that these might eliminate a relatively high proportion of the oldest age group and those with infirmities. In addition to questions asking about specific conditions or problems, sections of the Rose angina questionnaire<sup>26</sup> were used to screen out individuals who were likely to have undiagnosed angina or to have had a possible previous heart attack.

Where relevant information had not already been collected at an earlier stage (which applied to medication, blood pressure, and among women, pregnancy), the nurse asked specific questions to screen participants for meeting an exclusion criterion. If an exclusion criterion was met, the participant was not invited to take part in the step test and no further exclusion questions were asked.

The exclusion criteria were:

- Younger than 16 or older than 74 at the initial interview;
- Pregnant (known by the participant);
- Taking beta blockers;
- Systolic blood pressure greater than 160 mmHg or diastolic blood pressure greater than 100 mmHg (mean of 2nd and 3rd measurements taken by the nurse earlier in the visit, or mean of 1st and 2nd measurements where a 3rd measurement was not possible);
- Aged 65-74 and had a fall (other than sport-related fall) in the previous 12 months;
- Dizzy spells – the participant's judgement of having balance problems, rather than a formal diagnosis;
- History of circulatory disease including any of the following: heart attack, heart valve disease, atrial fibrillation/ heart flutter, abnormal heart rhythm, heart transplant, congenital heart disease, stroke, angina, intermittent claudication (pain on exercise due to poor blood supply to legs);
- Transient ischaemic attack (TIA), if less than one year since last attack or not taking aspirin;
- Heart surgery including cardiac catheterisation, coronary angioplasty, or a pacemaker/implantable cardiac defibrillator;
- Taking digoxin;
- Chronic obstructive pulmonary disease including chronic bronchitis or emphysema;
- Musculoskeletal problem affecting lower back, hip, knees, ankles, feet etc (eg: bad



rheumatism, artificial leg, bad feet) that made it difficult for the participant to step up and down repeatedly;

- Abdominal surgery in the previous three months;
- Cardiac symptoms (responses indicating probable angina or possible heart attack from the Rose angina questionnaire).

Participants with asthma were not excluded. If participants with asthma did not wish to do the test, then they were excluded. If participants with asthma were willing to take part, the nurse advised them to take any medication they would normally take before doing physical exercise. Participants with a latex allergy were also excluded as the heart rate monitor was on a latex band.

Only those participants who were eligible for the test were asked to take part, and to fill in and sign a consent form saying they agreed to do the step test. Participants were also provided with a £5 voucher to thank them for participating.

### **Fieldwork procedure**

The step test involved the participant stepping up and down a single step, either 15cm high for those aged 55-74 years or 20cm high for those aged 16-54.<sup>27</sup> The participant was asked to sit quietly for five minutes in preparation for the test, after which the blood pressure and heart rate were measured (see Chapter 8). The nurse provided a leaflet about the test and then explained and demonstrated the procedure. The participant was asked to step at a steady pace for one minute, and directly thereafter at an increasing pace, for a maximum of eight minutes in total. The laptop computer produced a beat or rhythm, and the participant attempted to step in time with this. The participant wore a heart rate monitor around the chest while doing the step test. The nurse recorded the heart rate measurements every 30 seconds during the test and then every 15 seconds for the two minutes after the test, while the participant was sitting down.

### **Stopping criteria**

For similar safety reasons to the exclusion criteria, strict stopping rules were included in the protocol for conducting the test. The circumstances under which the nurse was instructed to stop the test were if:

- The participant's heart rate exceeded a safe level specified for that age: 85% of the age-specific theoretical maximum if aged 16-59, or 80% of the age-specific theoretical maximum if aged 60-74. The age-specific theoretical maximum was calculated in the CAPI program as 208 minus (age multiplied by 0.7);<sup>25</sup>
- The participant seemed to lose balance;
- The participant verbally complained about safety;
- The participant's performance deteriorated;
- The participant showed signs of confusion during the test;
- The participant showed signs of respiratory distress, such as gasping for breath;
- The participant slipped, stumbled, or fell off the step;
- The participant wanted to stop – this could be for any reason;
- The nurse felt it was unsafe for the participant to continue for any reason in addition to the ones above.

## **4.2.2 Processing the data**

### **Data processing**

The heart rate (HR) time-series data obtained for each participant were first divided into the three phases rest, exercise, and recovery. Resting HR was derived as the minimum non-noisy HR<sup>28</sup> observed, and this was the base against which all other HR observations were expressed as HR above rest (HRaR). It was usually the lowest non-noisy heart rate taken during the blood pressure measurements.<sup>29</sup> The start of the recovery phase was defined as the end of the step test recorded from the stop watch.

### Derivation of the $VO_{2max}$ fitness variable

A summary is given here, with more detail provided as Appendix B to this volume of the report.

The mass-specific mechanical work rate for lifting the body (lift power) in Joules per minute per kilogram (J/min/kg) is given by the product of body lift frequency (step frequency divided by four, since there are four step movements to each body lift), step height, and the gravitational constant. An estimation equation was derived for the physiological activity intensity or net energy turnover rate required to undertake the mechanical work for the step protocol. This was derived from a validation study calibrating the step test against submaximal oxygen consumption,<sup>30</sup> complemented by internal comparisons for different step heights.<sup>31</sup>

Omitting data from the first minute of stepping, a linear regression was fitted between the estimated physiological activity intensity and the observed valid HRaR (heart rate above rest) values to yield the slope and intercept of the straight line. This was done for participants who stepped for at least four minutes. Similarly, the first 90 seconds of recovery heart rate values were fitted in a quadratic regression equation against recovery time, from which the one minute recovery HRaR was derived.

Using the validation dataset,<sup>30</sup> an estimation of the sub-maximal physiological activity intensity during treadmill walking and running from HRaR was derived, which utilised the five calibration parameters available in the survey (slope, intercept, one minute recovery HRaR, step test duration, and resting heart rate).

An estimate of the maximal physiological activity intensity ( $VO_{2max}$ ) was derived by substitution of HRaR by an estimate of the maximal HRaR, predicted from age.<sup>25</sup> To this, an estimate of resting metabolic rate (RMR)<sup>32</sup> was added to yield maximal total metabolic rate.

## 4.2.3 Definitions

### Physical fitness

Mean  $VO_{2max}$  is reported as millilitres of oxygen uptake per minute per kilogram (ml  $O_2$ /min/kg). This is used to represent cardiovascular fitness.

As the step test has been calibrated against submaximal oxygen consumption using a treadmill, submaximal  $VO_{2max}$  for the step test can be directly compared with  $VO_{2max}$  reported from treadmill tests. Therefore this report uses the fitness categories defined in the ADNFS, based on the ease of being able to sustain two activities:

- walking at 3mph on the level (requiring 13 ml  $O_2$ /min/kg)
- walking at 3mph up a 5% gradient (requiring 21 ml  $O_2$ /min/kg).

Fitness categories were defined as follows:<sup>22</sup>

- Light exertion: requiring less than 30% of that person's  $VO_{2max}$
- Moderate exertion: requiring 30-64% of that person's  $VO_{2max}$
- Severe exertion: requiring 65-100% of that person's  $VO_{2max}$  (therefore unsustainable for any substantial length of time)
- Maximal exertion: requiring more than 100% of that person's  $VO_{2max}$ .<sup>33</sup>

In this report, those in the 'severe exertion' or 'maximal exertion' categories have been defined as lacking physical fitness, i.e. those who would not be able to sustain the activity.

### Summary activity levels

The summary measure of physical activity groups participants according to the Chief Medical Officer's (CMO's) physical activity guidelines, which are that adults should take part in activity of at least moderate intensity, of 30 minutes or more duration, on at least five days per week.<sup>34</sup> The summary measure incorporates three basic dimensions (frequency, intensity, and duration) of the participants' overall physical activity level. Self-reported data are based on the extended physical activity questionnaire (see Chapter 2, as reported in Table 2.1); objective data are based on accelerometer recordings (see Chapter 3).

The summary activity level classification is as follows:

- Meets recommendations: 20 or more occasions of moderate or vigorous activity of at least 30 minutes duration in the last four weeks (at least five days per week on average).
- Some activity: Four to 19 occasions of moderate or vigorous activity of at least 30 minutes' duration in the last four weeks (one to four days per week on average).
- Low activity: Fewer than four occasions of moderate or vigorous activity of at least 30 minutes' duration in the last four weeks (less than once per week on average).

### BMI categories

Body mass index (BMI) is weight in kilogrammes divided by height in metres squared (see Chapter 7). The BMI categories used were:

Not overweight or obese: Less than 25kg/m<sup>2</sup>  
 Overweight: 25kg/m<sup>2</sup> to less than 30kg/m<sup>2</sup>  
 Obese: 30kg/m<sup>2</sup> or more.

### NICE health risk categories based on BMI and waist circumference

National Institute of Health and Clinical Excellence (NICE) guidelines<sup>35</sup> use combined categories of BMI and waist circumference to assess risk of co-morbidities of obesity and overweight. The NICE categories are defined as follows (see Chapter 7):

Table 4A			
NICE health risk categories			
BMI classification	Waist circumference		
	Low	High	Very high
Normal weight	No increased risk	No increased risk	Increased risk
Overweight (25 to less than 30kg/m <sup>2</sup> )	No increased risk	Increased risk	High risk
Obesity I (30 to less than 35kg/m <sup>2</sup> )	Increased risk	High risk	Very high risk
Obesity II (35 to less than 40kg/m <sup>2</sup> )	Very high risk	Very high risk	Very high risk
Obesity III (40kg/m <sup>2</sup> or more)	Very high risk	Very high risk	Very high risk

For men, low waist circumference is defined as less than 94cm, high as 94–102cm, and very high as greater than 102cm. For women, low waist circumference is less than 80cm, high is 80–88cm, and very high is greater than 88cm.

## 4.2.4 Weighting and analysis

A sub-sample of the survey participants were eligible for the step test. Because of resource limitations, not all participants were invited to take part in the test, and it was intended that the invited sub-sample would be representative of all participants aged 16-74. However, an extensive list of exclusion criteria was then applied, and there are no population data available for the resultant group that were eligible and able to take part in the test. Therefore no additional weighting, apart from the nurse weighting, has been applied to adjust the profile of this group, since there is no profile to which the step test participants can be compared. When interpreting the results it should be borne in mind that they are representative only of people who were eligible to take part in the step test.

Because the step test was conducted among a sub-sample of participants, the scope for detailed analysis breakdowns is limited. Broader age ranges have been used than in other chapters, and tertiles rather than quintiles of equivalised household income. The sample size is not large enough to allow analysis by Strategic Health Authority.

## 4.3 Participation rates

Table 4.1 shows response rates to the step test by age group. A total of 3,645 adults aged 16-74 were in the households identified for the accelerometer and step test sub-sample, and went on to have a nurse visit (including 2,087 aged 16-74 who had some valid

accelerometry data). Among this group who were offered the step test, 41% of men and 45% of women were not eligible. The proportion of participants who were eligible decreased with age in both sexes. 3% of men and women refused to take part in the step test although they satisfied all eligibility criteria.

727 participants had valid accelerometry for a full week and also completed the step test.

**Table 4.1**

Table 4.2 shows, among those who were aged 16-74 but not eligible, the proportion that were excluded by each criterion. Before the step test was introduced, all participants were asked about medication (including beta blockers and digoxin) and had their blood pressure measured, and all women were asked whether they were pregnant. At the introduction of the step test the nurse asked about the remaining criteria, and it should be noted that once one exclusion criterion was met, no further information was obtained from excluded participants. The results for the remaining criteria therefore represent responses to consecutive questions, not the proportion of all ineligible participants who met each of the criteria.

Among those who were not eligible to do the step test, relatively large proportions of men and women reported having dizzy spells or musculoskeletal problems. Use of beta blocker drugs by men and having uncontrolled high blood pressure (systolic greater than 160 mmHg or diastolic greater than 100 mmHg) in women were also common causes for exclusion.

**Table 4.2**

A cardiovascular fitness measure was derived for participants who took part in the step test for at least four minutes (240 seconds); only a small proportion of those who started the test (7% of men and 10% of women) was not able to satisfy this requirement. This did not vary significantly between the sexes or across age groups.

Overall, the proportion of men who completed the step test (480 seconds) was significantly higher than for women (69% and 46% respectively). As would be expected, there was a significant decline by age, with 77% of men and 53% of women aged 16-34 completing the test, but only 53% of men and 36% of women aged 55-74 doing so.

Because of the strictness of the exclusion criteria, the majority of the sample who were eligible to start the step test were also able to complete the exercise fully, with the result that the duration of the tests has a highly skewed distribution. Additionally, there were some instances where there was equipment failure and the step test duration was recorded as 0 seconds. These have been excluded, and the mean duration of incomplete tests was calculated for all those participants who were not able to complete the exercise but did at least 10 seconds (348 seconds for men, 337 seconds for women). It should be noted that the mean step duration given in Table 4.3 does not represent the mean time that eligible people are able to step but is a measure of the length of time that those unable to complete the test were able or allowed to step before they needed to stop.

Although the results in Table 4.3 appear to show that mean duration of incomplete tests was lower in the older than younger participants in both sexes, this variation was not significant. This could be due to the low base size in some age groups.

**Table 4.3**

Among those who received a nurse visit and started the step test, 31% of men and 54% of women did not complete the test. Table 4.4 reports the reasons for stopping the step test prematurely. The two most frequent reasons for men were that their heart exceeded a safe level and equipment failure (43% and 13% respectively of those who did not complete the test). Among women, a heart rate exceeding the safe level was also the most common reason, followed by fatigue (58% and 10% respectively).

**Table 4.4**

The rest of the chapter presents the major findings from the objective measure of physical fitness carried out by 1,693 participants aged 16-74.

## 4.4 Physical fitness

### 4.4.1 Physical fitness by age and sex

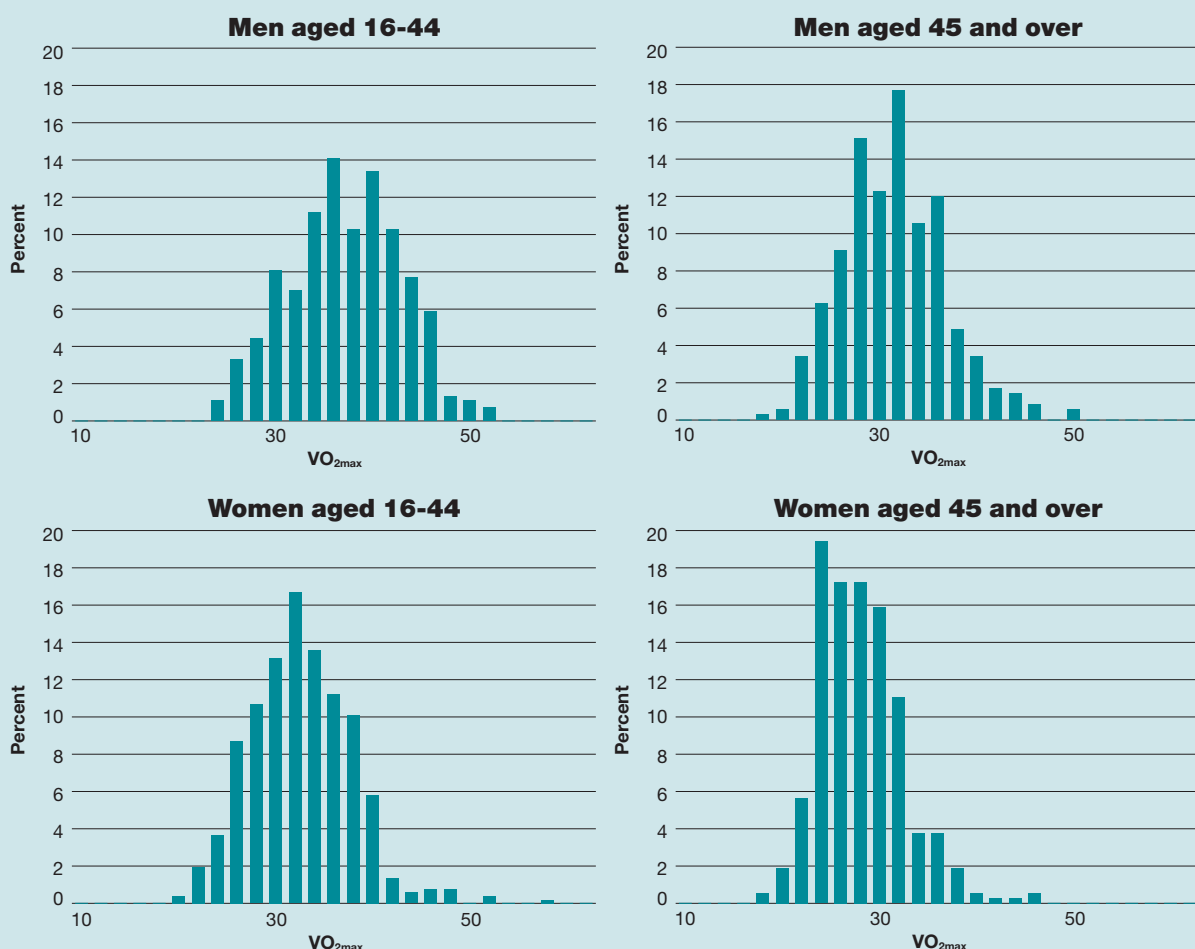
Table 4.5 shows how the average levels of maximal oxygen uptake ( $VO_{2max}$ ), representing cardiovascular fitness, varied by age and sex. Cardiovascular fitness among women was significantly lower than among men (mean  $VO_{2max}$  32.0 ml  $O_2$ /min/kg in women and 36.3 ml  $O_2$ /min/kg in men). As expected,  $VO_{2max}$  declined significantly with age, with the participants aged 16-34 being the fittest in both sexes. The decline was steeper for men than for women, although a significant difference remained between the sexes in each age group.

Figure 4A shows the distribution of  $VO_{2max}$  among two broad age groups, 16-44 and 45 and over, among men and women. Values for men aged 16-44 are mainly distributed between 30 and 50, whereas for older men and for women aged 16-44 the centre of the distribution is closer to 30. For women aged 45 and over, most values are below 30.

Figure 4A

#### Estimated $VO_{2max}$ [ml $O_2$ / min /kg]

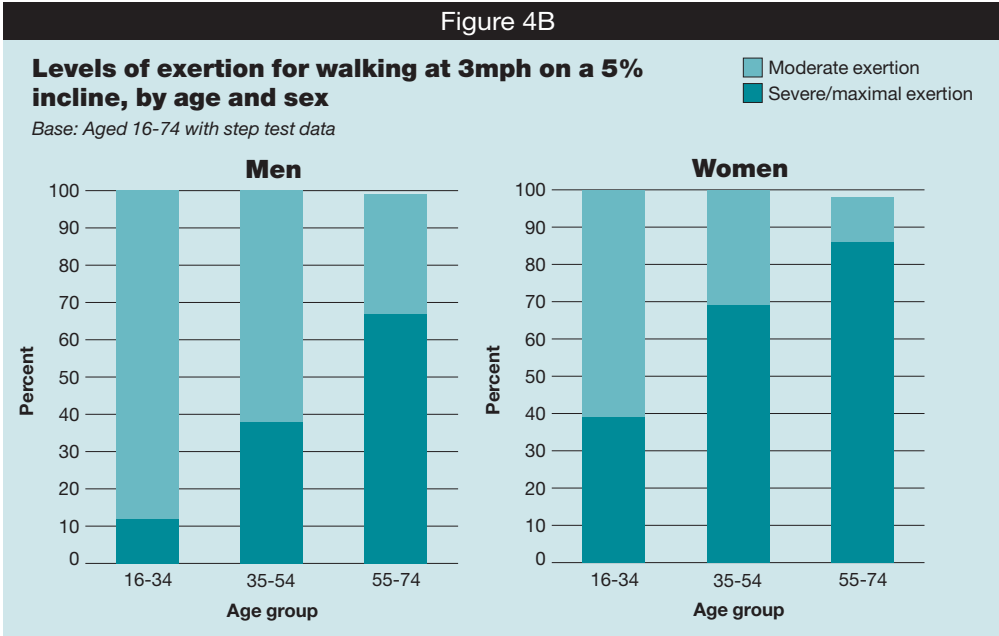
Base: Adults in step test subsample who stepped for at least 4 minutes



These  $VO_{2max}$  levels have been used to define fitness categories based on the exertion required for two activities on a treadmill (definitions can be found in section 4.2.2 above). Virtually all participants were deemed able to walk at 3mph on the flat. 84% of men and 97% of women would require moderate exertion for this activity, while 16% of men but only 3% of women would require light exertion to do this. The contrast was even greater between men and women aged 16-34, with 30% and 5% respectively requiring light exertion.

For the second assessment of fitness, the exertion required for walking at 3mph on a 5% incline, significantly more women than men showed a lack of fitness. 32% of men but 60% of women would require severe exertion for this, meaning that they would not be able to sustain the activity. The lack of fitness (those in the categories ‘severe exertion’ or ‘maximal exertion’) increased significantly with age for both sexes, as shown in Figure 4B. Only 32% of men and 12% of women aged 55-74 would find this exercise required moderate exertion, while 68% of men and 87% of women in this age group would not be able to sustain it.

Table 4.5, Figure 4A, 4B



#### 4.4.2 Physical fitness by equivalised household income and Spearhead status

Neither mean  $VO_{2max}$  nor the prevalence of different fitness categories varied by tertiles of equivalised household income. There was also no association with Spearhead status.<sup>36</sup>

Tables 4.6, 4.7

#### 4.4.3 Physical fitness by physical activity levels

##### Self-reported physical activity

Mean  $VO_{2max}$  was significantly related to reported physical activity in men and women in each age group. Mean  $VO_{2max}$  ranged from 37.3 ml  $O_2$ /min/kg for men in the highest physical activity category (‘meets recommendations’) to 33.9 ml  $O_2$ /min/kg for those in the low activity group, and the equivalent range for women was 33.0 ml  $O_2$ /min/kg to 30.8 ml  $O_2$ /min/kg.

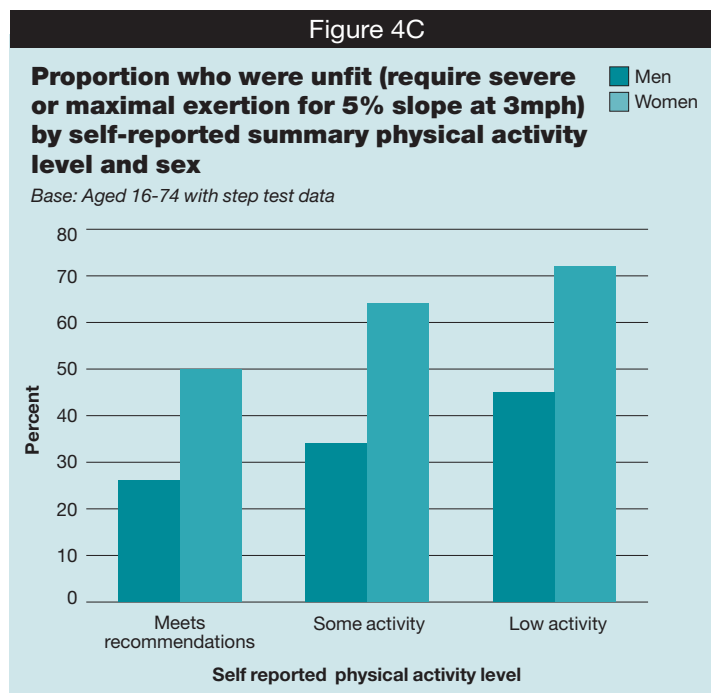
Table 4.8 also shows prevalence of those who could be considered ‘unfit’, with a  $VO_{2max}$  below 33 ml  $O_2$ /min/kg, representing the proportion who would find it difficult or impossible to walk at 3mph up a 5% slope. The proportion classified unfit increased as activity level decreased, as illustrated in Figure 4C. There was a similar pattern by age for men and women, with the proportion unfit increasing substantially with age within each activity level.

Table 4.8, Figure 4C

##### Objective measure of physical activity (accelerometry)

Table 4.9 reports levels of fitness by the objective measure of physical activity from accelerometry. This is based on participants who wore an accelerometer for seven days and also took part in the step test (342 men and 388 women). Only 27 participants (15 men and 12 women) were in the group meeting government recommendations for physical activity (achieving at least 30 minutes of at least moderate activity on at least five of the seven days of accelerometer wear), and this group is therefore too small for analysis.

The remaining two levels of objective physical activity were considered: ‘some activity’ and ‘low activity’. Overall, mean  $VO_{2max}$  did not decrease significantly between the two physical activity levels for either men or women. Similarly, the proportion who could be considered



unfit was similar in both groups: 37% of men and 62% of women in the 'some activity' group, compared with 41% of men and 69% of women in the low activity group.

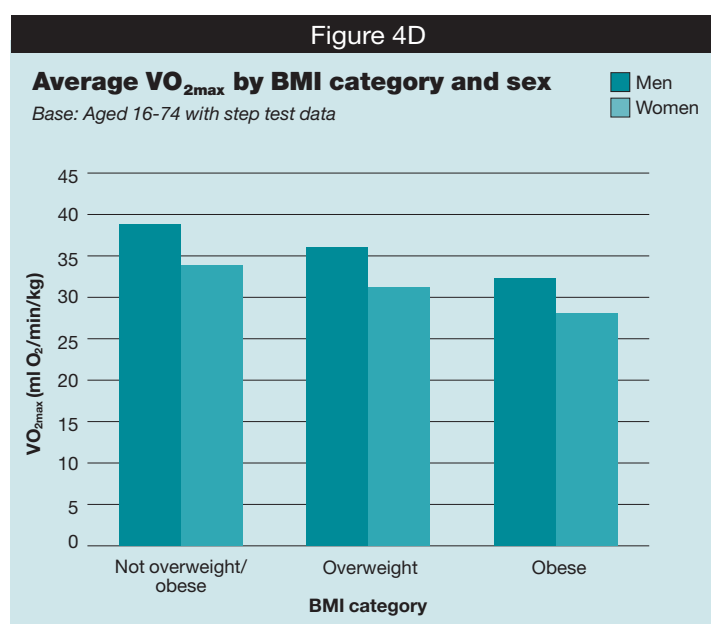
Although base sizes are small for examination of variation across age groups, there are indications that the proportion of participants who were unfit increased with age within the low activity group in both sexes. 12% of men and 43% of women aged 16-34 in the low activity group were unfit, and this rose to 75% of men and 96% of women aged 55-74.

**Table 4.9**

#### 4.4.4 Physical fitness by BMI category

There was significant variation in mean  $VO_{2max}$  by BMI category, as shown in Figure 4D. Cardiovascular fitness was lower on average among those who were obese (32.3 ml  $O_2$ /min/kg among men, 28.1 ml  $O_2$ /min/kg among women) than among those who were neither overweight nor obese (38.8 ml  $O_2$ /min/kg and 33.9 ml  $O_2$ /min/kg respectively). There was also the expected fall in fitness with increasing age among men and women who were of normal weight or overweight; however, in obese participants, there appeared to be little variation by age, although these results should be interpreted with caution as the numbers in these categories were small.

**Table 4.10, Figure 4D**





#### 4.4.5 Predictors of lack of fitness

Multivariate logistic regression was used to explore associations between cardiovascular fitness and possible risk factors, using forward stepwise regression. The outcome was lack of fitness, defined as  $VO_{2max}$  of less than 33 ml  $O_2$ /min/kg, indicating that walking at 3mph up a 5% incline would require severe or maximal exertion.

The regression technique adjusts for several explanatory variables simultaneously. The following explanatory variables were included in the model:

- Socio-demographic: age group, ethnicity, education, equivalised household income, Index of Multiple Deprivation (IMD), NS-SEC<sup>37</sup> of household reference person, Strategic Health Authority (SHA), selected to avoid co-linearity.
- Health-related: self-rated general health (good or very good vs. worse health); limiting longstanding illness vs. non-limiting vs. no longstanding illness.
- Behaviours: smoking status, alcohol consumption, physical activity measured by accelerometry.
- Measurements: BMI and waist circumference (NICE health risk category),<sup>35</sup> hypertension category.<sup>38</sup>

Initial iterations identified variables with no significant link to the outcomes of interest and these were excluded from the final regression models. These were ethnicity, education, equivalised household income, SHA, self-rated general health, smoking status, alcohol consumption, physical activity measured by accelerometry, hypertension category.

Table 4.11 presents a model of the risk factors associated with lack of fitness; the odds ratios presented are after adjustment for the other risk factors. Although the model was run separately for men and women, all variables of significance in the model for one sex were included in the models for both sexes. The final model made statistical adjustment for the complex survey design.

The risk factors indicate associations, not causes. These variations in risk are expressed as odds ratios, the degree to which the probability of the key outcome increases or decreases relative to the reference category. Odds ratios greater than 1 indicate an increased risk compared with the reference category; odds ratios less than 1 indicate a decreased risk. 95% confidence intervals are shown; odds are significantly different from the reference category if the limits of the confidence interval do not include 1.

Age and health risk categories were the strongest predictors associated with lack of fitness in both sexes.

Relative to the youngest age group (16-34), the odds ratios for lack of fitness increased progressively with age, up to 14.97 in men aged 55-74, and up to 9.25 in women in the same age group.

Adults in the higher health risk categories (due to raised BMI and/or raised waist circumference) had higher odds of being unfit than those with no increased risk. The very high risk group is defined as being obese with BMI below 35kg/m<sup>2</sup> and a very high waist circumference, or obese with BMI of 35kg/m<sup>2</sup> or more. Men and women in the very high risk group had much higher odds of being unfit (6.51 and 14.13 respectively). Those with increased risk and high risk were around two to three times as likely.

Longstanding illness was also associated with lack of fitness. In men, those reporting limiting longstanding illness had higher odds of being unfit (2.16) compared with men with no longstanding illness. In women, those with limiting and non-limiting longstanding illness had increased odds of being unfit (odds ratio 1.2 and 1.8 respectively).

Other risks factors varied according to sex. Deprivation was strongly related to lack of fitness in men: those living in the most deprived areas were more likely to be unfit than those living in the least deprived areas. For women, the occupation of the household reference person was significantly associated with level of fitness: those in routine and manual households had increased odds of being unfit compared with those in managerial and professional households.

**Table 4.11**

## 4.5 Discussion

### 4.5.1 Limitations of collecting physical fitness data

#### *Inclusion and exclusion rates and the effect of the stopping criteria*

In total, 3,645 participants (aged 16-74) received a nurse visit at home and were selected to take part in the step test. However, about 43% of the total sample was not eligible to perform the exercise.

It should be noted that 10% of men (24% aged 16-34) and 9% of women (16% aged 16-34) said they did not feel safe to participate in the exercise. In the oldest age group, only 5% of men and 4% of women felt unsafe. The difference in prevalence could be because of ineligibility in older participants already determined by previous exclusion criteria questions, but a greater concern or lack of interest in participating in the test in the youngest age groups cannot be excluded.

Two-thirds (67%) of the participants who started but did not complete the test were women (Table 4.4). 869 participants in total stopped the exercise prematurely.

#### *Methodological issues*

There are various limitations in using a step test to collect data about physical fitness.

Reference equations for normal standards should be specific as to whether  $VO_2$  was measured or estimated, because estimated values require several assumptions and tend to over-predict  $VO_2$ . Reference equations also should be specific as to whether the test was performed on a treadmill or cycle ergometer, because exercise capacity is typically higher on a treadmill. Predictions based on heart rate (as used in HSE 2008) use the essentially linear relationship between sub-maximal heart rate and oxygen uptake (or work rate), which is then extrapolated to the age-predicted maximal heart rate. The prediction of maximal heart rate from age is usually considered the largest source of error in this estimation, with individual estimates being within 20 beats per minute (bpm).<sup>25</sup> This translates into error in the  $VO_{2max}$  estimate in proportion to the slope of the observed relationship between heart rate and (estimated)  $VO_2$ . After stopping exercise, the body needs to return to resting levels but this does not occur immediately. The 'recovery oxygen uptake' not only represents the metabolic requirements for replacing the used glycogen energy stores, but also the physiological effects of the exercise on circulation, ventilation, hormones, and temperature.<sup>1</sup> The test and data processing procedures used in HSE 2008 yield estimates of  $VO_{2max}$  comparable to those from a sub-maximal treadmill test but with a higher degree of uncertainty in the estimate.

### 4.5.2 Comparison with Allied Dunbar National Fitness Survey (ADNFS)

#### *ADNFS response rates and HSE 2008 inclusion rates*

In the HSE 2008, the size of the eligible sample performing the step test was larger than the ADNFS sample (1,969 and 1,741 participants respectively). However in the HSE 2008, the cardiovascular fitness measure was derived only for those who completed at least four minutes of the step test, reducing the sample size to 1,802 participants (92% of the sample who started the test). Further, 109 respondents were excluded due to invalid heart rate measurements, resulting in a final sample size of 1,693 participants (85% of the sample who started the step test).

The ADNFS was conducted in central testing centres using a treadmill, while the HSE 2008 was conducted in participants' homes using the step test. The set of exclusion criteria was another divergent factor between the two surveys. For example, ADNFS participants had an initial exclusion of people who were not fit enough to attend the central testing centre. The exclusion criteria included principally medical reasons identified from an entry in the questionnaire or by the doctor in the laboratory, including high blood pressure or abnormal pre-test electrocardiograms (ECGs) amongst others. The HSE exclusion criteria were particularly stringent to ensure that people were not put at risk in a home setting with no

medical support available, and may have excluded a wider range of potential participants than the criteria used in the ADNFS.

16% of men and 20% of women discontinued the ADNFS test prematurely (compared with 31% of men and 54% of women in the HSE 2008). Principal reasons for stopping in the ADNFS were that the subjects showed some distress or wished to stop; or an ECG abnormality or other medical problem arose during the test.

Both the ADNFS and the HSE presented results for similar numbers of men and women. In the ADNFS there were 858 men and 883 women (49% and 51% of the sample respectively), compared with 806 men and 887 women who stepped for at least 4 minutes (48% and 52% respectively) in the HSE 2008. In both surveys, fewer than 10% of participants aged 65-74 provided usable test data (7% in HSE 2008 and 6% in ADNFS).

**Physical fitness levels in adults in England in 2008**

The HSE 2008 used a step test for practical reasons, as data collection occurs in private homes. As mentioned in section 4.1, the ADNFS in 1990 used a different protocol: measurements were made in a mobile laboratory, not in the participants’ home; the activity was walking on a treadmill at increasing speed and gradient; and the sample was selected from only 30 parliamentary constituencies, so there was more clustering. The results would not therefore be expected to be identical to the step test results, even if the two surveys had been conducted in parallel, with the same participants over a similar period. However, the difference in  $VO_{2max}$  should be small, as the equations for estimating  $VO_{2max}$  in the HSE step test were obtained through calibration on a treadmill. Both surveys excluded the least fit people, particularly among older age-groups. Table 4B compares mean  $VO_{2max}$  by age in the two surveys, and Figure 4E shows the data graphically.

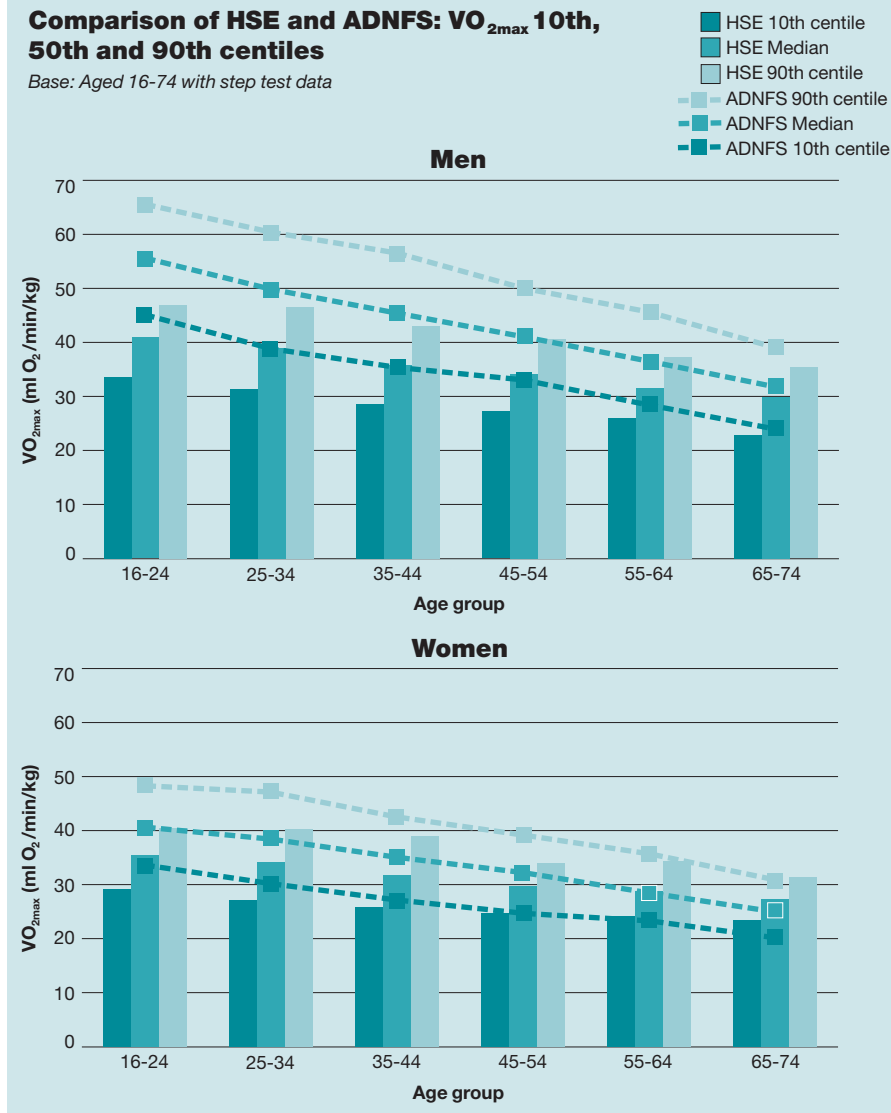
Table 4B						
Comparison of mean $VO_{2max}$ from ADNFS and HSE 2008						
Mean $VO_{2max}$ (ml O <sub>2</sub> /min/kg)	16-24	25-34	35-44	45-54	55-64	65-74
<b>Men</b>						
HSE 2008	40.9	38.9	35.8	34.1	31.5	29.9
ADNFS 1990	55.5	49.8	45.5	41.3	36.6	32.0
<b>Women</b>						
HSE 2008	35.4	34.1	31.8	29.8	28.7	27.3
ADNFS 1990	40.3	38.2	34.8	31.9	28.3	24.7

The mean  $VO_{2max}$  in both sexes by 10 year age groups has a similar pattern in both surveys, showing a decline with age, and greater values in men than women. However, male participants in ADNFS in 1990 appeared to be fitter than men tested in the HSE 2008. The aerobic fitness level among men aged 16-24 dropped from 55.5 ml O<sub>2</sub>/min/kg in ADNFS to 40.9 ml O<sub>2</sub>/min/kg in the HSE 2008. In contrast, the decline with age was less steep in women in the HSE 2008 than in ADNFS, and participants aged 55-74 in HSE 2008 had higher fitness levels than their counterparts in ADNFS.

There is an additional difficulty in comparing fitness levels between the two surveys. The ADNFS defined fitness categories in relation to the percentage of  $VO_{2max}$  required to walk at 3mph on the flat or up a 5% incline. Those same thresholds have been used for analyses in this chapter (see section 4.2.3). However, the results in the ADNFS report were presented as the proportion of participants who found this walking to be ‘unaccustomed exertion’, ‘demanding’ or ‘impossible’<sup>22</sup> without defining which categories they included within these terms.

The ADNFS results revealed that nearly one third of men and over two thirds of women aged 16-74 found walking up a 5% gradient at a steady 3mph to be unaccustomed exertion. HSE 2008 results suggest that 32% of men and 60% of women would encounter

Figure 4E



substantial difficulties performing the exercise (severe exertion), while 68% of men and 39% of women would require moderate exertion to do this.

Almost one third of men and more than half of women aged 55-74 in ADNFS found it 'impossible' to walk at 3 mph on the flat. HSE 2008 results suggest that only 1% of participants aged 55-74 in both sexes would find this exercise required severe exertion or maximal exertion. However 84% of men and 97% of women would find even this level of activity requires moderate exertion. The average man over 55 years and the average woman over 35 years in ADNFS found this 'demanding' and would have been unable to maintain that walking pace.

More than one-third of women aged 16-34 in ADNFS would have found it impossible to walk up a 5% gradient at 3mph; HSE 2008 results seem to show an increase in prevalence with 39% of women aged 16-34 showing that this would require severe exertion or not be possible.

Figure 4E

#### 4.5.3 Associations between physical fitness and other factors

Physical fitness was significantly associated with self-reported physical activity. However, the decline in fitness with age was an even stronger effect, and could be observed both overall and within any physical activity category. There was no observed association between fitness and objectively measured physical activity in this study, although the scope for analysis was limited by the very small sample size, and in particular there were not enough participants in the sample with step test data who were found to be meeting

government recommendations for physical activity according to accelerometry. Other epidemiological studies<sup>5,39</sup> and controlled experimental investigations<sup>40</sup> have shown that adults who are physically active tend to develop and maintain higher levels of physical fitness than those that are sedentary.

Health risk associated with obesity and raised waist circumference showed a strong relationship with levels of physical fitness, in particular, participants who were in the very high risk category were less likely to be fit enough to sustain light or moderate exercise.

The results also suggest that there is a socio-economic component related to lack of physical fitness in both men and women. Men living in the most deprived areas were more likely to be unfit than those in the least deprived areas, and women in routine and manual occupations were more likely to be unfit, compared with those in managerial or professional households.

There are important implications for public health policy from an understanding of the factors associated with lack of fitness. While direct comparison with the ADNFS is not straightforward, it would seem that men in 2008 were less fit than in 1990, though there is less evidence of equivalent change among women. Both surveys showed the same pattern of difference between the sexes, and the decline in fitness with age. Lack of fitness is associated with the health risks linked to obesity, and impacts on cardiovascular disease, cancers and mortality; it is therefore important to continue to promote, support and extend the strategies in place to increase levels of physical activity and fitness in the population. Different approaches and interventions are likely to be appropriate for different groups of the population, taking into account sex, age and socio-economic circumstances.

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- 26 The Rose angina questionnaire was originally developed to identify the characteristic symptom complex known as angina in a standard way, irrespective of medical diagnosis. Its validity has been established predominantly by studies comparing the questionnaire with clinical diagnosis.
- 27 The test involved the following equipment:
  - Single 'Chester' step of lightweight material carried to each household by the nurse (20cm high step for those aged 16 to 54 and 15cm high step for those aged 55 to 74).
  - Sound file on the laptop computer to provide a regular beat to step to (a voice saying 'up' 'up' 'down' 'down').
  - Stop watch to determine duration of stepping and to ensure heart rate readings taken every 30 seconds during the stepping and every 15 seconds during recovery.
  - Heart rate monitor worn by the participant.
- 28 Heart rate is subject to variability, i.e. beat-to-beat alterations in heart rate. A measurement was regarded as 'noisy' if the variability fell outside an acceptable range.
- 29 Occasionally, the participant's heart rate during the recovery phase after stopping the step test was lower than the 'resting' heart rate during blood pressure measurement (for example, some people do not like having their blood pressure measured). In those cases, the resting heart rate actually comes from the last section of the recovery phase.
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- 32 Henry CJ. *Basal metabolic rate studies in humans: measurement and development of new equations*. Public Health Nutr. 2005;**8**:1133-1152.
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- 35 National Institute of Health and Clinical Excellence (NICE). *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children, 2006*. [www.nice.org.uk/guidance/index.jsp?action=download&o=38295](http://www.nice.org.uk/guidance/index.jsp?action=download&o=38295).
- 36 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 37 NS-SEC is a social classification system that attempts to classify groups on the basis of employment relations, based on characteristics such as career prospects, autonomy, mode of payment and period of notice. It was introduced in 2001. It has similarities to Registrar General's Social Class. Participants are assigned to an NS-SEC category based on the current or former occupation of the household reference person (the person in whose name the accommodation is held; if more than one, the person with the highest income; and if more than one, the oldest).  
For a full explanation of NS-SEC and its derivation see the Glossary in Volume 2 of this report and *The National Statistics Socio-economic Classification User Manual 2002*. ONS 2002.

38 Hypertension categories are defined as follows (see Chapter 8):

Normotensive untreated	SBP below 140 mmHg and DBP below 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat high blood pressure
Hypertensive controlled	SBP below 140 mmHg and DBP below 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive uncontrolled	SBP at least 140 mmHg or DBP at least 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive untreated	SBP at least 140 mmHg or DBP at least 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat their high blood pressure

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- 4.1 Response to step test, by age and sex
- 4.2 Exclusions from step test, by age and sex
- 4.3 Duration of step test, by age and sex
- 4.4 Reasons for stopping step test, by age and sex
- 4.5 Physical fitness levels, by age and sex
- 4.6 Physical fitness levels (age-standardised), by equivalised household income and sex
- 4.7 Physical fitness levels (age-standardised), by Spearhead status and sex
- 4.8 Mean  $VO_{2max}$  by self-reported physical activity level, age and sex
- 4.9 Mean  $VO_{2max}$  by objective physical activity level, age and sex
- 4.10 Mean  $VO_{2max}$  by BMI category, age and sex
- 4.11 Estimated odds ratios for lack of physical fitness, by associated risk factors and sex

Table 4.1

**Response to step test, by age and sex***Age 16-74 with a nurse visit and in the step test sub-sample*

2008

Response to step test	Age group			Total
	16-34	35-54	55-74	
	%	%	%	%
<b>Men</b>				
Ineligible <sup>a</sup>	24	34	62	41
Eligible but refused	5	3	2	3
Eligible and started step test	72	63	36	56
<b>Women</b>				
Ineligible <sup>a</sup>	33	40	60	45
Eligible but refused	5	3	1	3
Eligible and started step test	62	57	39	53
<i>Bases (unweighted)</i>				
<i>Men</i>	<i>413</i>	<i>658</i>	<i>564</i>	<i>1635</i>
<i>Women</i>	<i>547</i>	<i>810</i>	<i>653</i>	<i>2010</i>

<sup>a</sup> Excluding ineligible because not in the right age group (16 -74).

Table 4.2

**Exclusions from step test, by age and sex**

*Aged 16-74 with a nurse visit and in the step test sub-sample but not eligible*

2008

Eligibility for step test <sup>a</sup>	Age group			Total
	16-34	35-54	55-74	
	%	%	%	%
<b>Men</b>				
Taking beta blockers	1	8	23	15
Systolic blood pressure >160mmHg or diastolic blood pressure >100mmHg <sup>b</sup>	10	17	11	13
Aged 65-74 and had a fall (other than sport-related) in the previous 12 months	n/a	n/a	8	4
Dizzy spells <sup>c</sup>	30	17	17	19
Circulatory disease <sup>d</sup>	5	11	16	13
Transient ischaemic attack (TIA) <sup>e</sup>	0	0	1	0
Had heart surgery <sup>f</sup>	0	0	1	1
Taking digoxin	2	0	2	1
Chronic lung disease	2	3	3	3
Musculoskeletal problem affecting lower back, hip, knees, ankles, feet etc	20	26	12	18
Abdominal surgery within past 3 months	0	1	1	1
Rose angina questionnaire <sup>g</sup>	4	4	1	3
Latex allergy	1	1	0	1
Feels unsafe	24	11	5	10
<b>Women</b>				
Pregnant	16	3	0	4
Taking beta blockers	1	6	15	9
Systolic blood pressure >160mmHg or diastolic blood pressure >100mmHg <sup>b</sup>	12	8	17	12
Aged 65-74 and had a fall (other than sport-related) in the previous 12 months	n/a	n/a	11	5
Dizzy spells <sup>c</sup>	21	24	19	21
Circulatory disease <sup>d</sup>	4	12	13	11
Transient ischaemic attack (TIA) <sup>e</sup>	0	0	0	0
Had heart surgery <sup>f</sup>	0	0	1	0
Taking digoxin	0	2	1	1
Chronic lung disease	0	2	3	2
Musculoskeletal problem affecting lower back, hip, knees, ankles, feet etc	17	24	16	19
Abdominal surgery within past 3 months	4	2	1	2
Rose angina questionnaire <sup>g</sup>	3	2	1	2
Latex allergy	6	1	0	2
Feels unsafe	16	13	4	9
<b>Bases (unweighted)</b>				
<i>Men</i>	98	223	351	672
<i>Women</i>	180	323	392	895

<sup>a</sup> Before the step test was introduced, all participants were asked about medication and had their blood pressure measured, and all women were asked whether they were pregnant. For all other criteria, as soon as a participant met an exclusion criterion, no further information was elicited about further exclusion criteria. This table therefore presents the proportion of selected participants who were excluded by each subsequent criterion. There is no information on the proportion of excluded participants who met more than one exclusion criterion.

<sup>b</sup> Mean of 2nd and 3rd measurements taken by the nurse earlier in the visit, or mean of 1st and 2nd measurements where a 3rd measurement was not possible.

<sup>c</sup> Participant's judgement of having balance problems, rather than a formal diagnosis

<sup>d</sup> Any of the following: heart attack, heart valve disease, atrial fibrillation (heart flutter), abnormal heart rhythm, heart transplant, congenital heart disease, stroke, angina, intermittent claudication (pain on exercise due to poor blood supply to legs).

<sup>e</sup> If less than 1 year since last attack or not on aspirin for a previous TIA.

<sup>f</sup> Including cardiac catheterisation, coronary angioplasty, or a pacemaker/implantable cardiac defibrillator.

<sup>g</sup> Responses to the Rose angina questionnaire indicating probable angina or possible heart attack.

Table 4.3

**Duration of step test, by age and sex**

*Aged 16 and over, in step test sub-sample  
and started step test*

2008

Duration of step test	Age group			Total
	16-34	35-54	55-74	
	%	%	%	%
<b>Men</b>				
Started but less than 4 minutes	8	5	8	7
4 minutes but less than 6 minutes	5	6	15	7
6 minutes but less than 8 minutes	9	19	24	16
Completed full 8 minutes	77	69	53	69
Enough usable data for fitness <sup>a</sup>	92	95	92	93
Started but completed less than 8 minutes	23	31	47	31
Mean duration of step test among those not completing step test <sup>b</sup> (sec)	[333.1]	356.7	347.5	347.9
Standard error of the mean	[14.62]	11.10	11.46	8.12
Median duration of step test among those not completing step test <sup>b</sup> (sec)	[360]	390	360	378
<b>Women</b>				
Started but less than 4 minutes	8	9	14	10
4 minutes but less than 6 minutes	14	18	22	17
6 minutes but less than 8 minutes	25	30	28	28
Completed full 8 minutes	53	43	36	46
Enough usable data for fitness <sup>a</sup>	92	91	86	90
Started but completed less than 8 minutes	47	57	64	54
Mean duration of step test among those not completing step test <sup>b</sup> (sec)	342.0	340.7	321.9	336.9
Standard error of the mean	8.14	5.32	7.31	4.29
Median duration of step test among those not completing step test <sup>b</sup> (sec)	360	362	337	360
<i>Bases (unweighted)</i>				
Men – started step test	296	415	203	914
Men – partial step test (10 sec to less than 8 minutes)	49	118	90	257
Women – started step test	341	461	253	1055
Women – partial step test (10 sec to less than 8 minutes)	148	251	156	555
<i>Bases (weighted)</i>				
Men – started step test	450	472	173	1095
Men – partial step test (10 sec to less than 8 minutes)	81	138	77	295
Women – started step test	396	420	196	1012
Women – partial step test (10 sec to less than 8 minutes)	175	232	121	528

<sup>a</sup> The minimum duration of the step test to be included in the results was 4 minutes.

<sup>b</sup> Among those doing at least 10 seconds of the step test.

Table 4.4

**Reasons for stopping step test, by age and sex**

*Aged 16-74 who started step test but stopped before 8 minutes completed*

2008

Reason for stopping step test	Age group			Total
	16-34	35-54	55-74	
	%	%	%	%
<b>Men</b>				
Participant heart rate exceeded a safe level <sup>a</sup>	27	48	47	43
Equipment failure	30	9	6	13
Participant wanted to stop the test	14	6	8	9
Participant slipped/ stumbled/ fell off step/ lost balance	9	9	6	8
Participant performance deteriorated during the test	9	5	9	7
Participant fatigue	5	6	9	7
Participant showed signs of confusion during the test	3	7	6	6
Participant pain/ discomfort	2	2	4	2
Participant showed signs of respiratory distress such as gasp	2	4	-	2
Participant felt unsafe doing test	-	3	-	1
Nurse felt it unsafe for the participant to continue	-	-	3	1
Other problem	-	1	-	0
<b>Women</b>				
Participant heart rate exceeded a safe level <sup>a</sup>	54	60	58	58
Equipment failure	11	8	7	9
Participant wanted to stop the test	8	5	8	7
Participant slipped/ stumbled/ fell off step/ lost balance	6	3	4	4
Participant performance deteriorated during the test	2	2	3	2
Participant fatigue	5	12	12	10
Participant showed signs of confusion during the test	1	1	-	1
Participant pain/ discomfort	2	1	2	1
Participant showed signs of respiratory distress such as gasp	1	0	1	1
Participant felt unsafe doing test	-	2	1	1
Nurse felt it unsafe for the participant to continue	1	3	1	2
Other problem	8	3	4	5
<b>Bases (unweighted)</b>				
<i>Men</i>	<i>64</i>	<i>128</i>	<i>97</i>	<i>289</i>
<i>Women</i>	<i>158</i>	<i>261</i>	<i>161</i>	<i>580</i>

<sup>a</sup> 85% of age-specific theoretical maximum if aged 16-59 or 80% of age-specific theoretical maximum if aged 60-74; age-specific theoretical maximum being calculated as 208 minus (age multiplied by 0.7)

Table 4.5

**Physical fitness levels, by age and sex**Aged 16-74 with step test data<sup>a</sup>

2008

Physical fitness	Age group			Total
	16-34	35-54	55-74	
Men				
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	39.9	35.0	31.0	36.3
Standard error of the mean	0.37	0.26	0.35	0.23
Equivalence of VO <sub>2max</sub> level:				
Sustained walking 3mph on the level				
% Light exertion <sup>b</sup>	30	8	1	16
% Moderate exertion <sup>b</sup>	70	92	98	84
% Severe exertion <sup>b</sup>	-	-	1	0
% Maximal exertion <sup>b</sup>	-	-	-	-
Sustained walking 3mph up a 5% incline				
% Light exertion <sup>c</sup>	-	-	-	-
% Moderate exertion <sup>c</sup>	88	62	32	68
% Severe exertion <sup>c</sup>	12	38	67	32
% Maximal exertion <sup>c</sup>	-	-	1	0
Women				
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	34.8	31.0	28.4	32.0
Standard error of the mean	0.34	0.25	0.31	0.21
Equivalence of VO <sub>2max</sub> level:				
Sustained walking 3mph on the level				
% Light exertion <sup>b</sup>	5	1	0	3
% Moderate exertion <sup>b</sup>	95	98	98	97
% Severe exertion <sup>b</sup>	-	0	1	0
% Maximal exertion <sup>b</sup>	-	-	-	-
Sustained walking 3mph up a 5% incline				
% Light exertion <sup>c</sup>	-	-	-	-
% Moderate exertion <sup>c</sup>	61	31	12	39
% Severe exertion <sup>c</sup>	39	69	86	60
% Maximal exertion <sup>c</sup>	-	0	1	0
Bases (unweighted)				
Men	257	369	180	806
Women	287	399	201	887
Bases (weighted)				
Men	387	422	155	964
Women	331	366	155	851

a At least 4 minutes of step test conducted

b Light exertion: VO<sub>2max</sub> more than 43 ml O<sub>2</sub>/min/kgModerate exertion: VO<sub>2max</sub> 21-43 ml O<sub>2</sub>/min/kgSevere exertion: VO<sub>2max</sub> 13-20 ml O<sub>2</sub>/min/kgMaximal exertion: VO<sub>2max</sub> less than 13 ml O<sub>2</sub>/min/kgc Light exertion: VO<sub>2max</sub> more than 70 ml O<sub>2</sub>/min/kgModerate exertion: VO<sub>2max</sub> 33-70 ml O<sub>2</sub>/min/kgSevere exertion: VO<sub>2max</sub> 21-32 ml/kg O<sub>2</sub>/min/kgMaximal exertion: VO<sub>2max</sub> less than 21 ml O<sub>2</sub>/min/kg

Table 4.6

**Physical fitness levels (age-standardised), by equivalised household income and sex**Aged 16-74 with step test data<sup>a</sup>

2008

Physical fitness	Equivalised household income tertile		
	Highest	Middle	Lowest
<b>Men</b>			
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	36.1	35.5	35.0
Standard error of the mean	0.41	0.36	0.60
<b>Equivalence of VO<sub>2max</sub> level:</b>			
<b>Sustained walking 3mph on the level</b>			
% Light exertion <sup>b</sup>	15	12	12
% Moderate exertion <sup>b</sup>	85	88	87
% Severe exertion <sup>b</sup>	0	-	1
% Maximal exertion <sup>b</sup>	-	-	-
<b>Sustained walking 3mph up a 5% incline</b>			
% Light exertion <sup>c</sup>	-	-	-
% Moderate exertion <sup>c</sup>	66	64	59
% Severe exertion <sup>c</sup>	34	36	40
% Maximal exertion <sup>c</sup>	0	-	1
<b>Women</b>			
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	31.6	31.2	30.6
Standard error of the mean	0.33	0.35	0.43
<b>Equivalence of VO<sub>2max</sub> level:</b>			
<b>Sustained walking 3mph on the level</b>			
% Light exertion <sup>b</sup>	3	1	2
% Moderate exertion <sup>b</sup>	97	98	98
% Severe exertion <sup>b</sup>	0	1	-
% Maximal exertion <sup>b</sup>	-	-	-
<b>Sustained walking 3mph up a 5% incline</b>			
% Light exertion <sup>c</sup>	-	-	-
% Moderate exertion <sup>c</sup>	36	35	28
% Severe exertion <sup>c</sup>	64	64	72
% Maximal exertion <sup>c</sup>	0	1	-
<b>Bases (unweighted)</b>			
Men	330	245	112
Women	314	268	166
<b>Bases (weighted)</b>			
Men	348	276	123
Women	260	235	139

a At least 4 minutes of step test conducted

b Light exertion: VO<sub>2max</sub> more than 43 ml O<sub>2</sub>/min/kgModerate exertion: VO<sub>2max</sub> 21-43 ml O<sub>2</sub>/min/kgSevere exertion: VO<sub>2max</sub> 13-20 ml O<sub>2</sub>/min/kgMaximal exertion: VO<sub>2max</sub> less than 13 ml O<sub>2</sub>/min/kgc Light exertion: VO<sub>2max</sub> more than 70 ml O<sub>2</sub>/min/kgModerate exertion: VO<sub>2max</sub> 33-70 ml O<sub>2</sub>/min/kgSevere exertion: VO<sub>2max</sub> 21-32 ml/kg O<sub>2</sub>/min/kgMaximal exertion: VO<sub>2max</sub> less than 21 ml O<sub>2</sub>/min/kg

Table 4.7

<b>Physical fitness levels (age-standardised), by Spearhead status<sup>a</sup> and sex</b>		
<i>Aged 16-74 with step test data<sup>b</sup></i>		2008
Physical fitness	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	35.8	35.1
Standard error of the mean	0.29	0.40
<b>Equivalence of VO<sub>2max</sub> level: Sustained walking 3mph on the level</b>		
% Light exertion <sup>c</sup>	13	14
% Moderate exertion <sup>c</sup>	86	85
% Severe exertion <sup>c</sup>	0	0
% Maximal exertion <sup>c</sup>	-	-
<b>Sustained walking 3mph up a 5% incline</b>		
% Light exertion <sup>d</sup>	65	59
% Moderate exertion <sup>d</sup>	35	41
% Severe exertion <sup>d</sup>	0	0
% Maximal exertion <sup>d</sup>	-	-
<b>Women</b>		
Mean VO <sub>2max</sub> (ml O <sub>2</sub> /min/kg)	31.4	31.4
Standard error of the mean	0.25	0.36
<b>Equivalence of VO<sub>2max</sub> level: Sustained walking 3mph on the level</b>		
% Light exertion <sup>c</sup>	2	3
% Moderate exertion <sup>c</sup>	97	97
% Severe exertion <sup>c</sup>	0	1
% Maximal exertion <sup>c</sup>	-	-
<b>Sustained walking 3mph up a 5% incline</b>		
% Light exertion <sup>d</sup>	-	-
% Moderate exertion <sup>d</sup>	36	33
% Severe exertion <sup>d</sup>	64	66
% Maximal exertion <sup>d</sup>	0	1
<b>Bases (unweighted)</b>		
Men	512	288
Women	576	304
<b>Bases (weighted)</b>		
Men	581	304
Women	500	249

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> At least 4 minutes of step test conducted

<sup>c</sup> Light exertion: VO<sub>2max</sub> more than 43 ml O<sub>2</sub>/min/kg

Moderate exertion: VO<sub>2max</sub> 21-43 ml O<sub>2</sub>/min/kg

Severe exertion: VO<sub>2max</sub> 13-20 ml O<sub>2</sub>/min/kg

Maximal exertion: VO<sub>2max</sub> less than 13 ml O<sub>2</sub>/min/kg

<sup>d</sup> Light exertion: VO<sub>2max</sub> more than 70 ml O<sub>2</sub>/min/kg

Moderate exertion: VO<sub>2max</sub> 33-70 ml O<sub>2</sub>/min/kg

Severe exertion: VO<sub>2max</sub> 21-32 ml/kg O<sub>2</sub>/min/kg

Maximal exertion: VO<sub>2max</sub> less than 21 ml O<sub>2</sub>/min/kg

Table 4.8

<b>Mean VO<sub>2max</sub> by self-reported physical activity level, age and sex</b>				
<i>Aged 16-74 with step test data<sup>a</sup></i>				2008
Summary physical activity level (self-reported) <sup>b</sup>	Age group			Total
	16-34 ml O <sub>2</sub> /min/kg	35-54 ml O <sub>2</sub> /min/kg	55-74 ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg
<b>Men</b>				
Meets recommendations				
Mean VO <sub>2max</sub>	40.7	35.8	30.9	37.3
Standard error of the mean	0.48	0.35	0.55	0.33
% Unfit <sup>c</sup>	7	33	69	26
Some activity				
Mean VO <sub>2max</sub>	39.3	35.4	31.6	36.2
Standard error of the mean	0.66	0.44	0.66	0.37
% Unfit <sup>c</sup>	19	35	64	34
Low activity				
Mean VO <sub>2max</sub>	[38.4]	32.1	[29.9]	33.9
Standard error of the mean	[0.89]	0.63	[0.73]	0.54
% Unfit <sup>c</sup>	[11]	60	[73]	45
<b>Women</b>				
Meets recommendations				
Mean VO <sub>2max</sub>	35.4	32.6	29.4	33.0
Standard error of the mean	0.56	0.40	0.48	0.35
% Unfit <sup>c</sup>	28	55	81	50
Some activity				
Mean VO <sub>2max</sub>	35.5	30.1	28.2	31.7
Standard error of the mean	0.58	0.35	0.50	0.33
% Unfit <sup>c</sup>	34	79	88	64
Low activity				
Mean VO <sub>2max</sub>	32.9	30.2	[26.6]	30.8
Standard error of the mean	0.58	0.46	[0.45]	0.36
% Unfit <sup>c</sup>	58	76	[98]	72
<b>Bases (unweighted)</b>				
<i>Men</i>				
Meets recommendations	128	165	65	358
Some activity	91	143	76	310
Low activity	38	61	38	137
<i>Women</i>				
Meets recommendations	110	150	80	340
Some activity	102	156	76	334
Low activity	74	91	45	210
<b>Bases (weighted)</b>				
<i>Men</i>				
Meets recommendations	195	192	55	442
Some activity	136	159	66	361
Low activity	57	70	33	160
<i>Women</i>				
Meets recommendations	124	139	63	325
Some activity	115	142	58	315
Low activity	91	83	34	209

<sup>a</sup> At least 4 minutes of step test conducted.

<sup>b</sup> Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks.  
Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions in the last four weeks.  
Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks.

<sup>c</sup> Unfit: VO<sub>2max</sub> less than 33ml O<sub>2</sub>/min/kg i.e. walking at 3mph up 5% requires severe or maximal exertion.



Table 4.9		
Mean VO <sub>2max</sub> by objective physical activity level and sex		
Aged 16-74 and over with step test data and accelerometry data <sup>a</sup> 2008		
Physical fitness	Objective physical activity level <sup>b</sup>	
	Some activity	Low activity
	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg
<b>Men</b>		
Mean VO <sub>2max</sub>	35.8	35.0
Standard error of the mean	0.54	0.37
% Unfit <sup>c</sup>	37	41
<b>Women</b>		
Mean VO <sub>2max</sub>	32.0	30.8
Standard error of the mean	0.56	0.32
% Unfit <sup>c</sup>	62	69
<i>Bases (unweighted)</i>		
Men	131	211
Women	109	279
<i>Bases (weighted)</i>		
Men	126	220
Women	86	228

<sup>a</sup> At least 4 minutes of step test conducted.

<sup>b</sup> Only 27 participants were in the first category. Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least five days in the week of accelerometer wear; this group is too small for reliable analysis and is not shown in the table.  
Some activity: 30 minutes or more of moderate or vigorous activity on one to four days.  
Low activity: no days with 30 minutes or more of moderate or vigorous activity in the last four weeks.

<sup>c</sup> Unfit: VO<sub>2max</sub> less than 33ml O<sub>2</sub>/min/kg i.e. walking at 3mph up 5% requires severe or maximal exertion.

Table 4.10				
Mean VO <sub>2max</sub> by BMI category, age and sex				
Aged 16-74 with step test data <sup>a</sup>				2008
BMI category <sup>b</sup>	Age group			Total
	16-34	35-54	55-74	
	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg
<b>Men</b>				
<b>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</b>				
Mean VO <sub>2max</sub>	41.2	36.2	[32.4]	38.8
Standard error of the mean	0.44	0.55	[0.91]	0.39
% Unfit <sup>c</sup>	5	28	[55]	17
<b>BMI 25 to less than 30 kg/m<sup>2</sup> (overweight)</b>				
Mean VO <sub>2max</sub>	39.3	35.8	30.9	36.0
Standard error of the mean	0.57	0.37	0.49	0.32
% Unfit <sup>c</sup>	14	32	69	33
<b>BMI 30 kg/m<sup>2</sup> or more (obese)</b>				
Mean VO <sub>2max</sub>	d	32.2	[30.1]	32.3
Standard error of the mean	d	0.54	[0.67]	0.42
% Unfit <sup>c</sup>	d	62	[76]	61
<b>Women</b>				
<b>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</b>				
Mean VO <sub>2max</sub>	36.1	32.7	29.3	33.9
Standard error of the mean	0.38	0.38	0.53	0.28
% Unfit <sup>c</sup>	27	54	81	45
<b>BMI 25 to less than 30 kg/m<sup>2</sup> (overweight)</b>				
Mean VO <sub>2max</sub>	34.2	30.7	28.4	31.2
Standard error of the mean	0.70	0.31	0.41	0.31
% Unfit <sup>c</sup>	42	74	90	68
<b>BMI 30 kg/m<sup>2</sup> or more (obese)</b>				
Mean VO <sub>2max</sub>	[29.6]	27.9	[26.8]	28.1
Standard error of the mean	[0.63]	0.44	[0.58]	0.33
% Unfit <sup>c</sup>	[85]	94	[92]	91

<sup>a</sup> At least 4 minutes of step test conducted.

<sup>b</sup> BMI: Body mass index = weight (kg) /height squared (m<sup>2</sup>).

<sup>c</sup> Unfit: VO<sub>2max</sub> less than 33ml O<sub>2</sub>/min/kg i.e. walking at 3mph up 5% requires severe or maximal exertion.

<sup>d</sup> Data not shown because the base is too small.

Continued...

Table 4.10 continued

Aged 16-74 with step test data<sup>a</sup>

2008

BMI category <sup>b</sup>	Age group			Total
	16-34	35-54	55-74	
	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg	ml O <sub>2</sub> /min/kg
<i>Bases (unweighted)</i>				
<i>Men</i>				
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	140	101	40	281
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	91	179	93	363
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	25	88	47	160
<i>Women</i>				
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	169	173	70	412
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	78	151	86	315
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	39	74	45	158
<i>Bases (weighted)</i>				
<i>Men</i>				
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	215	112	33	361
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	132	204	79	415
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	39	104	43	185
<i>Women</i>				
<i>BMI less than 25 kg/m<sup>2</sup> (not overweight or obese)</i>	200	154	55	409
<i>BMI 25 kg/m<sup>2</sup> to less than 30 kg/m<sup>2</sup> (overweight)</i>	85	140	65	290
<i>BMI 30 kg/m<sup>2</sup> or more (obese)</i>	44	70	36	150

<sup>a</sup> At least 4 minutes of step test conducted.<sup>b</sup> BMI: Body mass index = weight (kg) /height squared (m<sup>2</sup>).<sup>c</sup> Unfit: VO<sub>2max</sub> less than 33ml O<sub>2</sub>/min/kg i.e. walking at 3mph up. 5% requires severe or maximal exertion.<sup>d</sup> Data not shown because the base is too small.

Table 4.11

**Estimated odds ratios for lack of physical fitness<sup>a</sup>, by associated risk factors<sup>b</sup> and sex***Aged 16-74 with step test data<sup>c</sup>*

2008

Variable	N	Odds ratio	95 C.I. <sup>d</sup>	Variable	N	Odds ratio	95 C.I. <sup>d</sup>
<b>Men</b> <i>Weighted Base</i>	806			<b>Women</b> <i>Weighted Base</i>	887		
<b>Age (p&lt; 0.001)</b>				<b>Age (p&lt; 0.001)</b>			
16-34	257	1		16-34	287	1	
35-54	369	3.79	(2.33 -6.18)	35-54	399	3.18	(2.28 -4.44)
55-74	180	14.97	(7.95 -28.17)	55-74	201	9.25	(5.16 -16.57)
<b>Health risk category<sup>e</sup> (p&lt; 0.001)</b>				<b>Health risk category<sup>e</sup> (p&lt; 0.001)</b>			
No increased risk	384	1		No increased risk	437	1	
Increased risk	181	2.13	(1.36 -3.33)	Increased risk	142	2.41	(1.54 -3.79)
High risk	96	2.40	(1.27 -4.54)	High risk	142	3.02	(1.79 -5.1)
Very high risk	135	6.51	(3.61 -11.74)	Very high risk	150	14.13	(7.23 -27.65)
Not measured	10	3.85	(0.87 -17.11)	Not measured	16	1.00	(0.31 -3.27)
<b>Longstanding illness (p=0.04)</b>				<b>Longstanding illness (p=0.028)</b>			
No longstanding illness	556	1		No longstanding illness	620	1	
Non limiting longstanding illness	172	0.93	(0.6 -1.44)	Non limiting longstanding illness	164	1.83	(1.18 -2.85)
Limiting long standing illness	78	2.16	(1.16 -4.05)	Limiting long standing illness	103	1.17	(0.63 -2.16)
<b>NS-SEC of household reference person (p= 0.278)</b>				<b>NS-SEC of household reference person (p=0.034)</b>			
Managerial and professional	342	1		Managerial and professional	287	1	
Intermediate	159	1.12	(0.72 -1.75)	Intermediate	216	1.56	(0.99 -2.47)
Routine and manual	265	0.78	(0.51 -1.18)	Routine and manual	341	1.63	(1.08 -2.46)
Other/not known	40	1.17	(0.35 -3.88)	Other/not known	43	0.93	(0.45 -1.91)
<b>Index of multiple deprivation (p=0.008)</b>				<b>Index of multiple deprivation (p=0.956)</b>			
1st quintile (least deprived)	199	1		1st quintile (least deprived)	209	1	
2nd and 3rd quintiles	343	1.20	(0.68 -2.11)	2nd and 3rd quintiles	372	1.03	(0.63 -1.69)
4th and 5th quintiles (most deprived)	264	2.15	(1.19 -3.86)	4th and 5th quintiles (most deprived)	306	1.08	(0.66 -1.77)

<sup>a</sup> Defined as VO<sub>2max</sub> less than 33 ml O<sub>2</sub>/min/kg, indicating that walking at 3mph up a 5% incline would require severe exertion or not be possible.

<sup>b</sup> The following variables were also included in the initial models, but were not significant in either sex after adjustment for the variables listed above: ethnicity, education, self related general health, smoking status, alcohol consumption, hypertension, income tertile, objective physical activity and Strategic Health Authority (SHA).

<sup>c</sup> At least 4 minutes of step test conducted.

<sup>d</sup> Confidence interval.

<sup>e</sup> NICE categories of health risk based on overweight/obesity and waist circumference (see Section 4.2.3).

# Self-reported physical activity in children

# 5

Deanna Pickup, Natalie Gunning

## Summary

- This chapter focuses on self-reported physical activity among children aged 2-15. Information was collected using the new version of the HSE physical activity questionnaire for children, which has been extensively revised from previous versions.
- A higher proportion of boys (32%) than girls (24%) were classified as meeting the government's recommendations for physical activity, doing at least an hour of at least moderate activity every day. Among girls the proportion meeting the government recommendations generally decreased with age, ranging from 35% among girls aged 2 to 12% among those aged 14. There was a less consistent pattern with age among boys.
- Levels of physical activity varied according to equivalised household income. Among both boys and girls, those in the lowest income quintile were more likely than those in the highest quintile to be meeting recommendations. Among boys the proportion increased from 25% in the highest quintile to 36% in the lowest one; for girls the increase was from 22% to 30%.
- Among boys aged 2-10, more met the physical activity recommendations for children if their parents did so for adults; among boys aged 11-15 the same pattern was apparent for fathers' activity levels but not for mothers'. Similarly, among both age groups, more were in the low activity category if their parents were also in this group. Among girls, the activity level of parents made relatively little difference to the proportion meeting recommendations, but those who had parents with low activity levels were considerably more likely to be in the low activity category themselves.
- Almost two thirds of children who had attended school, nursery or playgroup in the last week had walked to or from school on at least one occasion. The proportion of boys and girls who walked to or from school did not differ significantly (63% and 65% respectively). As would be expected, older children were more likely than those aged 2-4 to walk to or from school. More boys than girls who went to school in the last week cycled to or from school on at least one day (5% of boys and 2% of girls).
- Overall, 95% of boys and girls had participated in any type of physical activity in the last week. More girls than boys had done some walking (65% and 61% respectively). However, boys were more likely than girls to have participated in informal activities (90% and 86% respectively) and formal sports (49% and 38% respectively).
- Patterns of activities varied by age. Older children were the most likely to have spent time walking. For informal sports, while there was relatively little difference across ages for boys, among girls, participation decreased among those of secondary school age. For formal sports, participation increased from a relatively low proportion of the youngest children. Among boys, participation in formal sports increased up to 62% at the age of 10, and then remained at a similar level among older boys. Among girls, participation was a little below 50% for those aged 7-12, but decreased in older girls.
- More boys than girls participated in at least seven hours of any type of physical activity

in the last seven days (51% and 43% respectively). The average total number of hours was greater for boys than for girls (10.0 and 8.7 respectively), with a clear decrease with age among girls. For most children, the largest contribution to their total physical activity came from informal sports and activities, but for girls aged 14-15, more of their activity was from walking than from informal sports.

- For both boys and girls, there was a gradual increase in the average number of hours' participation in any type of physical activity as household income decreased; this increase was from 8.2 hours for boys and 8.6 hours for girls in the highest income quintile to 11.4 hours and 10.0 hours respectively in the lowest income quintile.
- Average total sedentary time (excluding time at school) was very similar for boys and girls on weekdays (3.4 hours each) and weekend days (4.1 hours and 4.2 hours respectively). Average sedentary time generally increased with age, whether for TV viewing or other sedentary time, and whether for weekdays or weekend days. Furthermore, the proportion of children who reported four or more hours of either TV viewing or other sedentary time on a typical day, or six or more hours of total sedentary time, also increased with age.
- A different pattern of sedentary time was apparent for weekdays and weekend days. On weekdays, there was little variation among younger children, with fewer than 10% of those aged 2-9 sedentary for six or more hours, while the proportion rose steeply after that age. At weekends, the proportion that were sedentary for six or more hours generally increased across all ages, ranging from 8% of boys and girls aged 2 to 40% of boys and 41% of girls aged 15.

## 5.1 Introduction

The most commonly accepted definition of physical activity is ‘any bodily movement produced by the muscles resulting in energy expenditure above the basal level’.<sup>1</sup> This chapter focuses on self-reported activities that are believed to account for the majority of children’s total physical activity, including active transport to and/or from school, formal and informal activities. This chapter also presents data on self-reported sedentary behaviour among children.

The importance of physical activity for the health of children and young people is well documented. Establishing a physically active lifestyle during childhood can bring health benefits for the individual, and at a population level this can result in reduced overweight and obesity, improved psychological well being, social interaction and self-esteem, and reduced prevalence of other health related risk factors.<sup>2,3</sup> Establishing physical activity as a habit at an early age can also help lead to a physically active lifestyle in adulthood, thus extending its health benefits across the life course.<sup>4,5</sup> The strong evidence of the relationship between physical activity and various health outcomes means it is important that levels of physical activity among the general population are documented and monitored.

When investigating physical activity and links with health outcomes, it is also important to consider sedentary behaviour, which can affect health independently of physical activity. Sedentary behaviour is not merely the absence of physical activity. Rather it should be viewed as a distinct class of behaviours characterised by low energy expenditure.<sup>6</sup> Research looking at sedentary behaviour, rather than physical inactivity, suggests that some activities, in particular screen time and TV viewing, are associated with higher blood pressure levels in young children.<sup>7</sup> Sedentary behaviour among children has also been associated with increased sleep latency (the time it takes to fall asleep once the lights have been turned off), which can lower cognitive performance,<sup>8</sup> and is loosely associated with increased body fat.<sup>9</sup>

Physical inactivity among children and young people has been an important government focus for some time, due to its association with rising levels of obesity in England (see Chapter 13 in this report, and also the HSE 2006 report<sup>10</sup>). Children who are either overweight or obese are more susceptible to adverse health risks and conditions such as cardiovascular disease,<sup>11</sup> premature atherosclerosis<sup>12</sup> and diabetes.<sup>13</sup> Evidence suggests that childhood obesity also puts children at greater risk of being obese or overweight during adulthood, as behaviours often extend into later life.<sup>14</sup> In 2007, the Department for Health, the Department for Children, Schools and Families and the Department for Culture, Media and Sport announced a target to reduce the proportion of overweight and obese children living in England to the levels in 2000 by 2020.<sup>15</sup> Although the exact degree to which inactivity has contributed to rising levels of childhood obesity is not known,<sup>4</sup> physical activity has become a vital policy area in the attempt to reverse the current trends by 2020.<sup>16</sup>

The Chief Medical Officer (CMO) of England recommends that children and young people should do a minimum of 60 minutes of at least moderate intensity physical activity each day. Children should also participate in activities that improve bone health, muscle strength and flexibility at least twice a week.<sup>4</sup> With this in mind, the government has launched various initiatives centred around different types of sports and activities to encourage children and families to meet this guidance.

In early 2009, the government published a new framework ‘*Be active, be healthy: A plan for getting the nation moving*’;<sup>17</sup> this outlines current and future policies which together aim to deliver the recommended physical activity targets specified in 2007.<sup>16</sup> For children and young people, this included initiatives that would take effect both in and out of school. The *PE and Sports Strategy for Young People* aims to give all children aged 5-16 the opportunity to take part in five hours of PE or sport during the school week.<sup>18</sup> This would encourage many children to reach their recommended 60 minutes of physical activity each school day.

In order to tackle physical inactivity outside school, initiatives such as the *Change4life* campaign have been launched. Change4life provides families with information, tips and advice about how they can become more physically active, among other things, and by autumn 2009 over 300,000 families have signed up.<sup>19</sup> Since its launch, sub-brands aimed at encouraging specific physical activity have also been launched such as *Play4life*, *Bike4life*, *Walk4life* and *Swim4life*. Swim4life, for example, was launched in early 2009 and by September had led to more than 200 councils offering free swimming to all those aged 16 and under.<sup>17</sup>

Children's play and informal exercise have been recognised by the government as making an important contribution for children to achieve part of their recommended 60 minutes of physical activity a day. In 2008, the government launched its first National Play Strategy,<sup>20</sup> with the aim to provide more safe outdoor play areas for children throughout the country. Backed by £235 million of investment, active play is considered important for children's physical development and the expenditure of excess calories.

In recent years, travelling to and from school has been recognised as a key opportunity for children and young people to achieve part of their recommended 60 minutes of physical activity a day. In 2003, the government launched its *Travelling to School* initiative, which aims to get all schools in England to develop approved school travel plans by 2010.<sup>21</sup> These travel plans would help provide safe bike routes for children, accessible walking paths and more flexibility within the school day so that children are able to walk or cycle to school if they choose to do so. Research suggests that for many children, if safe provision was made, they would prefer to walk or cycle to school.<sup>22</sup>

This chapter presents findings from 2008 on formal and informal physical activity as well as travelling to and from school and sedentary behaviours. All findings are based on self-reported physical activity. Chapter 6 presents results from an objective measure of children's physical activity from accelerometry, and compares the self-reported and objective measures. Adult physical activity is discussed in Chapters 2 and 3. Trend tables for key HSE measures are published separately by The NHS Information Centre, *Health Survey for England 2008 Latest Trends*.<sup>23</sup>

## 5.2 Methods and definitions

### 5.2.1 Questionnaire development

Despite their limitations, questionnaires are a practical and cost effective way of measuring physical activity in large scale epidemiological research.<sup>24</sup> Questions on physical activity have been asked of children in previous HSE years, including 1997, 1998, 2002, and 2005 to 2007; the questions were also asked of children in minority ethnic groups in 1999 and 2004. Over the years, the physical activity questionnaire for children has been revised and amended in line with changing recommendations about the levels of physical activity they should be reaching.

Unlike the adult questionnaire which was based on a major national study of activity (The Allied Dunbar National Fitness Survey<sup>25</sup>), the initial questionnaire used for children in 1997 was based on small scale research studies and drew on the adult questionnaire, as no other questionnaire was available. Before implementation, the questionnaire underwent extensive testing to assess respondent perception and understanding of the questions being asked. Between 1997 and 2002, the structure of the questionnaire changed,<sup>26</sup> although a comparison of the overall physical activity levels between 1997 and 2002 showed no significant difference in the proportion of boys and girls meeting recommended physical activity targets across all ages. In 2002, the variables used for analysis were redefined, and these variables were used in the reporting of subsequent years up to 2007.

For the 2008 survey, the children's physical activity questions were completely revised. This decision was based on the following factors:

- There was concern about the accuracy of the data collected from the existing physical



activity questions, given the high proportions of children that were found to be meeting government recommendations according to the assumptions on which the analysis was based.

- Recommendations that the questionnaire would need to be adapted to provide data which reflected the Chief Medical Officer's (CMO) 2004 guidance regarding levels of physical activity. The guidance is that children should be doing 60 minutes of physical activity every day which can be achieved in one session or in several bouts of at least 10 minutes. The previous questionnaires did not capture physical activity bouts as short as 10 minutes, which could potentially add up to the recommended levels.
- School breaks and travel to school provide important opportunities for children to take part in physical activity. While the questions in the original version included activity in school breaks and travelling to school, these were not separately identified.
- The previous questionnaire asked very limited questions on children's sedentary time. It was deemed important that more extensive questions on sedentary time were included in the questionnaire since this is independently linked with health outcomes.
- The validity and reliability of the previous questionnaire were unknown.
- There were only three previous years of comparable HSE data for children's physical activity; thus if significant changes needed to be made to the questionnaire, it was important that they should be introduced as soon as possible so that a new time series could be started.

The questionnaire used in the 2008 survey was developed based on extensive research of pre-existing questions and of survey methods. The drafted version was tested in March 2007 with a cognitive pilot involving eight children aged 11-15 and five parents of children aged 2-10. The aim of the cognitive pilot was to test various aspects of the questionnaire, namely the content (attendance at school/nursery, travel to school, school breaks, active play and sedentary time), personal reports of physical activity among children aged 11-15 and parental proxy reports for children aged 2-10. Following the pilot, the report made several recommendations to improve the comprehension of the questionnaire and respondent recall of physical activity. Where it was deemed practical, these recommendations were included in the final questionnaire.

The questionnaire was then tested in a larger scale pilot and validation study, and appeared to have good convergent and face validity. The key changes to the 2008 questionnaire were:

- A new division of sports and activities into formal and informal; and as well as the activities on the show cards, participants were asked about any other similar activities they had done, and these were recorded individually;
- For each activity undertaken, participants were asked on which specific days of the week they had done them, rather than on how many weekdays and weekend days;
- For each day that the participant had done an activity, they were asked how long they had done it (in hours and minutes), rather than giving an average for all the days using half hour bands.

Due to the significant revisions to the 2008 children's physical activity questionnaire, the results reported here are not directly comparable with previous HSE reports that present findings on child physical activity. For this reason, this chapter does not present any trend tables and does not compare the 2008 results with previous years.

## 5.2.2 Method

Children aged 13-15 were asked questions directly about their physical activity, while the parents of children aged 2-12 were asked the questions on the child's behalf. Recalling specific detail about different types of physical activity carried out over a particular time period is a highly complex cognitive task. Existing physical activity literature suggests that, due to developmental differences in a child's ability to think abstractly and to perform detailed recall, children are less likely than adults accurately to report physical activities.<sup>27</sup> The Health Survey aims to limit recall effects by only asking children about the last seven days and by directing the questions at parents of younger children. Whenever possible,

children were present during the interview, so in most cases would have been able to contribute to the answers given, but this may not have always been the case. The ages for which parents answered on behalf of their children, or children answered for themselves, were based on the same rules applied to other survey modules and ensured consistency across the HSE questionnaire.

Participants were asked to recall the days in the last week that they (or their children) did any physical activity apart from during school hours (curriculum time). The decision to exclude activities during school hours was taken for three main reasons: firstly, it was assumed that, generally speaking, the amount of physical activity done as part of the school curriculum would be similar across all children, for a given age, and thus would contribute a 'standard' amount of physical activity for each child; activity done as part of the school curriculum would generally be compulsory and it was felt that the survey was concerned more with activities done out of choice; and thirdly, a large proportion of data collected was by parental proxy and it was thought that information about activities during school time would be less accurate than information collected about leisure time.

The revised physical activity questionnaire covered the seven day period prior to the day of interview; this meant that all children (or parents of younger children) had to recall physical activity for weekdays and weekend days, which typically differ in types and levels of physical activity. Additionally, as the survey follows an annual cycle, seasonal differences in physical activity are accounted for.

It is recognised that it is easier to remember formal, often planned, activity than informal or routine 'lifestyle' activity.<sup>28</sup> When asked for details about the types of physical activity they did, participants were presented with two lists of activities. It was explained to them that one list included examples of informal activities and the other included examples of formal sports. Cognitive testing of the questionnaire suggested that this helped children, and parents of younger children, to distinguish between and recall all the different types of physical activity a child had done on a specific day in more detail. For each activity that a child identified, they were asked to recall on which days they did it; and on each of the days recalled, how long they spent engaged in it (in hours and minutes). Participants were able to recall more than one type of activity for each day.

Participants were also asked if they had been to school (or playgroup or nursery) in the last seven days, and if so on how many days. Those children who had been to school on at least one day in the last seven were asked if they had walked or cycled to and/or from school on any of those days; if so they were asked the number of days they walked or cycled and the duration of this journey. Participants who had attended school were also asked to classify the type of activity they did during their school breaks (sitting down, hanging around, walking or running around or playing games).

The section on sedentary time estimates how much time on average children spent watching television, and in other sedentary time (e.g. reading, doing homework, drawing, using a computer or playing video games). This was recorded for a typical weekday and a typical weekend day. Total sedentary time is also estimated.

### **5.2.3 Assumptions underlying the intensity level classification of physical activities**

The information collected covers primarily the type of activity, frequency and duration. For some activities, an additional question '*When you did X, was it hard enough to make you out of breath or sweaty?*', was asked (as for adults), to provide an indication of the intensity level of the activity being reported. However, this has not been used in the results presented here, since there is no evidence to define how this information relates to intensity of physical activity in children. It is therefore assumed that all children's reported activities were of at least a moderate intensity. This is likely to lead to an overestimate of the amount of time spent in at least moderate intensity activity, and thus an overestimate of the proportions of children meeting the government's recommendations.

## 5.2.4 Definitions

### Summary activity levels

The government's physical activity recommendations for children are that they should do at least an hour of at least moderate activity each day. (Although not monitored here, it is also recommended that at least twice a week this should include activities to improve muscle strength, flexibility and bone health - activities that produce high physical stresses on the bones.)

The recommendation incorporates three basic dimensions (frequency, intensity, and duration) of children's overall physical activity level.

In 2008, the titles for the summary activity classifications have been changed to correspond better with what they actually measure, since the category previously labelled 'high' in fact simply represents those who meet government (minimum) recommendations. Therefore 'High' is now referred to as 'Meets recommendations'; 'Medium' is now 'Some activity'; and 'Low' is 'Low activity'. The classification of summary activity levels used in analyses are as follows:

#### Meets recommendations:

At least 60 minutes of moderate activity on all seven days in the last week.

#### Some activity:

30-59 minutes of moderate activity on all seven days in the last week.

#### Low activity:

Fewer than 30 minutes of moderate activity on each day, or moderate activity of 60 minutes or more on fewer than seven days in the last week.

As indicated above, this classification assumes all reported activities are of at least moderate intensity.

### Types of activity

To assist participants with the recall of all activities they did over a seven day period, and to focus them on the types of activity of interest, sports and activities were classified as informal (active play) or formal, such as organised games (e.g. football, basketball).

The groups of activities used for analysis in this chapter include:

#### 1. Walking (not including to or from school)

Walking was presented as part of the informal group of activities. It has been analysed separately as an activity of policy interest. The walks included are of any duration.<sup>29</sup>

#### 2. Informal activities

Activities in this group include cycling, dancing, skating, trampolining, hopscotch, active play, skipping rope, and housework and gardening.

#### 3. Formal sports

Activities in this group include any organised team sports such as football, rugby, cricket, and netball, as well as running or athletics, all types of swimming, gymnastics, weight training, aerobics and tennis.

Where the 'total physical activity' variable has been included in the tables, it is an aggregate of the grouped activities listed above.

Walking or cycling to and from school is reported separately from other walking and cycling in these analyses, because active travel to and from school is an important opportunity for physical activity amongst children. The structure of the questions about active travel to school differed from the structure for all other types of physical activity, since journeys were not related to specific weekdays. Thus it is not possible to combine walking and cycling to school with other occasions of walking and cycling in assessing the total amount of activity for the summary activity levels.

5.3 Self-reported summary activity levels

5.3.1 Physical activity levels by age and sex

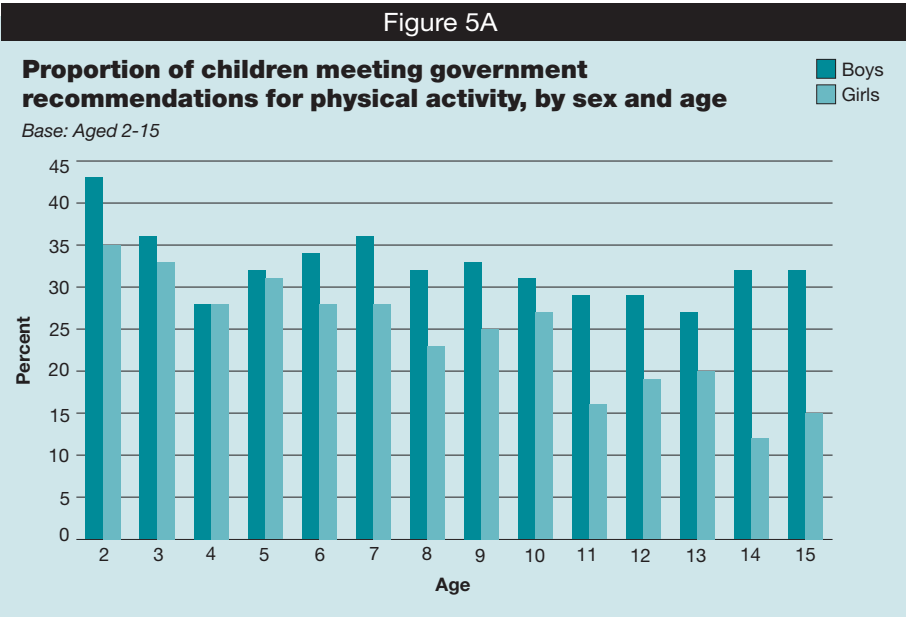
Based on their self-reported physical activity over the week before the interview, children were classified into summary activity groups of meeting recommendations, some activity or low activity (see section 5.2.3 for definitions).

A higher proportion of boys (32%) than girls (24%) were classified as meeting the government’s recommendations for physical activity. Table 5A shows the proportion of boys and girls at each summary activity level.

Table 5A		
Summary of children’s activity levels (self-reported), by sex		
Activity level	Boys	Girls
	%	%
Meets recommendations	32	24
Some activity	44	47
Low activity	24	29

Levels of physical activity varied with age. As figure 5A shows, among girls there was a downward pattern in activity associated with increasing age, with the proportion meeting the government recommendations ranging from 35% among girls aged 2 to 12% among those aged 14. Among boys significant variation was found according to age, but no clear pattern was obvious.

Tables 5.1, 5A, Figure 5A



5.3.2 Physical activity levels by socio-economic characteristics

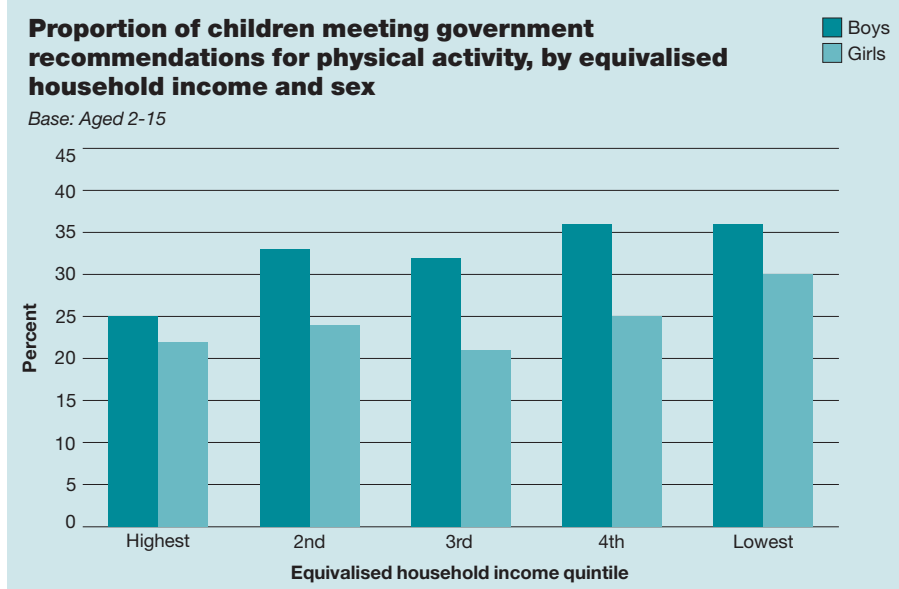
There was no significant variation by Strategic Health Authority regions in children’s summary activity levels.

Table 5.2

A relationship was evident between levels of physical activity and equivalised household income. Among both boys and girls, those in the lowest income quintile were more likely than those in the highest quintile to be meeting recommendations. Among boys the proportion increased from 25% in the highest quintile to 36% in the lowest one. For girls the increase was from 22% to 30% respectively.

Table 5.3, Figure 5B

Figure 5B



Levels of physical activity were analysed by whether or not the participant's household was in a Spearhead PCT;<sup>30</sup> no significant variation was found in the proportion of children who reached the government's target.

Table 5.4

Analysis by BMI (Body Mass Index) category showed that the proportion of children meeting recommendations for reported physical activity did not vary significantly across categories.

Table 5.5

### 5.3.3 Children's physical activity levels in relation to parental physical activity

Children's physical activity levels were analysed by parental physical activity level. Parental physical activity was classified in three categories, as with children's, although the definitions were different (see Chapter 2, Self-reported physical activity in adults):

- Meeting recommendations for adults: at least 30 minutes per day of at least moderate activity on at least five days per week
- Some activity: at least 30 minutes per day of at least moderate activity on one to four days per week
- Low activity: at least 30 minutes per day of at least moderate activity on fewer than one day per week.

A greater proportion of fathers than mothers reached the government physical activity recommendations, based on self-reported data (46% and 38% respectively, as shown in Table 5B below). Only a minority of parents were in the low activity group, 14% of both fathers and mothers. This is a very different profile from the general population, where overall 39% of men and 29% of women met recommendations, and 30% and 38% respectively were in the low activity group. This in part reflects the younger age profile of parents; as Table 2.1 in Chapter 2 shows, the majority of those aged 65 and over were in the low activity group. However, parents (particularly mothers) were considerably less likely to be in the low activity group than non parents even in younger age groups.

Figure 5C shows the physical activity levels of children in two age groups according to whether their father or mother met recommendations for physical activity, or was in the low activity group. Although base sizes for parents in the low activity group are small, there are nevertheless clear and statistically significant differences between the two groups.

Among boys aged 2-10, more met the physical activity recommendations for children if their parents did so for adults; among boys aged 11-15 the same pattern was apparent for fathers' activity levels but not for mothers'. Similarly, among both age groups, more were in the low activity category if their parents were also in this group. Thus for instance, among boys aged 2-10, 36% with fathers and 41% of those with mothers meeting

Table 5B		
<b>Physical activity levels (self-reported) of parents</b>		
	<b>Fathers</b>	<b>Mothers</b>
	%	%
Meet recommendations	46	38
Some activity	40	48
Low activity	14	14
<i>Unweighted base</i>	<i>1770</i>	<i>2885</i>
<i>Weighted base</i>	<i>1701</i>	<i>2774</i>

recommendations also did so, compared with 26% and 29% respectively with parents in the low activity group. 30% with fathers and 32% with mothers in the low activity group were also in the low group, compared with 20% and 18% of those with parents meeting the recommendations.

Among girls, the activity level of parents made relatively little difference to the proportion meeting recommendations, either among those aged 2-10 or 11-15. However, those who had parents with low activity levels were considerably more likely to be in the low activity category themselves. This was especially marked among girls aged 11-15: while 35% with a father meeting recommendations and 34% of those with a mother meeting recommendations were in the low activity group, this rose to 52% and 47% respectively among those whose father or mother were also in the low group.

**Table 5.6, Figure 5C**

## 5.4 Self-reported participation in physical activities and sedentary time

### 5.4.1 Participation in walking and cycling to school

All children were asked if they had attended school, playgroup or nursery in the last seven days. For the remainder of this section attendance at 'school' refers to any of these. Children who attended school on at least one day in the last week were asked if they had walked and/or cycled to or from school. Almost two thirds of these children had walked to or from school on at least one occasion in the last seven days (64%). The proportion of boys and girls who walked to or from school did not differ significantly (63% and 65% respectively). However, as would be expected, older children were more likely than those aged 2-4 to walk to or from school on any occasion in the last week (66% of boys and 65% of girls aged 2-10, 65% of boys and 70% of girls aged 11-15, compared with 52% of boys and 56% of girls aged 2-4).

More boys than girls who went to school in the last week cycled to or from school on at least one day (5% of boys and 2% of girls). The proportion of boys who cycled to/from school increased with age (from 3% aged 2-4, to 8% aged 11-15).

**Table 5.7**

Among children who went to school in the last week, similar proportions of boys and girls walked to or from school every day (38% and 40% respectively). More than two in five children aged 5-15 walked to or from school each day (43% of boys and 42% of girls aged 5-10, 44% of boys and 45% of girls aged 11-15), while pre-school aged children (aged 2-4) were less likely to do so (18% of boys and 24% of girls).

**Table 5.8**

The average time both boys and girls spent walking to and/or from school in the last week was one hour, equating to an average of 12 minutes per day for a full school week. Children aged 11-15 averaged the most time in the last week walking to and or from school, 1.3 hours for both boys and girls. Boys aged 2-4 spent an average of 0.6 hours, and girls of this age an average of 0.8 hours, walking to or from school; this lower average is likely to reflect the fact that they attended on fewer days on average, rather than necessarily walking for a shorter time.

**Table 5.9**

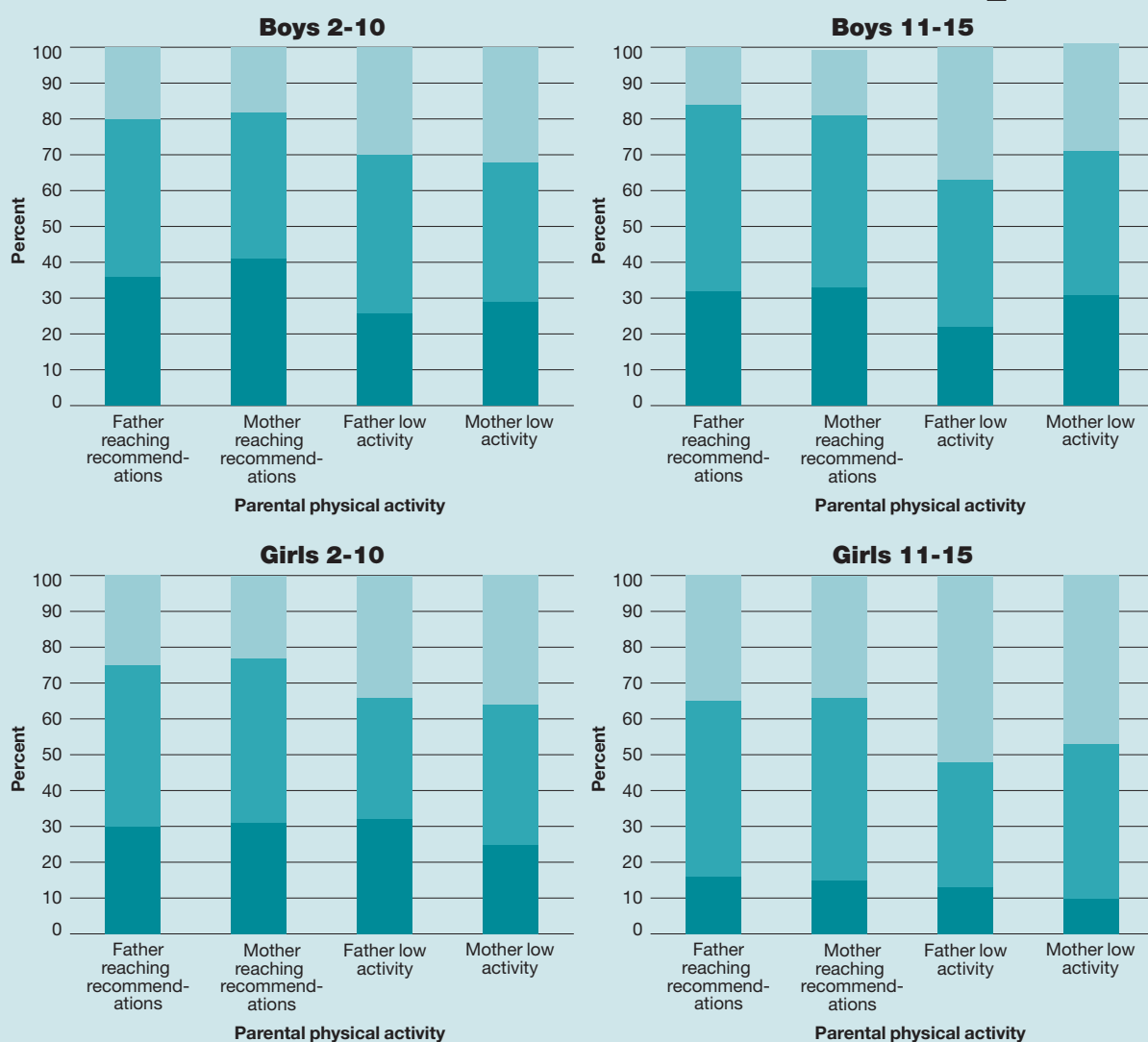


Figure 5C

### Children's physical activity by parental physical activity

Base: Aged 2-15 with valid BMI and valid parental BMI

Low activity  
Some activity  
Meets recommendations



## 5.4.2 Participation in different activities

### Participation by age and sex

Table 5.10 shows the proportion of children who participated in different types of physical activity in the last week. These types of activity include walking (not including walking to or from school), informal activities and formal sports (see section 5.2.3 for further definitions of these).

Overall, 95% of boys and girls had participated in any type of physical activity. More girls than boys participated in walking (65% and 61% respectively). However boys were more likely than girls to have participated in informal activities (90% and 86% respectively) and formal sports (49% and 38% respectively).

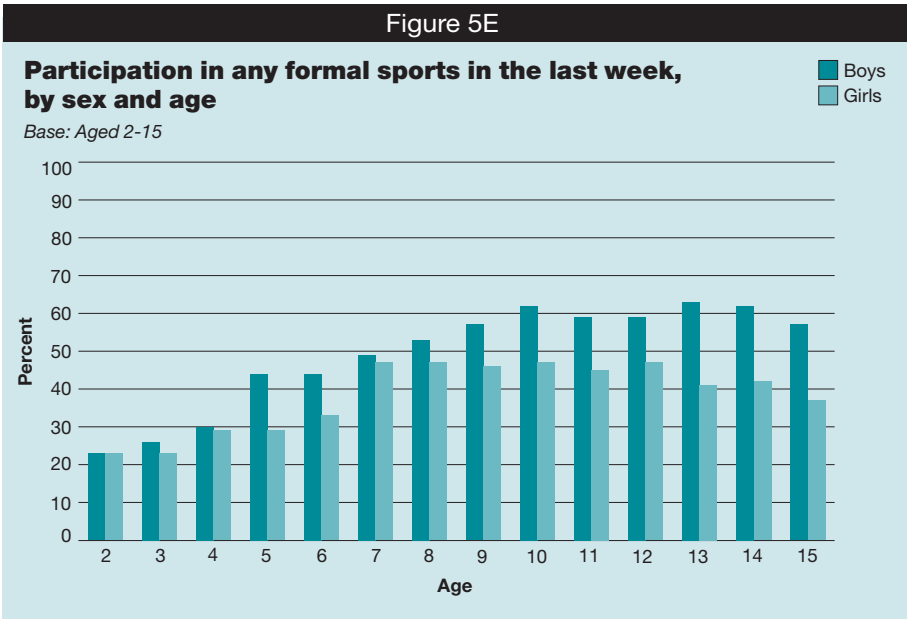
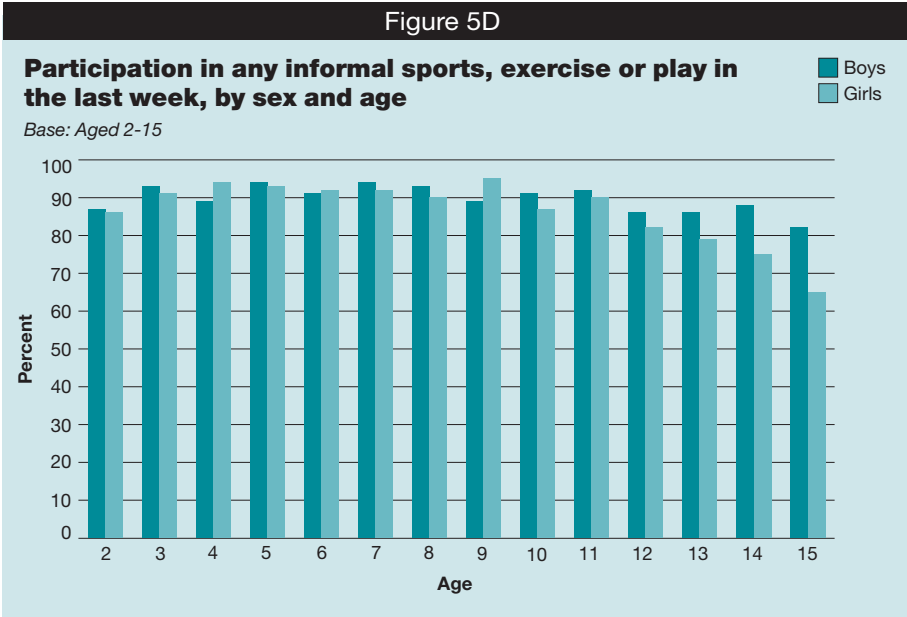
Patterns of children's participation in the different activities varied according to age. Children aged between 6 and 10 were slightly less likely than others to have done some walking in the last week, while the older children were the most likely to have done so.

Figures 5D and 5E show the proportion of boys and girls by age that participated in informal sports, exercise and play, and in formal sports in the last week. For informal sports, while there was relatively little difference across ages for boys, among girls, participation decreased among those of secondary school age. For formal sports, participation increased from a relatively low proportion of the youngest children, and there were different



patterns for older boys and girls. Among boys, participation in formal sports increased up to 62% at the age of 10, and then remained at a similar level among older boys. Among girls, participation was a little below 50% for those aged 7-12, but decreased for older girls.

Table 5.10, Figures 5D, 5E



Days and hours of participation

The number of days of participation in the last week was established for the different types of activities. Boys averaged more days of participation in informal sports (4.3 days) and formal sports (1.3 days) than girls (3.9 and 0.9 respectively). Younger and older children (aged 2-4 and 12-15) participated in walking on more days than those in the middle age groups.

On average, younger children took part in informal sports on more days than older children, with participation falling steadily with age. This fall was particularly marked among girls, with the average number of days decreasing by more than half from 4.7 days for those aged 2 to 2.2 for those aged 15. This pattern was also observed for boys but not to the same degree (4.9 for those aged 2 to 3.5 for those aged 15).

Conversely, older children participated in formal sports on more days than their younger counterparts. For boys, the mean number of days of participation in formal sports increased steadily with age, but for girls this steady increase was only noted for the younger age groups.

Table 5.11

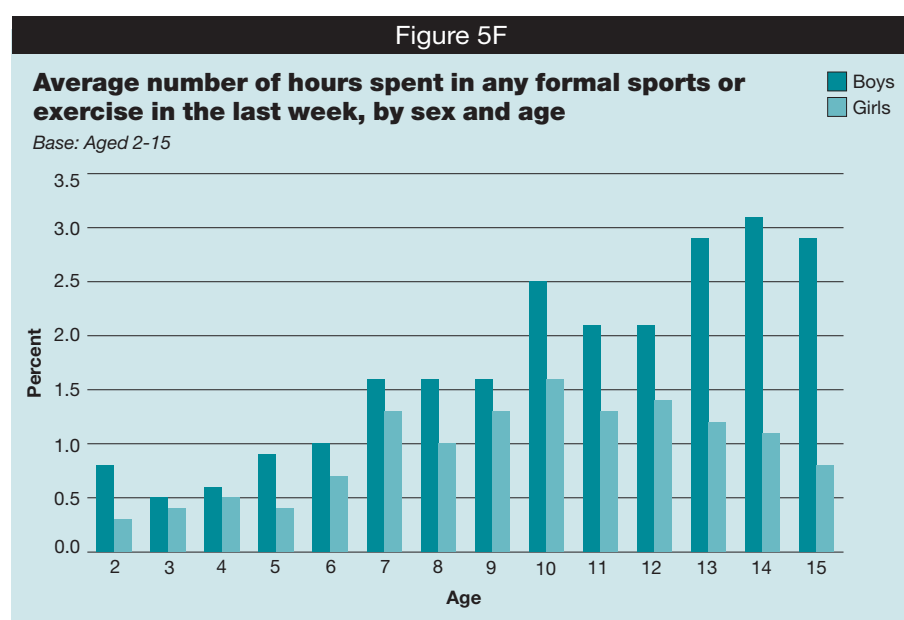
The amount of time children spent each day on each type of activity was aggregated to give a weekly total, within type of activity and overall. More boys than girls participated in at least seven hours of any type of physical activity (51% and 43% respectively). It should be noted that the proportions that did at least seven hours of activity in the last week were higher than the proportions that met the government recommendations (32% of boys and 24% of girls, see Table 5.1), since some may have done more than an hour on some days and less than an hour on others, while the recommendations require at least an hour of activity on each day.

Among boys, there was no consistent age pattern, but among girls, fewer in the older than younger age groups completed at least seven hours of physical activity (31% to 33% among girls aged 14-15, 51% to 52% among girls aged 2-3). Similarly the average total number of hours was greater for boys than for girls (10.0 and 8.7 respectively), with a clear decrease with age among girls. For most children, the largest contribution to their total physical activity came from informal sports and activities, but for girls aged 14-15, more of their activity was from walking than from informal sports.

For the different types of activity, there were again variations according to age. Older children (from around the age of 12) averaged more time spent walking in the last seven days than younger children. Boys, on average, spent more time participating in informal sports and activities than girls (7.6 and 6.4 hours respectively), and younger children averaged more time engaged in these than their older counterparts. Again, the relationship with age was more marked for girls than boys. Among girls, the mean number of hours for informal activity fell steadily from 7.5 hours for those aged 10 to 2.5 for those aged 15. Among boys, the decrease among the same ages was from 7.9 to 5.2 hours.

The average amount of time spent doing formal sports also varied by age and sex, as shown in Figure 5F. Overall, boys averaged more time engaged in formal sports than girls (1.8 and 1.0 hours respectively). The average amount of time boys participated in formal sports generally increased with age, but for girls, a different pattern was observed. There was a gradual increase until the middle age groups, and then the average time spent participating in formal sports began to decrease among older girls.

Table 5.12, Figure F



#### Participation by Strategic Health Authority and Spearhead status

There was no significant variation in the average amount of time children spent doing the different types of activity by Strategic Health Authority region or Spearhead status.

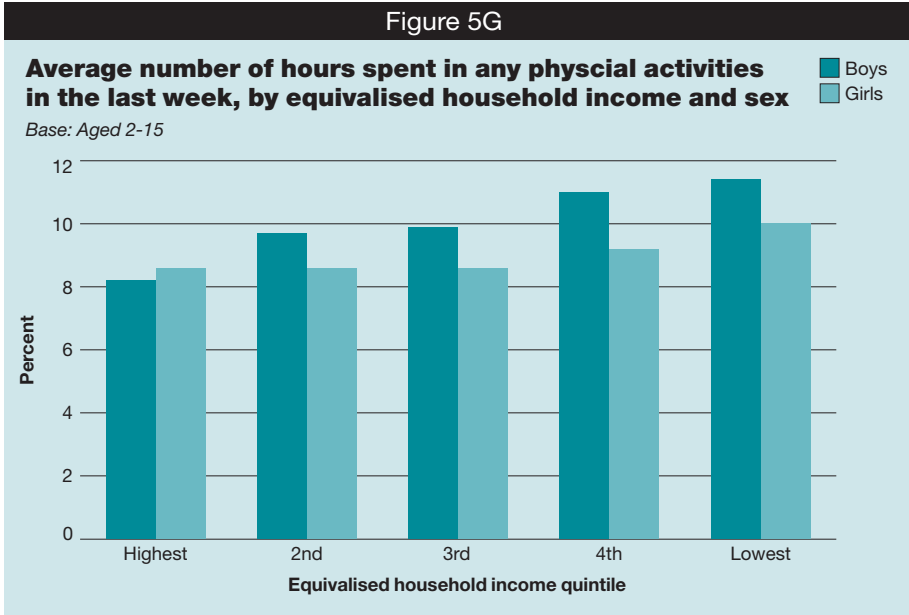
Table 5.13, 5.15

#### Participation by equivalised household income

The average amount of time children spent participating in physical activity varied by

equivalised household income, as shown in Figure 5G. For both boys and girls, there was a gradual rise in the average number of hours' participation in any type of physical activity as household income decreased; this increase was from 8.2 hours for boys and 8.6 hours for girls in the highest income quintile to 11.4 hours and 10.0 hours respectively in the lowest income quintile. There was a similar overall pattern for informal activities, although it differed in detail between the sexes. There was a gradual increase in the average number of hours boys participated in informal activities as household income quintile decreased (from 5.9 hours to 8.8 hours); however, among girls the average number of hours was similar in the highest three quintiles (6.2 to 6.4 hours) but increased in the lowest two quintiles (6.7 hours in the fourth quintile, 7.3 hours in the lowest).

Table 5.14, Figure 5G



### 5.4.3 Sedentary time

Sedentary behaviour has been classified into television viewing time on a typical weekday and weekend day and other sedentary time on a typical weekday and weekend day. These categories have also been combined to provide a total measure of sedentary time on a typical weekday and weekend day. Participants were asked about sedentary time after school, and therefore any sedentary time during the school day is not included.

#### Sedentary time by sex and age

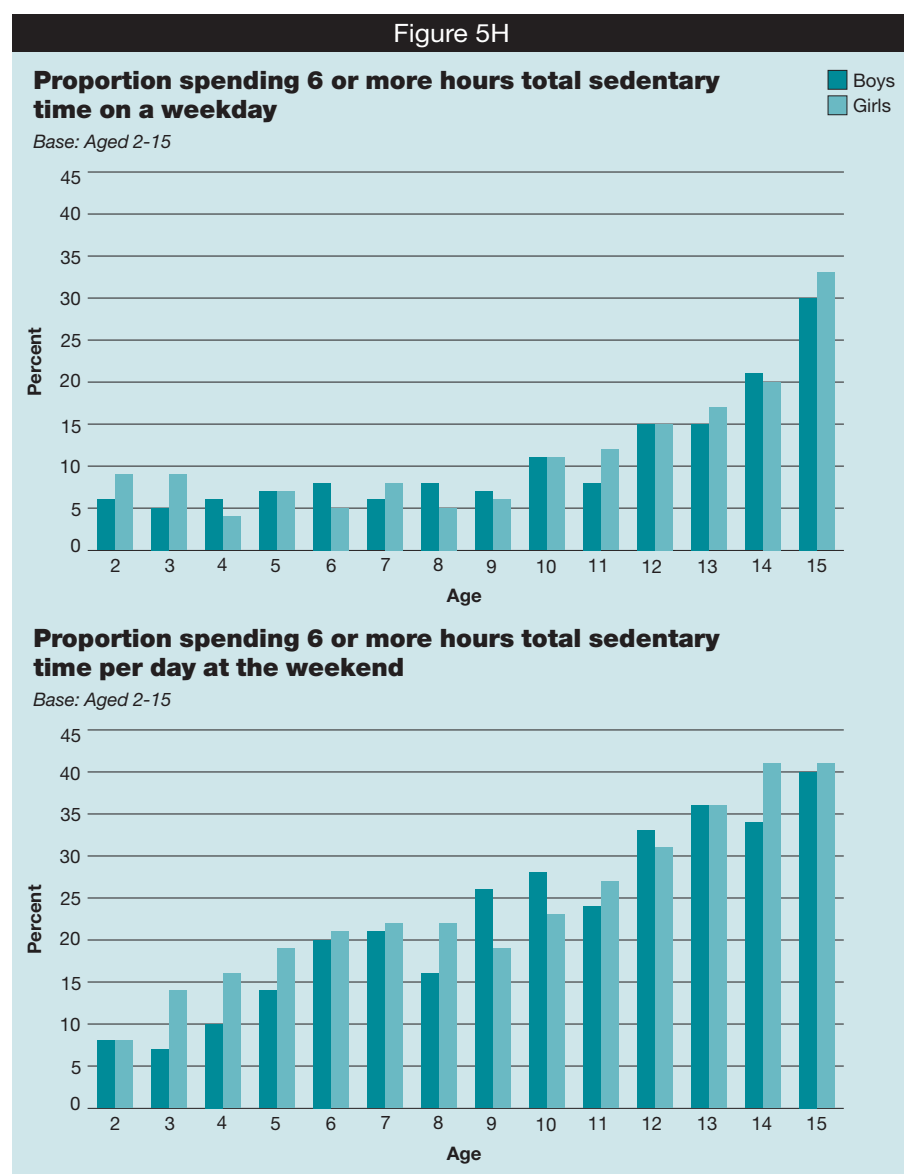
Average total sedentary time was very similar for boys and girls on weekdays (3.4 hours each) and weekend days (4.1 hours and 4.2 hours respectively). Average sedentary time generally increased with age, whether for TV viewing or other sedentary time, and whether for weekdays or weekend days. Furthermore, age was found to be related to the proportion of children who reported four or more hours of either TV viewing or other sedentary time on a typical day, or six or more hours of total sedentary time. Figure 5H shows the proportion of children who spent more than six hours of total sedentary time on weekdays and weekend days.

A different pattern was apparent for weekdays and weekend days. On weekdays, there was little variation among younger children, with fewer than 10% of those aged 2-9 sedentary for six or more hours, while the proportion rose steeply after that age. At weekends, the proportion who were sedentary for six or more hours generally increased across all ages, ranging from 8% of boys and girls aged 2 to 40% of boys and 41% of girls aged 15.

The pattern for TV viewing and for other sedentary time was similar to that for total sedentary time. On weekdays few of the younger children watched TV for four or more hours, or were otherwise sedentary for four or more hours, whereas the proportion of older children (from around the age of 12) increased rapidly. At the weekend, there was a more

general increase with age in the proportion spending four or more hours either watching TV or in other sedentary time; the increase among the older children was steepest for other sedentary time.

Table 5.16, Figure 5H



### Sedentary time by Strategic Health Authority

Comparison between Strategic Health Authority regions showed that the average time spent by children watching TV on weekdays varied by region, but no particular region stood out.

Table 5.17

### Sedentary time by equivalised household income

Household income was significantly associated with sedentary behaviour. For both boys and girls, as household income decreased, the average number of hours spent watching TV on weekdays and weekend days increased. On weekdays, in the highest income quintile boys averaged 1.4 hours and girls averaged 1.5 hours of TV viewing, while in the lowest quintile the average for both sexes was 2.0 hours. At weekends, the equivalent averages were 1.9 hours and 2.0 hours in the highest quintile, and 2.3 hours and 2.4 hours in the lowest.

Table 5.18

### Sedentary time by Spearhead status

Comparisons between Spearhead and non-Spearhead PCTs showed that, on a typical weekday, boys and girls living in Spearhead PCTs reported spending slightly more time

watching TV (1.8 hours and 1.9 hours respectively) than those living in non-Spearhead PCTs (1.7 hours for both sexes).

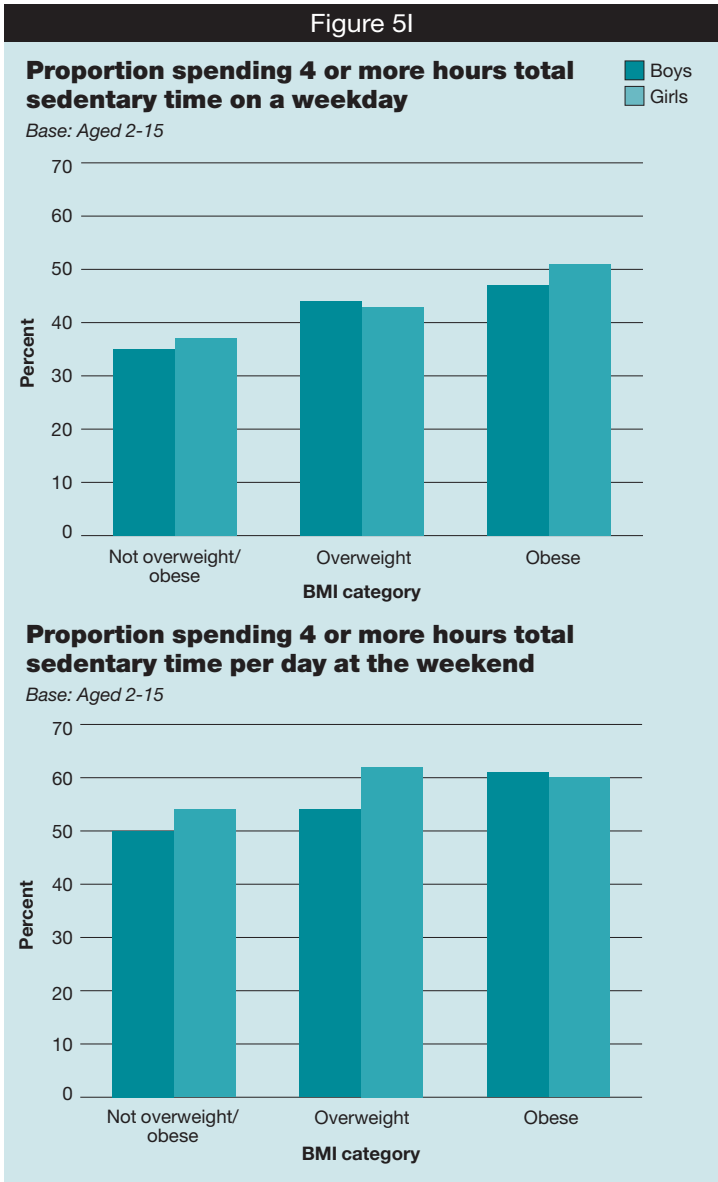
Table 5.19

Sedentary time by BMI category

Table 5.20 shows the proportion of children who were sedentary for more than four hours on a typical weekday or weekend day according to BMI categories.

Among both boys and girls there was a relationship between sedentary time and BMI category, as shown in Figure 5I. For boys, on weekdays, the proportion who spent 4 or more hours doing sedentary activities was 35% of those who were not overweight or obese, 44% of those classed as overweight and 47% of those classed as obese. For girls, a comparable pattern was found; 37%, 43% and 51% respectively. For boys, the relationship between weekend sedentary behaviour and BMI was very similar to that of weekday sedentary behaviour. For girls, similar proportions of those who were overweight and obese were sedentary for four or more hours on weekend days (62% and 60% respectively).

Table 5.20, Figure 5I



## 5.5 Discussion

### 5.5.1 Methodological issues

The substantially revised questionnaire used in 2008 means that it is not possible to present results from previous years with the aim of monitoring levels of physical activity over time. However, findings from this year's survey suggest that, in comparison with previous years, the new 2008 questionnaire presents significantly more modest estimates of the proportion of children who achieved the recommended levels of physical activity; 32% of boys and 24% of girls. Using the previous method the most recent HSE findings from 2007 suggested that 72% of boys and 63% of girls did at least one hour of physical activity every day of the week. The substantial decrease in these levels from 2007 to 2008 is a reflection of the questions asked and not of an actual decrease in the levels of physical activity among children.

Measuring children's levels of physical activity is known to be more difficult than measuring them in adults (which in itself is difficult, as outlined in Chapter 2). This is partly explained by the diverse and sporadic nature of children's physical activity, and the fact that it is less likely to involve clearly defined periods of specific activities, particularly among younger children.<sup>31,32</sup> In comparison, a significant proportion of adult physical activity typically occurs in sustained periods of activity (although the shorter, routine bouts of 'lifestyle' activities are similarly hard to capture).

In previous survey years, the information collected on child physical activity was based on the frequency a child performed a broad type of activity in the last seven days (e.g. walking, sports, other activities), and the duration of the activity. Questions established the average duration on each day that they did the activity, if more than one day, and duration was collected in half hour ranges rather than precise times. The lack of routine characteristic of much of children's physical activity suggests that it may have been difficult for participants accurately to 'fit' their activities to the questions asked; furthermore they were required to estimate average duration across several days, and there may have been some 'rounding up' into half hour categories. Coupled with recall difficulties outlined in section 5.2.2, these factors mean that previous information collected on child physical activity is likely to have overestimated the proportion of children who met government guidelines.

In 2008, for each specific activity participants mentioned, they were asked on which days they took part in it, and for each day of the week they were further asked the specific duration in hours and minutes. The more detailed structure of the questions assisted with respondent recall, as suggested by cognitive piloting of the questionnaire. This meant that information given was not referring to broad activity categories and was not an average, thus resulting in more refined estimates of child physical activity. This is supported by the observed decrease between 2007 and 2008 in the estimates of the proportion of children who achieve at least an hour of physical activity every day.

Despite the refinements to the questionnaire in 2008, limitations which exist for all self-report measures are still inherent. Namely, recall over a seven day period is a cognitively complex task, even when a participant is focused on specific activities, as was the case in 2008; inevitably participants may not always report accurate information. The influence of social desirability should also be noted when considering the results. There may be a tendency for some participants (especially parents reporting on behalf of children) to inflate levels of physical activity in the last week, by quoting what they believe the child should be doing rather than what is actually done. Conversely, some participants may under-report some types of physical activity as it is seen to be unfashionable by their peers, for example teenage girls may under-report their involvement in informal or formal activities.

Another key issue for HSE measures of self-reported physical activity for children is the underlying assumption about the intensity of activity. Since no definitive evidence is available about the intensity of children's activity, all reported activity is assumed to be of at least moderate intensity. If this is not the case, as seems likely, the HSE measures will over-estimate the amount of time spent in at least moderate activity, and thus the estimates of

the proportion of children meeting government recommendations. Objective measures will always provide a more reliable measure of actual physical activity both in terms of duration and intensity, as outlined in Chapters 3 and 6 (for adults and children respectively). Further research is needed to establish guidelines for intensity of different activities for children that could be used to refine analysis of self-report measures; such guidelines would need to be age sensitive.

### 5.5.2 Levels of activity and sedentary behaviours

Based on the self-reported data presented here, in 2008 around one in three boys and one in four girls achieved the guidelines for physical activity set out by the Chief Medical Officer. Given the impact that a lack of physical activity can have on health outcomes, not only in childhood but in later life, this would suggest that further work is necessary to improve these figures. With the implementation of various government initiatives in recent years, it will be important to evaluate the effectiveness of these by monitoring the proportion of children who reach the guidelines.

There is evidence to suggest that inactivity and sedentary behaviour are related to health outcomes independently from physical activity, for both adults and children.<sup>6,33</sup> Interestingly, children in lower income households were more likely than those in higher income households to reach the targets for physical activity; however, they also averaged more time in sedentary activities, particularly watching TV. It will be just as important to continue to monitor levels of sedentary behaviour as well as levels of physical activity to determine public health outcomes.

### 5.5.3 Influence of parental physical activity levels

Findings from the 2008 HSE indicate there was an association between children's and parents' physical activity levels (Table 5.6). However, as the HSE is a cross sectional study it is not possible to determine the direction of the association, i.e. whether parents influence children's activity or vice versa. Overall, nearly half of all children (49% of boys and 46% of girls) live in households where neither parent reaches the recommended levels of physical activity, although relatively few were in the low activity group.

Other research has shown that both mothers' own participation in physical activity and fathers' involvement and assistance with children's activities are important in sustaining physical activity levels, particularly in adolescent girls.<sup>34</sup> A recent study by the University of Bristol also suggests that active parents have active children.<sup>35</sup> A systematic review of published literature looking at the effectiveness of interventions to promote physical activity in children and adolescents found strong evidence that multi-component interventions involving the family or the community can increase physical activity in adolescents.<sup>36</sup> Analysis and modelling on the USA's National Longitudinal Study of Adolescent Health data suggested that family cohesion, parent-child communication and parental engagement positively predicted higher levels of physical activity amongst children. The sample used over 13,000 children from grades 7 to 12 (aged 12-18) to understand parent influences on achieving five or more bouts of at least moderate physical activity per week.<sup>37</sup>

While parents, carers and teachers need targeted, practical information about the importance of a healthy and active lifestyle for all children, there is a particular need for advice on how this can be achieved and easily incorporated into daily life. For example, the government launched its *Travelling to School* initiative in 2003, which aims to get schools in England developing safe bike routes by 2010.<sup>21</sup> Since adolescent girls are less likely than other children to reach the recommended activity levels, there is a need to make physical activity not only more accessible and affordable for families but also more widely accepted by teenage girls. Parents should be aware that their own levels of physical activity are likely to be mirrored in their children.



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| <p>5.1 Summary of children's activity levels (self-reported), by age and sex</p> <p>5.2 Summary of children's activity levels (self-reported), by Strategic Health Authority and sex</p> <p>5.3 Summary of children's activity levels (self-reported), by equivalised household income and sex</p> <p>5.4 Summary of children's activity levels (self-reported), by Spearhead status and sex</p> <p>5.5 Summary of children's activity levels (self-reported), by BMI category, age and sex</p> <p>5.6 Summary of children's activity levels (self-reported), by parents' summary activity levels (self-reported), age and sex</p> <p>5.7 Summary of children's participation in active travel to/from school (self-reported), by age and sex</p> <p>5.8 Number of days walking or cycling to/from school in the last week (self-reported), by age and sex</p> <p>5.9 Time spent walking or cycling to/from school in the last week (self-reported), by age and sex</p> <p>5.10 Summary of children's participation in different activities in the last week (self-reported), by age and sex</p> <p>5.11 Number of days' participation by children in different activities in the last week (self-reported), by age and sex</p> <p>5.12 Time spent by children participating in different activities in the last week (self-reported), by age and sex</p> <p>5.13 Time spent by children participating in different activities in the last week (self-reported), by Strategic Health Authority and sex</p> <p>5.14 Time spent by children participating in different activities in the last week (self-reported), by equivalised household income and sex</p> <p>5.15 Time spent by children participating in different activities in the last week (self-reported), by Spearhead status and sex</p> | <p>5.16 Sedentary time spent by children in the last week (self-reported), by age and sex</p> <p>5.17 Sedentary time spent by children in the last week (self-reported), by Strategic Health Authority and sex</p> <p>5.18 Sedentary time spent by children in the last week (self-reported), by equivalised household income and sex</p> <p>5.19 Sedentary time spent by children in the last week (self-reported), by Spearhead status and sex</p> <p>5.20 Summary of children's total sedentary time in the last week (self-reported), by BMI category, age and sex</p> |
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Table 5.1

**Summary of children's activity levels (self-reported), by age and sex**

Aged 2-15

2008

Self-reported summary activity level <sup>a</sup>	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Boys															
Meets recommendations	43	36	28	32	34	36	32	33	31	29	29	27	32	32	32
Some activity	30	39	41	43	41	47	45	46	49	50	46	52	43	42	44
Low activity	27	25	30	25	25	18	23	22	20	21	25	21	24	26	24
Girls															
Meets recommendations	35	33	28	31	28	28	23	25	27	16	19	20	12	15	24
Some activity	38	42	49	43	44	50	55	49	44	55	50	46	47	40	47
Low activity	27	24	23	26	27	22	23	26	29	29	31	34	41	45	29
Bases (unweighted)															
Boys	253	240	247	239	249	235	236	243	255	254	260	286	267	229	3493
Girls	246	268	229	225	236	254	231	248	296	291	240	259	278	244	3545
Bases (weighted)															
Boys	250	227	226	223	230	215	235	235	247	236	237	258	275	239	3332
Girls	224	230	218	211	202	225	220	225	236	226	223	245	257	226	3168

<sup>a</sup> Meets recommendations: 60 minutes or more on all 7 days  
 Some activity: 30-59 minutes on all 7 days  
 Low activity: lower level of activity.

Table 5.2

**Summary of children's activity levels (self-reported), by Strategic Health Authority<sup>a</sup> and sex**

Age 2-15

2008

Self-reported summary activity level <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>										
Meets recommendations	32	36	38	29	32	32	33	28	34	28
Some activity	40	40	42	49	41	42	44	48	47	49
Low activity	28	25	21	22	27	26	23	23	19	22
<b>Girls</b>										
Meets recommendations	27	22	24	23	22	28	24	23	30	21
Some activity	42	46	51	47	47	44	44	48	47	50
Low activity	31	32	25	29	31	27	32	29	24	29
<b>Bases (unweighted)</b>										
Boys	171	524	348	296	354	413	458	318	261	350
Girls	180	533	390	290	339	412	465	289	312	335
<b>Bases (weighted)</b>										
Boys	154	433	323	290	377	378	503	290	250	333
Girls	159	435	336	259	332	359	471	244	273	300

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Meets recommendations: 60 minutes or more on all 7 days  
 Some activity: 30-59 minutes on all 7 days  
 Low activity: lower level of activity.

Table 5.3

**Summary of children's activity levels (self-reported), by equivalised household income and sex**

Aged 2-15 2008

Self-reported summary activity level <sup>a</sup>	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
	%	%	%	%	%
<b>Boys</b>					
Meets recommendations	25	33	32	36	36
Some activity	53	50	45	39	40
Low activity	22	18	24	25	25
<b>Girls</b>					
Meets recommendations	22	24	21	25	30
Some activity	55	49	49	45	39
Low activity	23	26	30	29	31
<i>Bases (unweighted)</i>					
Boys	418	560	691	639	644
Girls	454	607	608	669	660
<i>Bases (weighted)</i>					
Boys	385	521	655	625	623
Girls	392	520	542	601	614

<sup>a</sup> Meets recommendations: 60 minutes or more on all 7 days  
Some activity: 30-59 minutes on all 7 days  
Low activity: lower level of activity.

Table 5.4

**Summary of children's activity levels (self-reported), by Spearhead status<sup>a</sup> and sex**

Aged 2-15 2008

Self-reported summary activity level <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
	%	%
<b>Boys</b>		
Meets recommendations	31	34
Some activity	46	40
Low activity	23	25
<b>Girls</b>		
Meets recommendations	25	23
Some activity	47	46
Low activity	28	31
<i>Bases (unweighted)</i>		
Boys	2188	1286
Girls	2209	1319
<i>Bases (weighted)</i>		
Boys	2099	1215
Girls	1962	1192

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Meets recommendations: 60 minutes or more on all 7 days  
Some activity: 30-59 minutes on all 7 days  
Low activity: lower level of activity.

Table 5.5

**Summary of children's activity levels (self-reported), by BMI category, age and sex**

Aged 2-15

2008

Self-reported summary activity level <sup>a</sup> within BMI category <sup>b</sup>	Age group		Total
	2-10	11-15	
	%	%	%
<b>Boys</b>			
<b>Not overweight or obese</b>			
Meets recommendations	35	30	33
Some activity	42	47	44
Low activity	23	23	23
<b>Overweight</b>			
Meets recommendations	31	30	30
Some activity	45	48	46
Low activity	25	23	24
<b>Obese</b>			
Meets recommendations	33	29	31
Some activity	40	44	42
Low activity	28	27	27
<b>Girls</b>			
<b>Not overweight or obese</b>			
Meets recommendations	30	16	25
Some activity	46	49	47
Low activity	24	35	28
<b>Overweight</b>			
Meets recommendations	25	16	21
Some activity	48	47	47
Low activity	27	36	31
<b>Obese</b>			
Meets recommendations	27	18	23
Some activity	44	42	43
Low activity	29	40	34
<i>Bases (unweighted)</i>			
<i>Boys</i>			
Not overweight or obese	1662	867	2529
Overweight	259	188	447
Obese	276	241	517
<i>Girls</i>			
Not overweight or obese	1730	916	2646
Overweight	251	184	435
Obese	252	212	464
<i>Bases (weighted)</i>			
<i>Boys</i>			
Not overweight or obese	1591	838	2430
Overweight	242	175	418
Obese	254	231	484
<i>Girls</i>			
Not overweight or obese	1548	824	2372
Overweight	220	163	383
Obese	223	190	413

<sup>a</sup> Meets recommendations: 60 minutes or more on all 7 days  
 Some activity: 30-59 minutes on all 7 days  
 Low activity: lower level of activity.

<sup>b</sup> Overweight was defined as ≥85th<95th UK National BMI percentile; obese was defined as ≥95th UK National BMI percentile.

Table 5.6

**Summary of children's activity levels (self-reported), by parents' summary activity levels (self-reported), age and sex**

Aged 2-15

2008

Self-reported summary activity level <sup>a</sup> within age group	Father's activity level <sup>b</sup>			Mother's activity level <sup>b</sup>		
	Meets recommend- ations	Some activity	Low activity	Meets recommend- ations.	Some activity	Low activity
	%	%	%	%	%	%
<b>Boys</b>						
<b>2-10</b>						
Meets recommendations	36	39	26	41	34	29
Some activity	44	37	44	41	39	39
Low activity	20	24	30	18	27	32
<b>Boys 11-15</b>						
Meets recommendations	32	21	[22]	33	27	31
Some activity	52	59	[41]	48	51	40
Low activity	16	20	[37]	18	22	30
<b>Girls</b>						
<b>2-10</b>						
Meets recommendations	30	30	32	31	27	25
Some activity	45	44	34	46	45	39
Low activity	25	26	34	23	28	36
<b>11-15</b>						
Meets recommendations	16	13	[13]	15	16	10
Some activity	49	49	[35]	51	48	43
Low activity	35	39	[52]	34	36	47
<i>Bases (unweighted)</i>						
Boys aged 2-10	254	229	77	363	433	139
Boys aged 11-15	138	131	46	180	249	58
Girls aged 2-10	293	221	64	349	458	124
Girls aged 11-15	152	119	46	208	245	79
<i>Bases (weighted)</i>						
Boys aged 2-10	255	232	82	362	437	139
Boys aged 11-15	132	125	46	172	245	56
Girls aged 2-10	260	217	65	326	436	119
Girls aged 11-15	134	110	43	188	220	73

<sup>a</sup> Children's levels of activity (assuming all activity is of at least moderate intensity):

Meets recommendations: 60 minutes or more on all seven days per week

Some activity: 30-59 minutes on all seven days

Low activity: lower level of activity.

<sup>b</sup> Adults' levels of physical activity:

Meets recommendations: 30 minutes or more of moderate or vigorous activity on at least 20 occasions in the last four weeks (equivalent to at least five days per week)

Some activity: 30 minutes or more of moderate or vigorous activity on four to 19 occasions (one to four days per week)

Low activity: 30 minutes or more of moderate or vigorous activity on fewer than four occasions in the last four weeks

[ ] Results in brackets should be treated with caution because of the low base size (below 50).



Table 5.7

**Summary of children's participation in active travel to/from school (self-reported), by age and sex**

Children aged 2-15 who attended school on at least one day in the last week

2008

Participation in active travel on at least one day in the last week	Age group			Total
	2-4	5-10	11-15	
	%	%	%	%
<b>Boys</b>				
Walking to/from school	52	66	65	63
Cycling to/from school	3	4	8	5
<b>Girls</b>				
Walking to/from school	56	65	70	65
Cycling to/from school	1	2	2	2
<b>Bases (unweighted)<sup>a</sup></b>				
Boys	536	1243	1068	2847
Girls	526	1245	1078	2849
<b>Bases (weighted)<sup>a</sup></b>				
Boys	503	1178	1026	2707
Girls	474	1104	971	2549

<sup>a</sup> Bases given are for 'Walking to/from school'. Bases for 'Cycling to/from school' are of a very similar size.

Table 5.8

**Number of days walking or cycling to/from school in the last week (self-reported), by age and sex**

Children aged 2-15 who attended school on at least one day in the last week

2008

Days spent in last week	Age group			Total
	2-4	5-10	11-15	
	%	%	%	%
<b>Boys</b>				
<b>Walking to/from school<sup>a</sup></b>				
None	48	34	35	37
1 day	8	4	3	4
2 days	10	6	4	6
3-4 days	17	14	15	15
5-6 days	18	43	44	38
Mean number of days <sup>b</sup>	1.7	2.8	2.8	2.6
Standard error of the mean	0.09	0.07	0.08	0.05
<b>Cycling to/from school<sup>a</sup></b>				
None	97	96	93	95
1 day	1	1	0	1
2 days	1	0	1	1
3-4 days	0	1	2	1
5-6 days	0	2	3	2
Mean number of days <sup>b</sup>	0.1	0.1	0.3	0.2
Standard error of the mean	0.02	0.02	0.04	0.02
<b>Girls</b>				
<b>Walking to/from school<sup>a</sup></b>				
None	44	36	31	35
1 day	9	4	5	5
2 days	8	6	5	6
3-4 days	15	13	14	14
5-6 days	24	42	45	40
Mean number of days <sup>b</sup>	2.0	2.7	2.9	2.6
Standard error of the mean	0.09	0.07	0.07	0.05
<b>Cycling to/from school<sup>a</sup></b>				
None	99	99	99	99
1 day	0	0	0	0
2 days	0	0	0	0
3-4 days	-	0	1	0
5-6 days	0	1	0	1
Mean number of days <sup>b</sup>	0.0	0.1	0.0	0.0
Standard error of the mean	0.01	0.01	0.01	0.01
<b>Bases (unweighted)<sup>c</sup></b>				
Boys	536	1243	1068	2847
Girls	526	1244	1078	2848
<b>Bases (weighted)<sup>c</sup></b>				
Boys	503	1178	1026	2707
Girls	474	1103	971	2548

<sup>a</sup> Totals on at least one day in the last week may differ from those in Table 5.7; some who reported participation in walking or cycling to or from school did not provide frequency/ duration information, and are included in 'None' in this table.

<sup>b</sup> Means are based on all participants who attended school in the last week.

<sup>c</sup> Bases given are for 'Walking to/from school'. Bases for 'Cycling to/from school' are of a very similar size.

Table 5.9

### Time spent walking or cycling to/from school in the last week (self-reported), by age and sex

Children aged 2-15 who attended school on at least one day in the last week

2008

Days spent in last week	Age group			Total
	2-4	5-10	11-15	
	%	%	%	%
<b>Boys</b>				
<b>Walking to/from school<sup>a</sup></b>				
None	49	34	36	38
Any time	51	66	64	62
Less than one hour	26	28	18	24
1 hour to less than 2	16	22	18	20
2 hours to less than 3	6	11	14	11
3 hours or more	4	5	14	8
Mean number of hours <sup>b</sup>	0.6	0.9	1.3	1.0
Standard error of the mean	0.04	0.03	0.05	0.03
<b>Cycling to/from school<sup>a</sup></b>				
None	97	96	93	95
Any time	3	4	7	5
Less than one hour	1	2	2	2
1 hour to less than 2	1	1	2	2
2 hours to less than 3	0	0	1	1
3 hours or more	-	0	1	0
Mean number of hours <sup>b</sup>	0.0	0.0	0.1	0.1
Standard error of the mean	0.01	0.01	0.03	0.01
<b>Girls</b>				
<b>Walking to/from school<sup>a</sup></b>				
None	45	36	31	36
Any time	55	64	69	64
Less than one hour	23	28	19	24
1 hour to less than 2	18	20	24	21
2 hours to less than 3	10	10	12	11
3 hours or more	5	5	13	8
Mean number of hours <sup>b</sup>	0.8	0.9	1.3	1.0
Standard error of the mean	0.05	0.04	0.05	0.03
<b>Cycling to/from school<sup>a</sup></b>				
None	99	99	99	99
Any time	1	1	1	1
Less than one hour	0	1	1	1
1 hour to less than 2	0	0	0	0
2 hours to less than 3	0	0	0	0
3 hours or more	-	0	0	0
Mean number of hours <sup>b</sup>	0.0	0.0	0.0	0.0
Standard error of the mean	0.01	0.00	0.01	0.00
<b>Bases (unweighted)<sup>c</sup></b>				
Boys	534	1229	1052	2815
Girls	519	1231	1055	2805
<b>Bases (weighted)<sup>c</sup></b>				
Boys	501	1166	1010	2677
Girls	468	1092	950	2510

<sup>a</sup> Totals on at least one day in the last week may differ from those in Table 5.7, as those who reported participation in walking or cycling to or from school but did not provide frequency/ duration information are included in 'None' in this table.

<sup>b</sup> Means are based on all participants who attended school in the last week.

<sup>c</sup> Bases given are for 'Walking to/from school'. Bases for 'Cycling to/from school' are of a very similar size.

Table 5.10

### Summary of children's participation in different activities in the last week (self-reported), by age and sex

Aged 2-15

2008

Participation in each activity type on at least one day in the last week	Age															Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	%	
<b>Boys</b>	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Walking <sup>a</sup>	65	61	64	57	56	57	58	54	58	64	62	59	68	75		61
Informal sports/ exercise/ active play <sup>b</sup>	87	93	89	94	91	94	93	89	91	92	86	86	88	82		90
Formal sports/ activities <sup>c</sup>	23	26	30	44	44	49	53	57	62	59	59	63	62	57		49
All physical activities	91	96	93	96	95	97	95	94	97	97	96	97	96	96		95
<b>Girls</b>																
Walking <sup>a</sup>	66	63	64	64	56	62	62	62	64	62	67	72	73	77		65
Informal sports/ exercise/ active play <sup>b</sup>	86	91	94	93	92	92	90	95	87	90	82	79	75	65		86
Formal sports/ activities <sup>c</sup>	23	23	29	29	33	47	47	46	47	45	47	41	42	37		38
All physical activities	91	94	98	96	97	97	97	98	96	95	95	96	92	92		95
<i>Bases (unweighted)<sup>d</sup></i>																
Boys	254	240	248	239	252	235	236	244	255	256	260	286	267	230		3502
Girls	247	268	229	225	237	254	234	250	296	291	240	259	279	245		3554
<i>Bases (weighted)<sup>d</sup></i>																
Boys	251	227	227	223	232	215	235	235	247	239	237	258	275	241		3341
Girls	226	230	218	211	203	225	223	226	236	226	223	245	258	227		3177

<sup>a</sup> Walking does not include walking to or from school, which is reported separately in Tables 5.7-5.9.

<sup>b</sup> Informal sports/ exercise/ active play include: cycling, hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc. Cycling does not include cycling to or from school, which is reported separately in Tables 5.7-5.9.

<sup>c</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.

<sup>d</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Table 5.11

**Number of days' participation by children in different activities in the last week (self-reported), by age and sex**

Aged 2-15

2008

Number of days in the last week	Age															Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
Boys																
Walking <sup>a,b</sup>																
None	35	39	36	43	44	43	42	46	42	36	38	41	32	25	39	
1 day	8	10	15	18	12	13	14	14	13	18	13	10	9	14	13	
2 days	9	8	15	11	9	13	15	12	13	12	12	12	10	8	11	
3-4 days	13	13	12	8	12	8	6	6	10	9	7	11	10	9	10	
5 or more days	34	30	22	20	23	22	22	21	22	25	30	27	39	45	27	
Mean number of days <sup>c</sup>	2.9	2.5	2.3	1.9	2.1	2.0	2.0	1.9	2.1	2.3	2.4	2.4	3.0	3.4	2.4	
Standard error of the mean	0.18	0.17	0.17	0.16	0.16	0.17	0.16	0.17	0.15	0.16	0.17	0.16	0.17	0.20	0.05	
Informal sports/ exercise/active play <sup>b,d</sup>																
None	13	7	11	6	9	6	7	11	9	8	14	14	12	18	10	
1 day	4	4	8	9	8	6	7	7	6	9	10	9	13	13	8	
2 days	8	10	10	12	9	11	11	12	14	13	14	13	10	12	11	
3-4 days	8	13	15	11	14	18	20	15	16	17	18	16	16	18	15	
5 or more days	67	65	56	62	60	59	54	55	55	52	44	48	48	39	54	
Mean number of days <sup>c</sup>	4.9	4.9	4.4	4.6	4.6	4.7	4.5	4.4	4.4	4.3	3.8	3.9	3.9	3.5	4.3	
Standard error of the mean	0.17	0.15	0.19	0.16	0.17	0.16	0.16	0.18	0.17	0.16	0.16	0.16	0.16	0.18	0.06	
Formal sports/activities <sup>b,e</sup>																
None	74	72	67	54	54	47	43	39	34	38	36	36	34	39	47	
1 day	15	20	18	27	21	20	23	27	23	21	23	16	16	19	21	
2 days	5	3	9	10	13	16	18	15	14	15	16	18	18	13	13	
3-4 days	1	3	2	7	9	11	11	14	18	19	15	17	16	13	11	
5 or more days	5	2	3	2	3	7	5	5	11	6	10	13	16	16	8	
Mean number of days <sup>c</sup>	0.6	0.5	0.6	0.8	0.9	1.3	1.2	1.3	1.8	1.5	1.6	1.8	2.0	1.9	1.3	
Standard error of the mean	0.09	0.07	0.07	0.08	0.09	0.11	0.10	0.11	0.13	0.11	0.12	0.12	0.14	0.14	0.03	
Bases (unweighted) <sup>f</sup>																
Boys	254	240	248	239	252	235	236	244	255	256	260	286	267	230	3502	
Bases (weighted) <sup>f</sup>																
Boys	251	227	227	223	232	215	235	235	247	239	237	258	275	241	3341	

<sup>a</sup> Walking does not include walking to or from school.<sup>b</sup> Totals on at least one day in the last week may differ from those in Table 5.10, as those who reported participation in walking/ sport/ activities but did not provide frequency/ duration information are included in 'None' in this table.<sup>c</sup> Means are based on all participants.<sup>d</sup> Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.<sup>e</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.<sup>f</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Continued...

Table 5.11 continued

Aged 2-15

2008

Number of days in the last week	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Girls															
Walking <sup>a,b</sup>															
None	34	37	36	36	44	38	38	38	36	38	33	28	27	23	35
1 day	11	10	14	20	15	17	20	17	17	10	11	17	16	17	15
2 days	11	9	13	12	12	11	14	10	13	15	14	14	16	11	12
3-4 days	9	14	12	9	8	9	9	11	9	12	10	12	11	14	11
5 or more days	36	29	26	24	20	26	21	24	24	25	32	29	30	35	27
Mean number of days <sup>c</sup>	2.8	2.5	2.3	2.2	1.8	2.2	2.0	2.2	2.2	2.2	2.6	2.7	2.7	3.0	2.4
Standard error of the mean	0.18	0.16	0.16	0.17	0.15	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.15	0.17	0.05
Informal sports/ exercise/active play <sup>b,d</sup>															
None	14	9	6	7	8	8	10	5	13	10	18	21	25	35	14
1 day	4	5	7	7	11	9	5	11	8	13	14	16	24	19	11
2 days	8	6	9	11	8	10	11	13	11	16	8	14	15	11	11
3-4 days	11	17	15	11	18	15	21	18	15	23	22	16	13	15	16
5 or more days	63	63	63	65	55	58	53	52	53	39	39	32	23	20	48
Mean number of days <sup>c</sup>	4.7	4.8	4.8	4.8	4.4	4.4	4.3	4.3	4.2	3.6	3.4	3.0	2.4	2.2	3.9
Standard error of the mean	0.18	0.14	0.17	0.15	0.17	0.16	0.17	0.16	0.16	0.15	0.17	0.16	0.14	0.17	0.06
Formal sports/activities <sup>b,e</sup>															
None	76	74	69	68	65	49	49	49	50	51	48	56	54	59	58
1 day	18	15	21	20	23	26	27	26	19	20	21	14	19	17	20
2 days	3	6	6	6	7	13	12	11	14	15	11	13	12	10	10
3-4 days	1	2	1	3	2	8	9	9	10	9	11	10	9	7	7
5 or more days	2	2	3	2	3	4	3	5	7	5	9	7	5	7	5
Mean number of days <sup>c</sup>	0.4	0.5	0.5	0.6	0.6	1.0	1.0	1.0	1.3	1.1	1.3	1.1	1.0	1.0	0.9
Standard error of the mean	0.07	0.07	0.09	0.08	0.09	0.09	0.09	0.10	0.11	0.09	0.13	0.11	0.10	0.12	0.03
Bases (unweighted) <sup>f</sup>															
Girls	247	268	229	225	237	254	234	250	296	291	240	259	279	245	3554
Bases (weighted) <sup>f</sup>															
Girls	226	230	218	211	203	225	223	226	236	226	223	245	258	227	3177

<sup>a</sup> Walking does not include walking to or from school.

<sup>b</sup> Totals on at least one day in the last week may differ from those in Table 5.10, as those who reported participation in walking/ sport/ activities but did not provide frequency/ duration information are included in 'None' in this table.

<sup>c</sup> Means are based on all participants.

<sup>d</sup> Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.

<sup>e</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.

<sup>f</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Table 5.12

# Time spent by children participating in different activities in the last week (self-reported), by age and sex

Aged 2-15

2008

Time spent in the last week	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Boys	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Walking <sup>a</sup>															
No time	35	39	36	43	44	43	42	46	42	36	38	41	32	25	39
Any time	65	61	64	57	56	57	58	54	58	64	62	59	68	75	61
Less than one hour	12	10	14	12	10	12	14	10	14	17	12	6	7	10	11
1 to less than 3 hours	27	23	26	28	23	29	22	22	22	18	19	22	22	18	23
3 to less than 5 hours	8	11	13	7	9	6	10	10	11	12	15	9	13	12	10
5 to less than 7 hours	6	6	6	2	8	5	4	6	4	9	4	7	8	12	6
7 hours or more	11	10	6	7	6	6	7	6	6	8	12	15	18	23	10
Mean number of hours <sup>b</sup>	2.4	2.3	2.1	1.6	1.8	1.8	1.9	1.8	1.9	2.1	2.6	3.0	3.9	4.6	2.4
Standard error of the mean	0.23	0.23	0.24	0.19	0.18	0.20	0.23	0.22	0.22	0.18	0.25	0.30	0.39	0.39	0.09
Informal sports/ exercise/active play <sup>c</sup>															
No time	13	7	11	6	9	6	7	11	9	8	14	14	12	18	10
Any time	87	93	89	94	91	94	93	89	91	92	86	86	88	82	90
Less than one hour	6	7	4	7	6	4	4	5	4	7	10	8	8	13	7
1 to less than 3 hours	13	19	17	20	18	19	18	21	22	18	18	19	20	17	18
3 to less than 5 hours	8	11	16	13	11	15	15	8	15	16	14	12	12	16	13
5 to less than 7 hours	10	16	12	11	9	11	18	12	9	9	10	7	10	10	11
7 hours or more	49	40	40	42	48	46	37	43	41	42	35	41	38	26	40
Mean number of hours <sup>b</sup>	10.5	9.0	8.3	7.6	8.1	7.6	7.2	8.0	7.9	7.2	6.3	6.6	6.8	5.2	7.6
Standard error of the mean	0.77	0.69	0.63	0.54	0.53	0.47	0.49	0.57	0.58	0.49	0.46	0.40	0.43	0.52	0.18
Formal sports/activities <sup>d</sup>															
No time	77	74	70	56	56	51	47	43	38	41	41	37	38	43	51
Any time	23	26	30	44	44	49	53	57	62	59	59	63	62	57	49
Less than one hour	6	7	8	9	7	4	4	5	7	4	3	6	4	7	6
1 to less than 3 hours	13	16	17	27	27	27	29	31	28	27	26	22	23	20	24
3 to less than 5 hours	2	2	2	4	6	11	12	12	14	16	14	14	15	11	10
5 to less than 7 hours	-	-	2	2	2	4	3	4	5	6	8	9	8	8	4
7 hours or more	2	1	1	2	2	4	5	5	8	6	6	12	12	11	6
Mean number of hours <sup>b</sup>	0.8	0.5	0.6	0.9	1.0	1.6	1.6	1.6	2.5	2.1	2.1	2.9	3.1	2.9	1.8
Standard error of the mean	0.21	0.12	0.08	0.12	0.12	0.20	0.17	0.15	0.39	0.21	0.18	0.25	0.34	0.34	0.07
Any physical activity <sup>e</sup>															
No time	9	4	7	4	5	3	5	6	3	3	4	3	4	4	5
Any time	91	96	93	96	95	97	95	94	97	97	96	97	96	96	95
Less than one hour	4	6	6	5	4	4	2	6	5	7	9	9	7	11	6
1 to less than 3 hours	13	13	13	14	16	12	12	14	18	12	15	14	16	11	14
3 to less than 5 hours	7	13	11	16	10	16	16	11	14	14	15	13	12	13	13
5 to less than 7 hours	9	12	12	13	10	12	17	12	12	9	11	8	10	11	11
7 hours or more	58	52	51	48	54	52	48	52	48	54	46	53	52	51	51
Mean number of hours <sup>b</sup>	12.9	11.3	10.4	9.1	9.9	9.3	9.2	9.7	9.8	9.3	8.9	9.6	10.7	9.9	10.0
Standard error of the mean	0.84	0.80	0.74	0.58	0.61	0.51	0.59	0.65	0.70	0.56	0.56	0.55	0.65	0.75	0.22
Bases (unweighted) <sup>f</sup>															
Boys	254	240	248	239	252	235	236	244	255	256	260	286	267	230	3502
Bases (weighted) <sup>f</sup>															
Boys	251	227	227	223	232	215	235	235	247	239	237	258	275	241	3341

a Does not include walking to or from school.

b Means are based on all participants.

c Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.

d Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.

e Does not include walking/ cycling to or from school

f Bases given are for Walking. All other bases vary but are of a similar size.

Continued...

Table 5.12

Table 5.12 continued

Aged 2-15

2008

Time spent in the last week	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Girls	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Walking <sup>a</sup>															
No time	34	37	36	36	44	38	38	38	36	38	33	28	27	23	35
Any time	66	63	64	64	56	62	62	62	64	62	67	72	73	77	65
Less than one hour	14	11	15	17	13	12	15	16	15	11	9	10	11	11	13
1 to less than 3 hours	24	24	28	28	22	28	28	22	22	25	22	26	22	24	25
3 to less than 5 hours	15	11	11	7	13	10	9	12	13	14	11	13	16	12	12
5 to less than 7 hours	6	7	4	4	4	3	8	4	6	6	8	10	11	10	7
7 hours or more	8	9	6	7	4	8	3	8	8	5	17	13	14	21	9
Mean number of hours <sup>b</sup>	2.3	2.3	1.8	1.9	1.5	1.9	1.7	2.0	2.1	1.9	3.4	3.0	3.2	3.9	2.4
Standard error of the mean	0.22	0.21	0.19	0.20	0.16	0.19	0.15	0.18	0.19	0.16	0.30	0.28	0.23	0.31	0.07
Informal sports/ exercise/active play <sup>c</sup>															
No time	14	9	6	7	8	8	10	5	13	10	18	21	25	35	14
Any time	87	92	91	93	91	93	92	92	89	91	84	83	82	74	88
Less than one hour	7	6	5	6	6	5	3	6	4	10	10	10	13	14	8
1 to less than 3 hours	15	19	18	18	20	19	20	22	22	20	20	22	22	18	20
3 to less than 5 hours	9	12	17	14	12	15	16	12	14	17	16	12	12	14	14
5 to less than 7 hours	10	13	13	12	9	11	14	11	10	11	10	8	10	8	11
7 hours or more	46	40	37	42	44	43	38	40	40	33	28	31	25	19	36
Mean number of hours <sup>b</sup>	9.9	9.2	7.3	7.9	8.2	7.5	7.0	7.1	7.5	5.2	4.5	3.8	2.7	2.5	6.4
Standard error of the mean	0.81	0.69	0.57	0.51	0.70	0.55	0.52	0.48	0.57	0.41	0.38	0.37	0.23	0.31	0.18
Formal sports/activities <sup>d</sup>															
No time	77	77	71	71	67	53	53	54	53	55	53	59	58	63	62
Any time	23	23	29	29	33	47	47	46	47	45	47	41	42	37	38
Less than one hour	8	7	11	7	8	10	10	7	7	5	10	4	9	9	8
1 to less than 3 hours	12	12	16	20	20	27	28	28	23	24	22	20	21	17	21
3 to less than 5 hours	2	4	1	3	1	5	4	6	10	9	8	8	7	7	5
5 to less than 7 hours	-	-	1	-	1	-	2	2	2	1	5	5	2	3	2
7 hours or more	1	0	1	-	2	5	2	4	5	6	3	3	3	2	3
Mean number of hours <sup>b</sup>	0.3	0.4	0.5	0.4	0.7	1.3	1.0	1.3	1.6	1.3	1.4	1.2	1.1	0.8	1.0
Standard error of the mean	0.07	0.06	0.08	0.05	0.14	0.26	0.13	0.24	0.24	0.14	0.20	0.15	0.17	0.11	0.06
Any physical activity <sup>e</sup>															
No time	9	6	2	4	3	3	3	2	4	5	5	4	8	8	5
Any time	91	94	98	96	97	97	97	98	96	95	95	96	92	92	95
Less than one hour	4	5	6	5	6	6	4	6	7	7	9	10	12	12	7
1 to less than 3 hours	13	11	16	14	16	15	17	16	15	16	16	21	18	16	16
3 to less than 5 hours	8	15	16	13	20	15	16	17	13	20	16	14	17	18	16
5 to less than 7 hours	13	13	15	11	10	9	12	14	13	16	17	15	14	13	13
7 hours or more	52	51	45	53	44	52	47	44	48	36	37	35	31	33	43
Mean number of hours <sup>b</sup>	12.2	11.5	9.1	9.8	9.7	9.4	8.7	9.2	9.4	7.1	7.8	6.8	6.0	6.3	8.7
Standard error of the mean	0.90	0.77	0.64	0.57	0.75	0.62	0.56	0.57	0.61	0.46	0.52	0.52	0.37	0.51	0.21
Bases (unweighted) <sup>f</sup>															
Girls	247	268	229	225	237	254	234	250	296	291	240	259	279	245	3554
Bases (weighted) <sup>f</sup>															
Girls	226	230	218	211	203	225	223	226	236	226	223	245	258	227	3177

a Does not include walking to or from school.

b Means are based on all participants.

c Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.

d Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.

e Does not include walking/ cycling to or from school

f Bases given are for Walking. All other bases vary but are of a similar size.



Table 5.13

**Time spent by children participating in different activities in the last week (self-reported), by Strategic Health Authority<sup>a</sup> and sex**

Age 2-15

2008

Mean number of hours in last week	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>										
<b>Walking<sup>b</sup></b>										
Mean number of hours <sup>c</sup>	1.9	2.2	2.9	2.4	2.7	2.4	2.3	2.3	2.7	2.4
Standard error of the mean	0.35	0.16	0.31	0.23	0.31	0.25	0.27	0.26	0.31	0.21
<b>Informal sports/ exercise/active play<sup>d</sup></b>										
Mean number of hours <sup>c</sup>	7.9	7.7	8.8	7.7	6.8	7.9	7.1	7.3	7.9	7.3
Standard error of the mean	0.74	0.42	0.65	0.56	0.51	0.52	0.41	0.73	0.73	0.52
<b>Formal sports/activities<sup>e</sup></b>										
Mean number of hours <sup>c</sup>	1.5	2.0	1.7	1.3	1.6	2.0	2.0	1.6	1.8	1.8
Standard error of the mean	0.24	0.17	0.23	0.13	0.17	0.35	0.17	0.15	0.25	0.22
<b>Any physical activity<sup>f</sup></b>										
Mean number of hours <sup>c</sup>	9.8	9.9	11.7	10.1	9.5	10.2	9.4	9.6	10.7	9.7
Standard error of the mean	0.81	0.51	0.82	0.67	0.72	0.69	0.56	0.87	0.87	0.59
<b>Girls</b>										
<b>Walking<sup>b</sup></b>										
Mean number of hours <sup>c</sup>	2.5	2.1	2.6	2.2	2.4	2.8	1.9	2.2	3.0	2.3
Standard error of the mean	0.42	0.17	0.25	0.18	0.22	0.25	0.18	0.23	0.27	0.21
<b>Informal sports/ exercise/active play<sup>d</sup></b>										
Mean number of hours <sup>c</sup>	7.2	5.8	7.2	6.1	5.3	6.7	6.7	6.3	7.5	5.5
Standard error of the mean	0.86	0.32	0.57	0.57	0.51	0.43	0.57	0.70	0.75	0.49
<b>Formal sports/activities<sup>e</sup></b>										
Mean number of hours <sup>c</sup>	0.8	0.9	0.7	1.2	0.8	1.2	1.1	0.9	1.0	0.9
Standard error of the mean	0.35	0.13	0.08	0.28	0.09	0.15	0.25	0.10	0.10	0.15
<b>Any physical activity<sup>f</sup></b>										
Mean number of hours <sup>c</sup>	9.7	7.9	9.7	8.3	7.7	9.4	8.6	8.6	10.5	7.8
Standard error of the mean	1.05	0.38	0.66	0.62	0.65	0.58	0.65	0.78	0.79	0.59
<b>Bases (unweighted)<sup>g</sup></b>										
Boys	171	524	349	298	356	413	458	319	262	352
Girls	180	534	392	292	341	412	465	291	312	335
<b>Bases (weighted)<sup>g</sup></b>										
Boys	154	433	324	292	380	378	503	291	250	336
Girls	159	435	338	262	333	359	471	247	273	300

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Does not include walking to or from school.

<sup>c</sup> Means are based on all participants.

<sup>d</sup> Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.

<sup>e</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.

<sup>f</sup> Does not include walking/ cycling to or from school

<sup>g</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Table 5.14

**Time spent by children participating in different activities in the last week (self-reported), by equivalised household income and sex**

Aged 2-15

2008

Mean number of hours in the last week	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Boys</b>					
<b>Walking<sup>a</sup></b>					
Mean number of hours <sup>b</sup>	2.3	2.4	2.5	2.8	2.7
Standard error of the mean	0.18	0.16	0.16	0.24	0.20
<b>Informal sports/ exercise/active play<sup>c</sup></b>					
Mean number of hours <sup>b</sup>	5.9	7.4	7.4	8.2	8.8
Standard error of the mean	0.40	0.36	0.33	0.41	0.42
<b>Formal sports/ activities<sup>d</sup></b>					
Mean number of hours <sup>b</sup>	1.7	1.7	1.7	2.1	1.7
Standard error of the mean	0.13	0.13	0.15	0.24	0.15
<b>Any physical activity<sup>e</sup></b>					
Mean number of hours <sup>b</sup>	8.2	9.7	9.9	11.0	11.4
Standard error of the mean	0.49	0.42	0.41	0.53	0.51
<b>Girls</b>					
<b>Walking<sup>a</sup></b>					
Mean number of hours <sup>b</sup>	2.2	2.3	2.4	2.5	2.7
Standard error of the mean	0.14	0.14	0.19	0.17	0.18
<b>Informal sports/ exercise/active play<sup>c</sup></b>					
Mean number of hours <sup>b</sup>	6.4	6.3	6.2	6.7	7.3
Standard error of the mean	0.46	0.37	0.37	0.38	0.42
<b>Formal sports/activities<sup>d</sup></b>					
Mean number of hours <sup>b</sup>	1.4	0.9	1.0	0.8	1.0
Standard error of the mean	0.23	0.09	0.11	0.08	0.20
<b>Any physical activity<sup>e</sup></b>					
Mean number of hours <sup>b</sup>	8.6	8.6	8.6	9.2	10.0
Standard error of the mean	0.49	0.43	0.45	0.43	0.49
<b>Bases (unweighted)<sup>f</sup></b>					
Boys	419	561	692	641	645
Girls	455	608	610	671	661
<b>Bases (weighted)<sup>f</sup></b>					
Boys	386	521	656	628	624
Girls	393	522	544	604	614

<sup>a</sup> Does not include walking to or from school.<sup>b</sup> Means are based on all participants.<sup>c</sup> Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.<sup>d</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.<sup>e</sup> Does not include walking/ cycling to or from school<sup>f</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Table 5.15

**Time spent by children participating in different activities in the last week (self-reported), by Spearhead status<sup>a</sup> and sex**

Aged 2-15

2008

Mean number of hours in the last week <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT %	Spearhead PCT %
<b>Boys</b>		
<b>Walking<sup>b</sup></b>		
Mean number of hours <sup>c</sup>	2.4	2.6
Standard error of the mean	0.10	0.15
<b>Informal sports/ exercise/active play<sup>d</sup></b>		
Mean number of hours <sup>c</sup>	7.6	7.6
Standard error of the mean	0.23	0.28
<b>Formal sports/ activities<sup>e</sup></b>		
Mean number of hours <sup>c</sup>	1.8	1.7
Standard error of the mean	0.10	0.10
<b>Any physical activity<sup>f</sup></b>		
Mean number of hours <sup>c</sup>	9.9	10.2
Standard error of the mean	0.28	0.37
<b>Girls</b>		
<b>Walking<sup>b</sup></b>		
Mean number of hours <sup>c</sup>	2.4	2.4
Standard error of the mean	0.09	0.13
<b>Informal sports/ exercise/active play<sup>d</sup></b>		
Mean number of hours <sup>c</sup>	6.4	6.2
Standard error of the mean	0.23	0.29
<b>Formal sports/ activities<sup>e</sup></b>		
Mean number of hours <sup>c</sup>	1.0	0.9
Standard error of the mean	0.06	0.12
<b>Any physical activity<sup>f</sup></b>		
Mean number of hours <sup>c</sup>	8.8	8.6
Standard error of the mean	0.27	0.33
<b>Bases (unweighted)<sup>g</sup></b>		
Boys	2196	1287
Girls	2214	1323
<b>Bases (weighted)<sup>g</sup></b>		
Boys	2108	1216
Girls	1967	1196

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.<sup>b</sup> Does not include walking to or from school.<sup>c</sup> Means are based on all participants.<sup>d</sup> Informal sports/ exercise/ active play include: cycling (apart from to and from school), hopscotch, bouncing on trampoline, playing around, e.g. kicking a ball around, catch, hide and seek, skating, skateboarding, using a scooter, dancing, skipping rope, vacuuming, cleaning car, gardening, etc.<sup>e</sup> Formal sports/activities include: football, rugby, hockey, lacrosse, netball, basketball, handball, cricket, rounders, tennis, badminton, squash, running, jogging, athletics, swimming (either laps or splashing about), gymnastics, workout with gym machines, weight training, aerobics.<sup>f</sup> Does not include walking/ cycling to or from school<sup>g</sup> Bases given are for Walking. All other bases vary but are of a similar size.

Table 5.16

**Sedentary time spent by children in the last week (self-reported), by age and sex**

Aged 2-15

2008

Sedentary time spent in the last week	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>															
<b>Watching TV<sup>a</sup></b>															
<b>Weekday</b>															
Less than 2 hours	72	62	63	67	57	60	54	53	50	50	47	45	48	45	55
2 to less than 4 hours	21	34	30	26	37	38	41	42	44	44	42	48	40	40	38
4 hours or more	7	4	7	7	6	3	5	6	6	6	11	7	11	15	7
Mean number of hours <sup>b</sup>	1.4	1.6	1.6	1.5	1.6	1.6	1.6	1.7	1.8	1.8	1.9	1.9	1.9	2.1	1.7
Standard error of the mean	0.09	0.07	0.07	0.08	0.07	0.06	0.07	0.07	0.07	0.07	0.08	0.07	0.09	0.12	0.02
<b>Weekend day</b>															
Less than 2 hours	69	54	46	38	36	30	34	34	32	30	30	32	37	39	39
2 to less than 4 hours	24	37	42	50	48	55	55	47	51	53	47	48	44	39	46
4 hours or more	7	9	12	12	16	14	11	20	18	17	23	21	18	22	16
Mean number of hours <sup>b</sup>	1.4	1.7	1.9	2.1	2.2	2.3	2.1	2.4	2.4	2.3	2.5	2.4	2.2	2.4	2.2
Standard error of the mean	0.09	0.08	0.09	0.08	0.10	0.09	0.08	0.10	0.09	0.10	0.10	0.10	0.10	0.14	0.03
<b>Other sedentary time<sup>c</sup></b>															
<b>Weekday</b>															
Less than 2 hours	80	74	75	69	69	65	65	64	55	54	45	43	38	31	59
2 to less than 4 hours	16	25	23	29	26	31	33	33	39	42	40	45	43	50	34
4 hours or more	4	1	2	2	5	4	3	3	6	5	14	12	19	19	7
Mean number of hours <sup>b</sup>	1.2	1.2	1.2	1.3	1.5	1.5	1.5	1.5	1.7	1.7	2.1	2.0	2.4	2.5	1.7
Standard error of the mean	0.08	0.06	0.06	0.09	0.08	0.07	0.06	0.09	0.07	0.06	0.09	0.08	0.11	0.11	0.03
<b>Weekend day</b>															
Less than 2 hours	77	71	65	57	50	48	53	45	43	44	41	35	41	30	50
2 to less than 4 hours	19	27	31	37	43	44	38	44	46	42	39	44	30	37	37
4 hours or more	5	2	3	6	8	8	8	11	11	14	20	21	29	34	13
Mean number of hours <sup>b</sup>	1.2	1.2	1.4	1.6	1.7	1.9	1.8	1.9	2.0	2.1	2.3	2.4	2.6	2.9	1.9
Standard error of the mean	0.08	0.06	0.07	0.07	0.08	0.09	0.11	0.09	0.09	0.10	0.11	0.10	0.15	0.14	0.03
<b>Total sedentary time</b>															
<b>Weekday</b>															
Less than 2 hours	40	26	24	32	24	17	17	15	14	10	8	6	7	7	18
2 to less than 4 hours	37	50	53	42	46	57	53	50	44	46	38	40	37	31	44
4 to less than 6 hours	16	19	17	19	22	20	22	28	30	35	38	39	35	33	27
6 hours or more	6	5	6	7	8	6	8	7	11	8	15	15	21	30	11
Mean number of hours <sup>b</sup>	2.6	2.8	2.8	2.8	3.1	3.0	3.1	3.3	3.5	3.5	4.0	3.9	4.3	4.6	3.4
Standard error of the mean	0.14	0.09	0.10	0.13	0.12	0.10	0.12	0.13	0.11	0.11	0.12	0.10	0.17	0.17	0.04
<b>Weekend day</b>															
Less than 2 hours	39	24	18	13	14	9	10	9	8	10	11	9	11	8	14
2 to less than 4 hours	38	46	42	44	33	33	42	35	34	30	25	24	26	24	34
4 to less than 6 hours	15	23	29	29	33	37	31	30	29	36	30	31	29	28	29
6 hours or more	8	7	10	14	20	21	16	26	28	24	33	36	34	40	23
Mean number of hours <sup>b</sup>	2.6	3.0	3.3	3.7	4.0	4.2	3.9	4.3	4.4	4.4	4.7	4.8	4.9	5.3	4.1
Standard error of the mean	0.14	0.11	0.12	0.12	0.15	0.13	0.14	0.15	0.14	0.17	0.16	0.14	0.18	0.19	0.05
<b>Bases (unweighted)<sup>d</sup></b>															
Boys	255	239	249	240	252	235	236	244	255	255	260	286	266	231	3503
<b>Bases (weighted)<sup>d</sup></b>															
Boys	252	226	228	223	232	215	235	235	247	238	237	258	274	242	3342

<sup>a</sup> Watching TV including DVDs or videos.<sup>b</sup> Means are based on all participants.<sup>c</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.<sup>d</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.

Continued...

Table 5.16 continued

Aged 2-15

2008

Sedentary time spent in the last week	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	%
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
<b>Girls</b>															
<b>Watching TV<sup>a</sup></b>															
<b>Weekday</b>															
Less than 2 hours	68	56	57	62	62	59	57	54	50	43	43	42	41	42	52
2 to less than 4 hours	26	36	40	34	35	34	38	41	41	47	46	48	42	42	39
4 hours or more	6	8	2	4	2	7	5	5	9	10	12	10	17	16	8
Mean number of hours <sup>b</sup>	1.3	1.7	1.6	1.6	1.4	1.6	1.6	1.7	1.8	2.0	2.0	2.0	2.2	2.2	1.8
Standard error of the mean	0.07	0.08	0.07	0.07	0.06	0.08	0.08	0.07	0.07	0.07	0.08	0.09	0.09	0.10	0.02
<b>Weekend day</b>															
Less than 2 hours	64	48	34	36	39	37	33	37	32	32	32	32	31	38	37
2 to less than 4 hours	31	42	53	49	44	46	51	51	53	45	41	51	38	41	45
4 hours or more	5	10	13	15	17	18	17	12	16	24	26	18	31	21	17
Mean number of hours <sup>b</sup>	1.4	1.9	2.1	2.2	2.2	2.2	2.2	2.1	2.3	2.5	2.6	2.4	2.7	2.4	2.2
Standard error of the mean	0.09	0.08	0.08	0.09	0.10	0.10	0.10	0.08	0.09	0.11	0.13	0.11	0.12	0.13	0.03
<b>Other sedentary time<sup>c</sup></b>															
<b>Weekday</b>															
Less than 2 hours	73	64	72	72	71	70	72	64	57	50	41	34	34	23	56
2 to less than 4 hours	23	31	26	26	26	27	26	33	41	44	53	55	52	54	37
4 hours or more	3	5	2	3	3	3	1	3	3	6	6	11	14	23	6
Mean number of hours <sup>b</sup>	1.2	1.5	1.3	1.3	1.4	1.4	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.7	1.7
Standard error of the mean	0.07	0.07	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.07	0.06	0.09	0.08	0.10	0.02
<b>Weekend day</b>															
Less than 2 hours	68	60	54	54	47	51	46	43	45	47	36	37	33	30	46
2 to less than 4 hours	29	35	39	38	46	43	44	49	46	42	52	44	46	41	42
4 hours or more	3	6	7	9	8	7	10	9	9	12	12	19	21	29	12
Mean number of hours <sup>b</sup>	1.3	1.5	1.6	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.1	2.3	2.4	2.8	1.9
Standard error of the mean	0.07	0.06	0.07	0.09	0.07	0.07	0.10	0.08	0.10	0.09	0.09	0.13	0.10	0.13	0.03
<b>Total sedentary time</b>															
<b>Weekday</b>															
Less than 2 hours	37	22	24	26	23	25	22	15	15	9	10	7	6	5	17
2 to less than 4 hours	41	42	48	49	58	49	55	53	49	44	37	38	27	24	43
4 to less than 6 hours	13	26	24	19	15	18	18	26	25	35	38	38	46	39	27
6 hours or more	9	9	4	7	5	8	5	6	11	12	15	17	20	33	12
Mean number of hours <sup>b</sup>	2.6	3.2	2.9	2.8	2.8	3.0	2.9	3.2	3.4	3.8	3.9	4.1	4.4	4.9	3.4
Standard error of the mean	0.11	0.11	0.10	0.10	0.09	0.12	0.11	0.11	0.10	0.11	0.11	0.12	0.12	0.14	0.04
<b>Weekend day</b>															
Less than 2 hours	34	19	13	12	13	13	17	10	10	11	8	10	10	7	13
2 to less than 4 hours	36	40	34	36	37	35	26	37	33	29	27	26	18	26	31
4 to less than 6 hours	21	27	37	34	29	31	36	35	34	33	34	29	31	26	31
6 hours or more	8	14	16	19	21	22	22	19	23	27	31	36	41	41	25
Mean number of hours <sup>b</sup>	2.7	3.4	3.8	4.0	3.9	3.9	4.1	3.9	4.2	4.4	4.7	4.7	5.1	5.2	4.2
Standard error of the mean	0.12	0.11	0.13	0.13	0.14	0.13	0.16	0.12	0.15	0.15	0.16	0.17	0.17	0.18	0.05
<b>Bases (unweighted)<sup>d</sup></b>															
Girls	248	268	230	226	237	255	233	252	297	291	241	257	281	246	3562
<b>Bases (weighted)<sup>d</sup></b>															
Girls	226	230	219	212	203	226	222	228	239	226	224	243	260	228	3186

<sup>a</sup> Watching TV including DVDs or videos.<sup>b</sup> Means are based on all participants.<sup>c</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.<sup>d</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.

Table 5.17

**Sedentary time spent by children in the last week (self-reported), by Strategic Health Authority<sup>a</sup> and sex**

Age 2-15

2008

Mean number of sedentary hours in the last week	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Boys</b>										
<b>Watching TV<sup>b</sup></b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	1.7	1.8	1.9	1.7	1.7	1.8	1.7	1.6	1.7	1.6
Standard error of the mean	0.11	0.06	0.08	0.07	0.06	0.08	0.06	0.09	0.09	0.08
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	2.1	2.2	2.2	2.1	2.2	2.2	2.2	2.1	2.3	2.0
Standard error of the mean	0.14	0.07	0.08	0.10	0.10	0.09	0.08	0.12	0.11	0.09
<b>Other sedentary time<sup>d</sup></b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	1.6	1.6	1.7	1.6	1.7	1.6	1.8	1.7	1.7	1.5
Standard error of the mean	0.11	0.06	0.07	0.09	0.07	0.08	0.07	0.08	0.14	0.07
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	2.1	2.0	2.0	1.9	2.0	2.0	2.0	1.9	1.9	1.8
Standard error of the mean	0.19	0.09	0.09	0.11	0.10	0.11	0.08	0.10	0.11	0.10
<b>Total sedentary time</b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	3.35	3.44	3.62	3.31	3.38	3.33	3.53	3.39	3.39	3.17
Standard error of the mean	0.14	0.09	0.12	0.13	0.09	0.13	0.11	0.13	0.20	0.13
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	4.2	4.2	4.2	4.0	4.2	4.2	4.2	4.1	4.2	3.8
Standard error of the mean	0.25	0.13	0.13	0.17	0.14	0.15	0.13	0.16	0.18	0.15
<b>Bases (unweighted)<sup>e</sup></b>										
Boys	173	525	348	297	355	413	458	320	261	353
<b>Bases (weighted)<sup>e</sup></b>										
Boys	156	433	323	291	379	378	503	292	250	337

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.<sup>b</sup> Watching TV including DVDs or videos.<sup>c</sup> Means are based on all participants.<sup>d</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.<sup>e</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.

Continued...

Table 5.17 continued

Age 2-15

2008

Mean number of sedentary hours in the last week	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Girls</b>										
<b>Watching TV<sup>b</sup></b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	1.7	1.9	1.8	1.8	2.0	1.8	1.9	1.6	1.5	1.6
Standard error of the mean	0.10	0.07	0.08	0.08	0.07	0.07	0.08	0.07	0.07	0.07
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	2.1	2.3	2.1	2.2	2.5	2.2	2.4	2.2	2.1	2.2
Standard error of the mean	0.12	0.09	0.09	0.11	0.11	0.09	0.10	0.09	0.08	0.12
<b>Other sedentary time<sup>d</sup></b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	1.5	1.6	1.8	1.7	1.7	1.6	1.7	1.6	1.6	1.7
Standard error of the mean	0.11	0.06	0.06	0.08	0.06	0.06	0.07	0.07	0.08	0.06
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	2.1	1.8	2.0	2.0	2.0	1.9	1.9	1.9	2.0	1.8
Standard error of the mean	0.17	0.07	0.08	0.09	0.09	0.07	0.07	0.10	0.08	0.08
<b>Total sedentary time</b>										
<b>Weekday</b>										
Mean number of hours <sup>c</sup>	3.2	3.4	3.7	3.5	3.7	3.4	3.6	3.2	3.1	3.3
Standard error of the mean	0.17	0.11	0.10	0.13	0.10	0.10	0.13	0.10	0.13	0.11
<b>Weekend day</b>										
Mean number of hours <sup>c</sup>	4.2	4.1	4.1	4.2	4.4	4.1	4.3	4.1	4.0	4.0
Standard error of the mean	0.20	0.13	0.14	0.15	0.17	0.13	0.14	0.15	0.13	0.17
<b>Bases (unweighted)<sup>e</sup></b>										
Girls	180	535	396	294	341	412	465	291	312	336
<b>Bases (weighted)<sup>e</sup></b>										
Girls	159	436	342	264	334	359	471	247	273	301

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Watching TV including DVDs or videos.

<sup>c</sup> Means are based on all participants.

<sup>d</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.

<sup>e</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.

Table 5.18

**Sedentary time spent by children in the last week (self-reported), by equivalised household income and sex**

Aged 2-15

2008

Mean number of sedentary hours in the last week	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Boys</b>					
<b>Watching TV<sup>a</sup></b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	1.4	1.6	1.7	1.8	2.0
Standard error of the mean	0.05	0.05	0.05	0.06	0.06
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	1.9	2.1	2.1	2.2	2.3
Standard error of the mean	0.06	0.06	0.06	0.07	0.07
<b>Other sedentary time<sup>c</sup></b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	1.7	1.5	1.8	1.7	1.7
Standard error of the mean	0.07	0.06	0.06	0.06	0.05
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	1.9	1.9	2.0	2.1	1.9
Standard error of the mean	0.07	0.08	0.08	0.09	0.07
<b>Total sedentary time</b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	3.1	3.1	3.5	3.5	3.7
Standard error of the mean	0.10	0.08	0.08	0.10	0.09
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	3.9	4.0	4.1	4.3	4.2
Standard error of the mean	0.09	0.11	0.11	0.12	0.11
<b>Girls</b>					
<b>Watching TV<sup>a</sup></b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	1.5	1.7	1.8	1.8	2.0
Standard error of the mean	0.05	0.05	0.05	0.05	0.07
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	2.0	2.2	2.3	2.2	2.4
Standard error of the mean	0.07	0.07	0.07	0.07	0.08
<b>Other sedentary time<sup>c</sup></b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	1.6	1.7	1.7	1.5	1.7
Standard error of the mean	0.06	0.05	0.05	0.05	0.06
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	2.0	2.1	2.0	1.8	1.8
Standard error of the mean	0.06	0.06	0.07	0.06	0.06
<b>Total sedentary time</b>					
<b>Weekday</b>					
Mean number of hours <sup>b</sup>	3.1	3.4	3.4	3.4	3.7
Standard error of the mean	0.08	0.08	0.08	0.08	0.11
<b>Weekend day</b>					
Mean number of hours <sup>b</sup>	4.0	4.3	4.4	4.0	4.1
Standard error of the mean	0.11	0.10	0.11	0.10	0.12
<b>Bases (unweighted)<sup>d</sup></b>					
Boys	419	562	693	640	644
Girls	453	610	611	673	666
<b>Bases (weighted)<sup>d</sup></b>					
Boys	386	522	657	627	623
Girls	391	524	545	607	618

<sup>a</sup> Watching TV including DVDs or videos.<sup>b</sup> Means are based on all participants.<sup>c</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.<sup>d</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.



Table 5.19

**Sedentary time spent by children in the last week (self-reported), by Spearhead status<sup>a</sup> and sex**

Aged 2-15

2008

Mean number of sedentary hours in the last week <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Boys</b>		
<b>Watching TV<sup>b</sup></b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	1.8	1.7
Standard error of the mean	0.04	0.03
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	2.2	2.2
Standard error of the mean	0.05	0.04
<b>Other sedentary time<sup>d</sup></b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	1.7	1.7
Standard error of the mean	0.04	0.03
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	2.0	1.9
Standard error of the mean	0.05	0.04
<b>Total sedentary time</b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	3.5	3.3
Standard error of the mean	0.06	0.05
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	4.2	4.1
Standard error of the mean	0.06	0.05
<b>Girls</b>		
<b>Watching TV<sup>b</sup></b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	1.9	1.7
Standard error of the mean	0.04	0.03
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	2.3	2.2
Standard error of the mean	0.06	0.04
<b>Other sedentary time<sup>d</sup></b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	1.7	1.7
Standard error of the mean	0.04	0.03
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	1.9	1.9
Standard error of the mean	0.05	0.03
<b>Total sedentary time</b>		
<b>Weekday</b>		
Mean number of hours <sup>c</sup>	3.5	3.4
Standard error of the mean	0.06	0.05
<b>Weekend day</b>		
Mean number of hours <sup>c</sup>	4.2	4.2
Standard error of the mean	0.08	0.06
<b>Bases (unweighted)<sup>e</sup></b>		
Boys	2198	1286
Girls	2217	1328
<b>Bases (weighted)<sup>e</sup></b>		
Boys	2109	1215
Girls	1970	1202

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Watching TV including DVDs or videos.

<sup>c</sup> Means are based on all participants.

<sup>d</sup> Sitting down doing any other activity, e.g. reading, doing homework, drawing, using a computer or playing video games.

<sup>e</sup> Bases given are for 'Watching TV'. All other bases vary but are of a similar size.

Table 5.20

**Summary of children's total sedentary time in the last week (self-reported), by BMI category, age and sex**

Aged 2-15

2008

Summary of sedentary time in the last week, within BMI category <sup>a</sup>	Age group		Total
	2-10	11-15	
	%	%	%
<b>Boys</b>			
<b>Not overweight or obese</b>			
Weekdays: Less than 4 hours	73	49	65
Weekdays: 4 hours or more	27	51	35
Weekends: Less than 4 hours	56	37	50
Weekends: 4 hours or more	44	63	50
<b>Overweight</b>			
Weekdays: Less than 4 hours	64	44	56
Weekdays: 4 hours or more	36	56	44
Weekends: Less than 4 hours	54	33	46
Weekends: 4 hours or more	46	67	54
<b>Obese</b>			
Weekdays: Less than 4 hours	66	37	53
Weekdays: 4 hours or more	34	63	47
Weekends: Less than 4 hours	46	31	39
Weekends: 4 hours or more	54	69	61
<b>Girls</b>			
<b>Not overweight or obese</b>			
Weekdays: Less than 4 hours	74	43	63
Weekdays: 4 hours or more	26	57	37
Weekends: Less than 4 hours	52	36	46
Weekends: 4 hours or more	48	64	54
<b>Overweight</b>			
Weekdays: Less than 4 hours	68	43	57
Weekdays: 4 hours or more	32	57	43
Weekends: Less than 4 hours	41	34	38
Weekends: 4 hours or more	59	66	62
<b>Obese</b>			
Weekdays: Less than 4 hours	64	31	49
Weekdays: 4 hours or more	36	69	51
Weekends: Less than 4 hours	52	26	40
Weekends: 4 hours or more	48	74	60
<i>Bases (unweighted)</i>			
<i>Boys</i>			
Not overweight or obese	1667	868	2535
Overweight	259	188	447
Obese	277	241	518
<i>Girls</i>			
Not overweight or obese	1735	919	2654
Overweight	252	184	436
Obese	253	212	465
<i>Bases (weighted)</i>			
<i>Boys</i>			
Not overweight or obese	1596	841	2437
Overweight	242	175	418
Obese	255	231	485
<i>Girls</i>			
Not overweight or obese	1554	828	2382
Overweight	221	163	384
Obese	225	190	415

<sup>a</sup> Overweight was defined as ≥85th<95th UK National BMI percentile; obese was defined as ≥95th UK National BMI percentile.

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# Accelerometry in children

# 6

*Dale Esliger, Julia Hall*

## Summary

- This chapter focuses on the use of accelerometry to measure physical activity and sedentary behaviour in children aged 4-15. The HSE 2008 is the first large national study of accelerometry that has been undertaken in England.
- In the 2008 HSE, 1,707 children aged 4-15 were selected for the accelerometry sample. 16% of boys and 15% of girls declined to wear an accelerometer. 53% of boys and 57% of girls provided at least one valid day of wear, and 43% of boys and 47% of girls wore an accelerometer for at least ten hours per day on at least four days. 16% of boys and 17% of girls wore the accelerometer for the full seven days.
- Sedentary activity accounted for the largest amount of time, with girls spending more time in sedentary pursuits than boys (over seven hours in each case). Boys and girls did similar amounts of light activity on average. In contrast, boys spent significantly more time than girls on average in moderate activity. Overall, the average amount of moderate to vigorous physical activity (MVPA) was 85 minutes per day for boys and 61 minutes for girls.
- Average time spent in sedentary pursuits increased with age for both girls and boys. Conversely, average time spent in light physical activity decreased with age, as did the average time spent doing any MVPA per day. MVPA decreased from 124 minutes among boys and 101 minutes among girls aged 4-7, to 52 minutes among boys and 28 minutes among girls aged 12-15.
- Based on accelerometry, a higher proportion of boys than girls were classified as meeting the government recommendations for physical activity (33% and 21% respectively). Only around one in five children had achieved the intermediate level of 'some activity' (at least 30 minutes of MVPA on each day), with 47% of boys and 61% of girls in the low activity group.
- There was considerable variation by age. For boys, 51% of those aged 4-10 had met the government recommendations, but only 7% of boys aged 11-15 had met these recommendations. For girls the pattern was similar, although fewer met the recommendations in either age group. Among girls aged 4-10, 34% had met the recommended target, while in this study none of the girls aged 11-15 had done so.
- Based on self-reported data, 31% of boys and 22% of girls aged 4-15 met the government recommendations for children's physical activity. Overall, these estimates are close to the proportions meeting recommendations according to accelerometry (33% and 21% respectively). However, there are some discrepancies between the two classifications, based on those children with both measurements. Accelerometry indicates a much larger contrast between younger and older children than is apparent with self-reported data. Furthermore, self-report may under-estimate MVPA in younger children, and over-estimate among older children.

## 6.1 Introduction

The links between physical activity in childhood and a range of health benefits are well established. These include reducing overweight and obesity and contributing to healthy growth and development, as well as enhancing psychological well-being and promoting social interaction. These benefits are set out in more detail in Chapter 5. In recognition of these benefits and rising levels of childhood obesity, the government has produced a set of guidelines to promote physical activity. In 2004, the Chief Medical Officer's Report recommended that children and young people should achieve a total of at least 60 minutes of at least moderate intensity physical activity each day. More recently, in 2009, the government established a new framework '*Be active, be healthy: A plan for getting the nation moving*'<sup>1</sup> which sets out current and future policies aimed at delivering the recommended physical activity targets.

It is therefore vital that accurate measurement of children's and young people's physical activity levels can be obtained. However, there are a number of well-known challenges to measuring children's physical activity, over and above the difficulties in measuring physical activity in adults (as set out in Chapter 2). The diverse and sporadic nature of children's physical activity, coupled with less clearly defined periods of specific activities, make it difficult to capture self-reported information. Remembering details of physical activity, especially activity that is not formal and planned, is a difficult cognitive task, and children are known to have trouble recalling their physical activities.<sup>2</sup> For very young children, parents must report on the child's behalf, and this may also introduce error. These factors are likely to result in under-estimation of total physical activity. On the other hand, there are factors which may result in over-estimation of physical activity. These include the fact that children may report a period when they were playing a sport or game, but may actually only have been moderately active for a portion of that time.<sup>3</sup> Similarly, parents may feel that it is socially desirable to report high levels of activity for their children.

As well as physical activity impacting on health outcomes, time spent in sedentary pursuits has been found to have an independent effect on health.<sup>4,5</sup> Some nations have already incorporated inactivity or sedentary time recommendations into their physical activity guidelines. Increasingly, activity monitors such as accelerometers are being recognised for their ability to measure the amount of time spent in sedentary activities.<sup>6</sup> Whereas self-reported measures may simply assume that the absence of physical activity is a measure of sedentary behaviour, accelerometers are able to provide objective, time-stamped data on how long a person is inactive. This is particularly important for children as their sedentary behaviour may differ from that of adults.

With the aim of improving the accuracy of measurement of children's physical activity and sedentary behaviour, the HSE for the first time has included an objective measure using accelerometers. These devices measure movement intensity and duration, can capture intermittent physical activity, and can store data for multiple days, making them one of the most useful tools in objectively assessing physical activity. A further advantage of objective measurement is that data can have greater precision, so the same statistical power can be obtained with smaller sample sizes. However, as with self-reported measures, measurements obtained using accelerometers also have limitations. Participants are required to wear the accelerometer during waking hours and to record activities when it is not worn, for example during swimming. An additional limitation of accelerometers is their inability to assess upper body activities such as throwing, lifting or rowing. Children may also be prone to playing with the device, artificially increasing the activity levels recorded.

Chapter 5 sets out the results for the self-reported measures of physical activity, which were based on recall of the past seven days (with parental proxy interviews for those aged under 13). This chapter reports on the results obtained for children using the accelerometer as the instrument of measurement, and compares these results to those obtained using the self-reported measures. While no single measure of childhood physical activity has been found to be the most accurate, reporting results using these different measurement instruments provides a more complete picture of children's physical activity and sedentary behaviours.<sup>3</sup>

## 6.2 Methods and definitions

### 6.2.1 Methods

#### *Fieldwork procedures*

As with the objective measurement of adult physical activity detailed in Chapter 3, an accelerometer, the Actigraph (model GT1M) was worn by children aged 4-15 selected for this element of the study. Full details of the field procedures are described in Chapter 3 and in the technical appendix to this volume, and the protocols used for placement of the accelerometers are provided in Volume 2, Methods and documentation, Appendix B.

A sub-sample of households was selected for accelerometry, as described in Volume 2, Chapter 2. In core households where there were adults and children of the appropriate age, one child and one adult were selected at random; in child boost households, all children aged 4-15 who were selected for interview were eligible for accelerometry.

The Actigraph is a digital uni-axial accelerometer<sup>8</sup> and provides a measure of frequency, intensity and duration of physical activity, allowing classification of activity levels as sedentary, light, moderate and vigorous. The accelerometer was worn on a specially provided belt and each child was asked to wear the accelerometer during waking hours for seven consecutive full days; parent co-operation was also required, particularly for younger children. The device was taken off for activities such as showering or swimming, as the Actigraph is not waterproof. Also, some children removed their monitor during contact sports such as karate or rugby.

Before participants were asked to wear the accelerometer, eligibility was checked, and the following exclusion criteria were applied:

- Younger than 4 at the initial interview;
- Pregnant (known by the participant), since HSE convention is to take no measurements from pregnant women;
- Confined to bed or in a wheelchair;
- Recent abdominal surgery or health problem that would make a belt round the waist uncomfortable;
- Latex allergy (the belt on which the accelerometer was worn contained latex).

Participants were asked to keep a logbook, to record what time the accelerometer was put on in the morning and what time it was taken off at night. They were also asked to record the times when it was removed during the day and the reason it was removed (for instance to go swimming, or for contact sports such as rugby or martial arts) or any periods of cycling or rowing, since it is known that the uni-axial accelerometer may under-represent the intensity of activity for these pursuits. The log book data have not been used in the analyses presented in this report, since subjective interpretation of logbook data is required; however, the data have been processed and will be available for future analyses.

Participants were given an information leaflet (with separate versions for adults and children) and provided with an opportunity to ask any questions. They were given a telephone number to call if they had any queries during the period of measurement. The interviewer obtained verbal consent from the participant, and from parents of selected children, as part of the placement procedure.

Due to the added burden of having to wear an accelerometer for a week, children were offered a £20 high street voucher to thank them for their participation.

### 6.2.2 Data processing

The raw data obtained from each accelerometer were processed using custom software<sup>9</sup> to produce a series of standardised outcome variables.<sup>6,7</sup>

The main variables of interest were average minutes of sedentary, light, moderate, and vigorous intensity physical activity per day. In this chapter, intensity variables were analysed to provide daily averages; they have also been analysed to provide averages for weekdays and weekend days.

For a day to be 'valid' for inclusion in analyses, participants had to have worn the accelerometer for a minimum of 600 minutes (10 hours). Participants with at least four days of valid wear have been included in the analyses to provide average daily estimates. For analyses of summary physical activity levels, including whether participants had met government recommendations for weekly activity, only those with seven valid days were included.

For adults, current evidence suggests that moderate or vigorous activity should be accumulated in bouts of at least 10 minutes to count towards meeting government recommendations, as it is these bouts of sustained activity that provide health benefits. However, this is not a realistic requirement for children, since the nature of children's physical activity typically differs from adults', being less likely to involve clearly defined periods of specific activities. Thus children's activity is much more likely to be sporadic, occurring in short bursts.<sup>10,11,12</sup> For this reason, in keeping with other studies,<sup>13,14</sup> all of children's moderate or vigorous activity has been taken into account in assessing whether they have met government guidelines for physical activity, rather than imposing a requirement for bouts of 10 minutes or more.

Some of the tables present average daily time in the various physical activity intensities: sedentary, light, moderate and vigorous, and a summary variable combining moderate and vigorous activity, referred to as MVPA. In these tables an adjustment has been made for average wear time using regression techniques (taking into account the complex survey design). This allows comparisons between groups after adjusting for any differences in their average wear time.

### 6.2.3 Weighting and analysis

Only a sub-sample of the children in HSE 2008 were eligible to be included in the accelerometry sub-study. Accelerometry weights were therefore derived to allow for non-response at each stage, for use when analysing accelerometry data.

Because accelerometry was conducted among a sub-sample of participants, the scope for detailed analysis breakdowns is limited. Broad age ranges have been used rather than individual age years as in most other children's chapters, and tertiles rather than quintiles of equivalised household income. The sample size is not large enough to allow analysis by Strategic Health Authority.

### 6.2.4 Definitions

#### *Recommended targets for physical activity levels*

The summary measure of physical activity groups participants according to the Chief Medical Officer's physical activity guidelines. For children the recommendation is that they should achieve at least 60 minutes of at least moderate intensity physical activity each day.<sup>2</sup> The summary measure incorporates three basic dimensions (duration, intensity and frequency) of the participants' overall physical activity level.

As indicated above, for children all minutes of MVPA were counted towards meeting the recommended amount per day.

The summary activity level classification for accelerometry data, for participants with seven valid days of data, is as follows:

**Meets recommendations:** moderate or vigorous activity of at least 60 minutes duration per day, on all seven days of accelerometer wear.

**Some activity:** 30-59 minutes of moderate or vigorous activity on all seven days of accelerometer wear.

**Low activity:** lower levels of activity.

#### *Definitions of accelerometry activity levels*

Table 6A gives the definitions of physical activity intensity categories, based on metabolic



equivalents (METs) and the counts per minute recorded by the accelerometer that represent these levels. MET intensity level is the ratio of the intensity of metabolic rate needed for a particular activity to the resting metabolic rate. Sedentary time is also defined in the table. The cutpoints for MVPA for children are one MET higher than the equivalent cutpoints for adults, reflecting the higher resting metabolic rate of children.<sup>15,16</sup>

Table 6A		
<b>Categories of physical activity intensity and age specific cutpoints based on accelerometry</b>		
<b>Physical activity intensity</b>	<b>Counts per minute (cpm)<sup>17</sup></b>	<b>Metabolic Equivalents (METS)</b>
Sedentary	0-199	0 up to 1.5
Light	200-2,801	More than 1.5 up to 4
Moderate (MPA)	2,802-5,480	More than 4 up to 7
Vigorous (VPA)	More than 5,480	More than 7
Moderate and vigorous (MVPA)	2,802 or more	More than 4

### **BMI categories**

Body mass index (BMI) is weight in kilograms divided by height in metres squared (see Chapter 13). Overweight and obesity for children was estimated using the age and sex-specific UK National BMI percentiles classification; the 85th and 95th BMI percentiles of the 1990 reference population are used as cutpoints respectively for overweight and obesity.<sup>18</sup>

## **6.3 Response to accelerometry**

Table 6.1 presents response rates for accelerometer wear by age and sex. 1,707 children aged 4-15 were selected for accelerometry in the households identified for the accelerometer sub-sample. Among this group, 16% of boys and 15% of girls refused to wear the accelerometer, and 2% of boys and 3% of girls were ineligible.

Although a significant proportion of participants agreed to wear the accelerometer, a fault with the device meant that there were unusable data for 24% of boys and 21% of girls selected for the accelerometer. In a small number of cases some data were recorded, but the results were spurious.

Overall 43% of boys and 47% of girls selected wore an accelerometer for at least 600 minutes (ten hours) per day on at least four days, and therefore provided sufficient data to be included in the analyses of daily average wear; this resulted in a sample size of 770 children. 53% of boys and 57% of girls provided at least one valid day of wear. The proportion wearing the accelerometer for the full seven days was 16% among boys and 17% among girls; this group (sample size 238) was used for analysis of meeting government recommendations. This is a relatively small group, and therefore the scope for analysis is restricted. The proportion achieving seven days' wear did not vary greatly by age. However, among those achieving at least four valid days of wear, boys aged 4-7 were the least likely to do so, and the proportion increased with age, from 33% of boys and 42% of girls aged 4-7 to 48% of boys and 51% of girls aged 12-15.

Most of those with at least four days' wear included at least one weekend day within this (39% of boys, 41% of girls). Again, younger boys were the least likely to include a weekend day within their four valid days of wear.

Boys and girls wore the accelerometer for a similar length of time on average, 776 minutes per day for boys and 769 minutes for girls (just under 13 hours). Average wear time increased with age, from around 12 hours 15 minutes for children aged 4-7, to closer to 13 hours for children aged 8-11, and around 13 hours 20 minutes for those aged 12-15.

**Table 6.1**

6.4 Objective measures of physical activity

6.4.1 Average daily physical activity profile, by age and sex

Table 6.2 shows the average minutes of daily wear in different categories of intensity of activity. The data have been adjusted for average daily wear time to allow comparisons between groups with different average wear times.

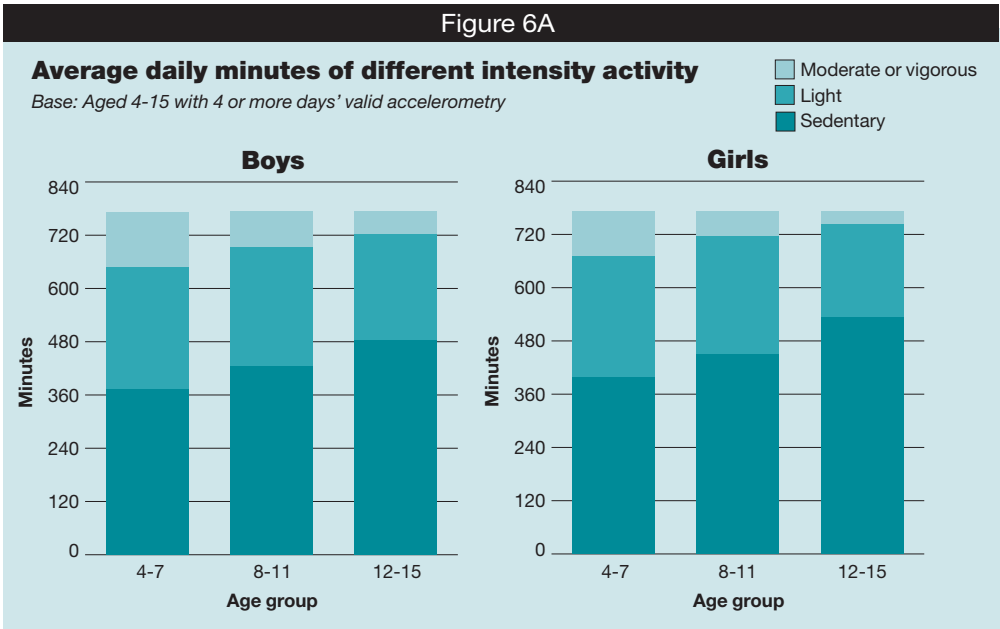
Sedentary activity accounted for the largest amount of time, with girls spending more time in sedentary pursuits than boys (a daily average of 427 minutes for boys and 460 for girls, over seven hours in each case). Boys and girls did similar amounts of light activity on average (260 minutes for boys, 250 minutes for girls). In contrast, boys spent considerably more time than girls on average in moderate activity (76 minutes and 55 minutes respectively), and the average time spent in vigorous activity was 9 minutes for boys and 6 minutes for girls. Thus overall the average amount of MVPA was 85 minutes per day for boys and 61 minutes for girls.

There were considerable variations in profile of physical activity by age, as illustrated in Figure 6A. Average time spent in sedentary pursuits increased with age for both girls and boys, from 374 minutes per day among boys aged 4-7 to 484 minutes among boys aged 12-15, and from 398 minutes per day among girls aged 4-7 to 534 minutes among girls aged 12-15. For all age groups, girls averaged more sedentary time than boys.

Conversely, average time spent in light physical activity decreased with age for both boys and girls. The average number of minutes spent in light physical activity were similar for boys and girls in the two younger age groups, but girls aged 12-15 averaged significantly fewer minutes on average than boys (237 minutes per day for boys compared with 209 minutes for girls).

The average time spent doing any MVPA per day also decreased with age for both sexes, from 124 minutes among boys and 101 minutes among girls aged 4-7, to 52 minutes among boys and 28 minutes among girls aged 12-15. Average minutes of MVPA were higher in all age groups for boys compared with girls.

Table 6.2, Figure 6A



6.4.2 Average daily physical activity profile on weekdays and weekend days

Table 6.3 shows a comparison of the average daily physical activity profile for weekdays and weekend days for boys and girls.

The average period of wear was around 40 minutes lower on weekend days than on weekdays for all ages, because children typically sleep for longer at weekends. Because of

this difference, a direct comparison of the number of minutes at a particular intensity on weekdays and weekend days will reflect the difference in the total waking time, as well as any change in the pattern of activities. If the pattern of activity was exactly the same on weekdays and weekends, then the average minutes at each intensity would be scaled down proportionately for weekend days; for boys this would mean around 23 minutes less time in sedentary pursuits, 14 minutes less in light activity and 5 minutes less in MVPA. For girls the equivalent reductions would be around 25 minutes in sedentary pursuits, 13 minutes in light activity and 3 minutes in MVPA.

In fact, for both boys and girls aged 8-15, the average reduction in MVPA time was around 11-12 minutes on a weekend day compared with a weekday, significantly more than the predicted 3-5 minutes. This indicates that for these age groups the proportion of MVPA time was slightly reduced at the weekend.

The pattern was somewhat different for children aged 4-7, however. Despite the shorter wear time overall at weekends, the average minutes of MVPA did not reduce, but were similar on weekdays and weekend days (123 minutes for boys aged 4-7 on weekdays, 126 minutes on weekend days; 99 minutes for girls of this age on weekdays, 103 minutes on weekend days). Thus for these younger children, it was sedentary and light activity rather than MVPA that were scaled back at the weekend.

Overall, taking into account the shorter period of accelerometer wear on weekend days, the amount of sedentary time was broadly similar throughout the week. Based on self-report, children had distinctly different patterns of sedentary behaviour on weekdays and weekend days (see Chapter 5, section 5.4.3 and Figure 5H). However, the self-reported data cover sedentary behaviour in leisure time and not at school, whereas participants were encouraged to wear their accelerometers at all times including at school. This may account for the fact that there is a less distinct difference between weekdays and weekend days according to accelerometry.

**Table 6.3**

There was no significant variation in the daily physical activity profile by tertile of equivalised household income or Spearhead status.<sup>19</sup> There was also no difference in the activity profile according to whether participants were overweight or obese. It should be noted that the small base sizes for some of these categories limits the scope for detailed analysis.

**Table 6.4-6.6**

### **6.4.3 Objectively measured summary activity levels, by age and sex**

Based on the data collected from accelerometry, children were classified into summary activity groups of meeting recommendations, some activity or low activity (see section 6.2.4 for definitions).

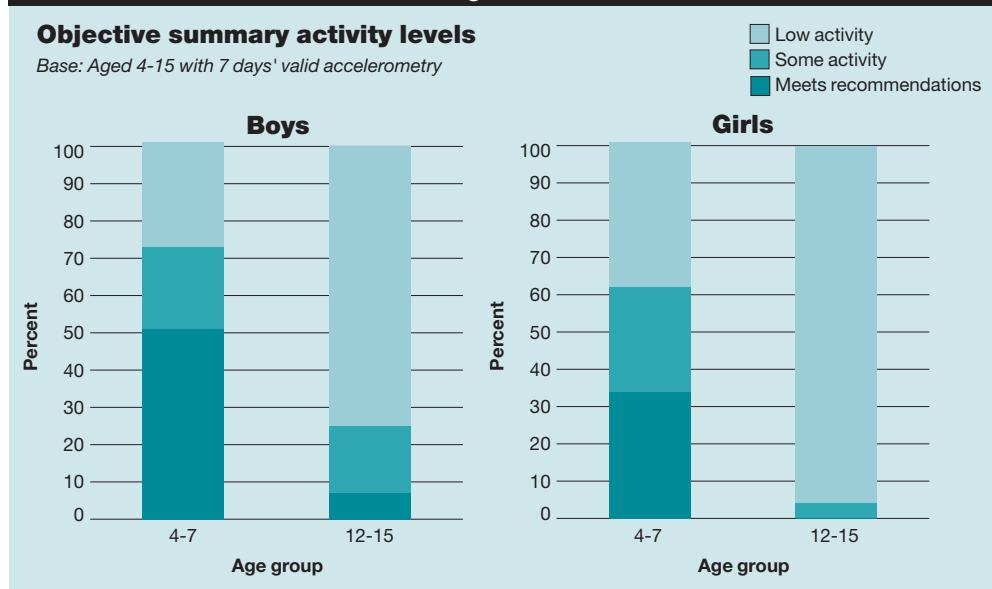
A higher proportion of boys than girls were classified as meeting the government recommendations for physical activity (33% and 21% respectively), i.e. having achieved at least 60 minutes of MVPA on each of the seven days of accelerometer wear. Only around one in five children had achieved the intermediate level of 'some activity' (at least 30 minutes of MVPA on each day), with 47% of boys and 61% of girls in the low activity group.

Figure 6B shows the significant variation in the proportions in each physical activity level within two age groups. For boys, 51% of those aged 4-10 had met the government recommendations of 60 minutes or more of MVPA each day, but only 7% of boys aged 11-15 had met these recommendations. For girls the pattern was similar, although fewer met the recommendations in either age group. Of girls aged 4-10, 34% had met the recommended target, while in this study none of the girls aged 11-15 had done so.

This age pattern also remained for girls classified as having done some activity (30-59 minutes of MVPA each day), decreasing from 28% of those aged 4-10 to 4% of those aged 11-15. For boys however, the drop was much smaller, with a decrease from 22% to 18%. Three quarters of boys and almost all girls aged 11-15 were in the low activity group.

**Table 6.7, Figure 6B**

Figure 6B



Tables 6.8 and 6.9 show the objectively measured summary activity levels by tertile of equivalised household income and Spearhead status, but bases are too small to allow any conclusions to be drawn.

## 6.5 Comparison of objective measurement and self-reported physical activity levels

### 6.5.1 Comparison of summary activity levels

Table 6.10 shows objectively measured summary activity levels by self-reported summary activity level, among those participants for whom both measures were available. Based on self-reported data (excluding time at school), 31% of boys and 22% of girls aged 4-15 met the government recommendations for children's physical activity (see Chapter 5; the proportions for all children aged 2-15 are 32% of boys and 24% of girls). Overall, these estimates are close to the proportions meeting recommendations according to accelerometry (33% and 21% respectively). However, despite small base sizes Table 6.10 shows that there are some discrepancies between the two classifications, based on those children with both measurements. Half of boys and a third of girls classified as meeting recommendations from self-reported data also met recommendations based on accelerometry (53% and 34% respectively). The majority of children in the low activity category from self-report were in the same category with accelerometry (68% of boys, 77% of girls). Among those classified as doing 'some activity' through self-report, however, large proportions were classified as being in the low category based on accelerometry. Moving in the opposite direction, there were some in the intermediate or low category by self-report who were meeting recommendations according to accelerometry.

It should be remembered that the periods of data collection were not the same: the self-reported data were based on the week before the interview, while the accelerometer was usually worn in the week following the interview. It is possible that for a small number of participants one of the measurement periods was out of line with their usual pattern of activity, leading to a discrepancy. Most validation studies with children have reported only moderate correlations between various forms of self-report and other objective criteria.<sup>3</sup>

While the overall proportions classified as meeting recommendations are similar using the different methods of measurement, accelerometry indicates a much larger differentiation between younger and older children than is apparent with self-reported data. The comparison between the two measurements suggests that self-report may under-estimate MVPA in younger children, and over-estimate among older children. Based on

accelerometry, 51 % of boys aged 4-10 met recommendations; as shown in Chapter 5 (Table 5.1, Figure 5A), self-reported data suggests a lower proportion, with the range for boys of these ages between 28% and 36%. Among older boys accelerometry shows 7% met recommendations while the self-reported data show a higher proportion, ranging between 27% and 32%.

Among girls, there is less discrepancy between the two methods for those aged 4-10: 34% met recommendations according to accelerometry, and 23%-33% in this age group did so according to self-reported data. The pattern for older girls was similar to that for older boys: while this study did not find any girls aged 11-15 who met the recommendations based on accelerometry, self-reported data suggested that between 12% and 20% did so.

Table 6.7, 6.10, 5.1

### 6.5.2 Comparison of MVPA time

Table 6.11 compares average daily minutes of MVPA time derived from accelerometry and from self-reported data. This shows a similar pattern to the results on the proportion meeting physical activity recommendations, with lower estimates from self-report for younger children, and higher estimates for older children.

As Figure 6C shows, for boys the self-reported average daily number of MVPA minutes varied little across age groups (around 80 minutes), while based on accelerometry there was a range from 124 minutes for boys aged 4-7 to 52 minutes for boys aged 12-15. Among girls, there was a clear decline in average minutes with age with both methods, but again the range across age groups was much wider based on accelerometry (from 101 minutes for girls aged 4-7 to 28 minutes for girls aged 12-15) than based on self-report (81 minutes for girls aged 4-7, 58 minutes for those aged 12-15). It is important to note that this demonstrated age-related decline in MVPA is not simply a function of the fact that intensity cutpoints increase with age. To support this assertion, the average 'counts per minute' outcome variable was analysed and the pattern of age related decline remained intact (data not shown). The 'counts per minute' outcome variable is based on the raw Actigraph count data; therefore, the age of the child has no bearing on this analysis.

Table 6.11, Figure 6C

## 6.6 Discussion

### 6.6.1 Methodological issues

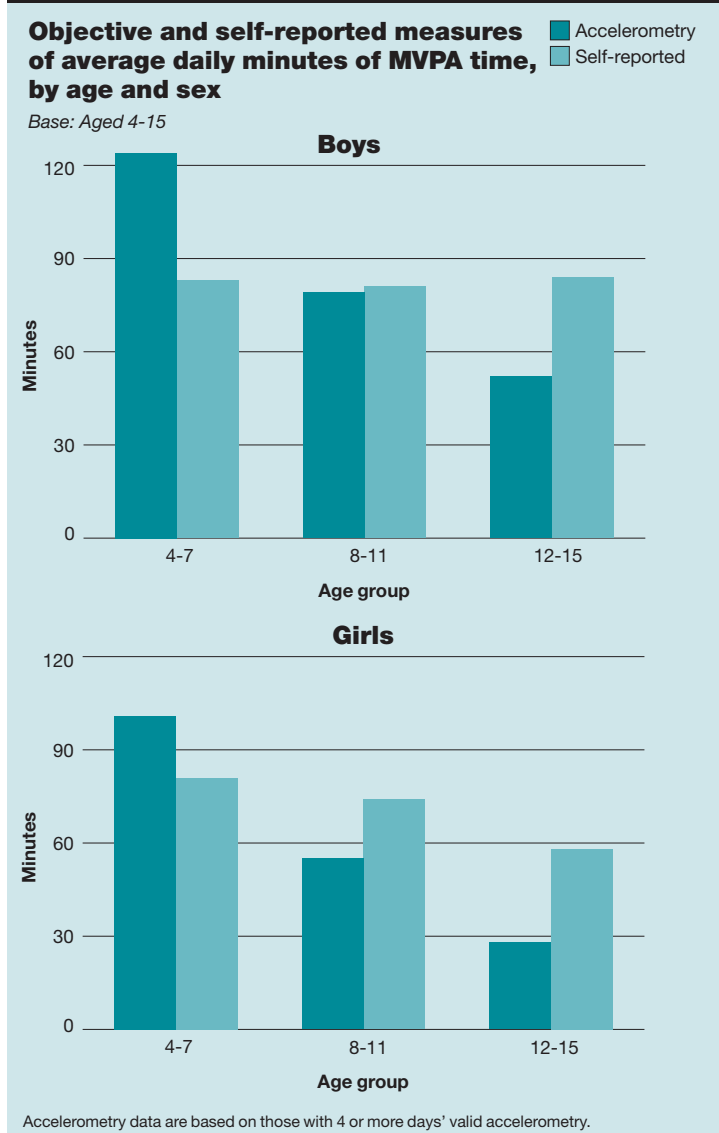
#### *Advantages of accelerometry*

Accelerometers have become one of the most utilised tools for the objective measurement of free-living physical activity.<sup>20</sup> Waist-mounted accelerometers provide an accurate estimate of physical activity within a given day or over several days by measuring bodily accelerations at the hip, and recording the varying levels of intensity of activity.

Self-report methods of recalling intensity, frequency and duration of bouts of activity are challenging for children, who are less time-conscious than adults and tend to engage in more sporadic physical activity rather than consistent patterns. Reliability may be compromised by recall difficulties, and the validity of measures may also be affected by the fact that some children and adolescents feel compelled to respond in a socially desirable manner.<sup>21</sup>

Accelerometers are able to capture sporadic periods of physical activity<sup>11,12</sup> because they offer a higher resolution sampling of physical activity than simple questionnaires. However, it is important to note that the analyses reported here are based on one minute epochs.<sup>22</sup> Although this practice may have limited impact on activity assessment in adults, several authors have noted that use of one minute epochs may obscure the short bursts of moderate to vigorous physical activity exhibited by children.<sup>23,24</sup> That is, if a child alternates between vigorous physical activity and sedentary behaviour within a given minute, the accumulation of counts for that minute may not reach the cutpoint necessary to be considered vigorous and as such, the short bout of vigorous activity is 'diluted' and is

Figure 6C



categorised as moderate instead.

### Limitations of accelerometry

While the objective measures obtained using the accelerometer provide many advantages over self-reported measures of physical activity, they do have their own set of limitations. As discussed in Chapter 3 (section 3.7.1), accelerometers do not capture all types of physical activity, such as cycling, carrying heavy loads, or walking up stairs or a slope.<sup>25,26</sup> In addition, accelerometers provide no information on the types of activities undertaken or the context (e.g. home, work, leisure). A further limitation to accelerometry in children relates to the fact that they have a higher resting metabolic rate, a key measurement for determining the intensity of activities. This is an important issue because interpretation of accelerometry data relies on calculations related to resting energy expenditure.<sup>27</sup> After the period of rapid growth normally associated with puberty, children's resting metabolic rate approaches that of an adult. As stated above (Section 6.2.4), an adjustment was made to accommodate the differences in resting metabolic rate between children and adults.<sup>15</sup>

### Interpretation of accelerometer data

A key consideration in the analysis of accelerometry data relates to the translation of raw accelerometer counts into meaningful physiological and/or behavioural outcomes.<sup>27</sup> Unfortunately, there is little agreement in the literature as to which set of cutpoints is best for use with children's accelerometry data. The lack of agreement hinders comparisons between studies, as the difference in cutpoints adopted can be considerable.<sup>28</sup> If a cutpoint



deemed to be too low is chosen to delineate MVPA, then compliance with physical activity guidelines will be artificially high and vice versa. The age-specific cutpoints used in the analyses of the children's data presented in this report are in line with other studies on large population samples.<sup>14,29,30</sup>

Another key analytical decision relates to the designation of monitor wear versus non-wear. This is important because the wear time differs markedly both within children (across days) and between children, depending primarily on daily bedtimes and getting up times and whether or not they removed the monitor for other reasons (e.g. bathing, swimming, contact sports such as rugby or martial arts, social occasions). In order to ensure that comparisons are valid, the data must undergo adjustment for wear time (as described in Section 6.2.2). Equally important is the calculation used for determining non-wear time.<sup>31</sup>

## 6.6.2 Findings

The accelerometry data from the HSE 2008 are the first objective measurements of physical activity in children in a nationally representative health survey in England. Though cross sectional, these data provide a detailed insight into the levels and patterns of children's physical activity and sedentary behaviours.

### *Time spent in different levels of activity, based on accelerometry*

The majority of the waking day of most children in England is spent in sedentary time (averaging around 7.5 hours) or light intensity physical activity (around 4.2 hours). A much smaller portion of the daily routine is given to the accumulation of moderate physical activity (averaging around 66 minutes), with only occasional episodes of vigorous intensity physical activity (around 7.5 minutes).

The large amounts of sedentary time found in the HSE 2008 were similar to that of another large British study conducted on children in the South West of England.<sup>32</sup> In that study, 11 year olds were found to be spending 7.2 hours of sedentary time per day. These data are a cause for concern considering that sedentary behaviour has been linked to overweight and obesity<sup>33,34</sup> and metabolic risk in children.<sup>35</sup> However, recent data suggest that it is vigorous physical activity and not sedentary time that is more strongly related to adiposity (the presence of fat in the body).<sup>36</sup> Nevertheless, sedentary time, especially television viewing, should be minimised, as not only is it an opportunity for minimal energy expenditure, but it also may provide a context for unhealthy snacking.<sup>37</sup> In fact, some nations have already begun to incorporate sedentary time recommendations into their physical activity guidelines.<sup>38,39</sup>

Unfortunately, the sedentary data from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) in the USA were analysed with a different intensity cutpoint from the HSE 2008 (100 rather than 200 counts/min), making direct comparisons difficult. However, although the absolute amount of sedentary time may not be comparable, the trend of increasing sedentary time by around 200 minutes from childhood through to adolescence was similar between the two national studies.<sup>40</sup> Fortunately the remaining intensity cutpoints between these population studies were similar, and therefore allow national comparisons. Interestingly, the amount of MVPA accumulated by children in England was greater than for children in the USA by only 3 to 6 minutes for each comparable age and gender grouping.<sup>30</sup> As a result, both studies lend support to one of the most ubiquitous findings in sport science, the existence of an age-related decline in physical activity.<sup>41</sup> From age 6 to 15 years, both surveys show boys are more active than girls, with boys' MVPA declining over this age range by around 50% and girls' by around 33%. It is important to note that this decline in activity is not simply a consequence of using age-specific intensity cutpoints, as it is maintained in other outcomes such as counts per minute.<sup>30</sup> Although the 'counts per minute' outcome is not presented in this report, the age-related decline is also evident when assessing this variable in the HSE 2008 data.

### *Compliance with current physical activity recommendations by accelerometry*

Based on accelerometry in the HSE 2008, 51% of boys and 34% of girls aged 4-10, and 7%



of boys aged 11-15 in England met the physical activity recommendations of at least 60 minutes of moderate or vigorous physical activity daily (in this study none of the girls aged 11-15 met the recommendations). This may be a small under-estimate of the true prevalence of compliance, because accelerometry may have under-represented activity for some individuals who met the current recommendations partially or wholly through swimming, cycling or rowing.<sup>42</sup> These prevalence estimates are remarkably similar to those found in the NHANES.<sup>40</sup> In the USA, 49% of boys and 35% of girls aged 6-11 and 12% of boys and 3% of girls aged 12-15 met the USA physical activity guidelines of at least 60 minutes of moderate or vigorous physical activity on 5 or more days per week. However, this is not a fair comparison, given that 60 minutes of MVPA need only be accumulated on 5 of 7 days for the USA measure. Therefore, it is likely that in a direct comparison the English children would be found to be more compliant.

These data provide a clear indication of where intervention efforts may be targeted. Firstly, programmes that target girls in an effort to close the gender divide in physical activity levels would seem justified. Likewise, these data indicate that a programme focusing on promoting lifelong physical activity behaviours, while limiting sedentary behaviours, may be worthwhile. Such a programme may benefit from targetting children and families early, as physical activity has been shown to follow closely from childhood through to adolescence.<sup>43</sup>

### 6.6.3 Comparison between subjective and objective assessment of activity

A recent systematic review of self-report versus directly measured physical activity in children found that overall, 72% of the indirect measures overestimated the directly measured physical activity levels. All studies comparing indirect measures to accelerometry, heart rate monitoring or direct observation reported an overestimation by indirect method, whether using combined gender, male-only or female-only data.<sup>21</sup> Therefore, it was not surprising to find that in the HSE 2008 the subjective self-reported method resulted in substantially higher levels of activity compared to the accelerometric methods. Despite this, the results from the objective accelerometer data corroborate self-report findings across sex and age. Specifically, both the subjective and objective measurements found that boys do more activity than girls, and that physical activity decreases with age. Both of these findings are similar to that found in a similar American study.<sup>30</sup> The researchers in this study emphasise the need for caution when interpreting self-reported physical activity across a range of domains, including clinical practice, public health campaigns, and research. The same is true when interpreting self-reported physical activity estimates from the population in England, which are known to be biased.<sup>44</sup> Objective measures provide more accurate data and should be increasingly used in addition to self-reported measures when available.

Effective population surveillance of physical activity and sedentary behaviour is important to enable:

- Assessment of baseline prevalence of physical activity and sedentary behaviour;
- Tracking of physical activity and sedentary patterns throughout the lifespan;
- Identification of sub-groups at high risk;
- Assessment of trends over time for the tracking of national targets;
- Development of population-specific physical activity interventions, and evaluation of advice, interventions, policies, and programmes;
- Analysis of changes in environmental design aimed at encouraging physical activity;
- Determination of the quantity and quality of physical activity and sedentary time required to provide health benefits;
- Budgeting of public health resource.<sup>45</sup>

Fortunately, the complementary strategy in the HSE 2008 of collecting both questionnaire-based and accelerometric measures of physical activity and sedentary behaviour allow each of these data sources to be critically appraised against these criteria. These rich data provide an important resource for a growing number of expert physical activity scientists in their efforts to optimise future physical activity measurement methods that combine self-report and direct measurements .

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- 6.1 Response to accelerometry by age and sex
- 6.2 Average daily physical activity profile, by age and sex
- 6.3 Average daily physical activity profile for weekdays and weekend days, by age and sex
- 6.4 Average daily physical activity profile, by tertile of equivalised household income and sex
- 6.5 Average daily physical activity profile, by Spearhead status and sex
- 6.6 Average daily physical activity profile, by BMI category and sex
- 6.7 Objective summary activity levels, by age and sex
- 6.8 Objective summary activity levels, by tertile of equivalised household income and sex
- 6.9 Objective summary activity levels, by Spearhead status and sex
- 6.10 Objective summary activity levels by self-reported summary activity levels and sex
- 6.11 Comparison of objective and self-reported average daily MVPA time, by age and sex

Table 6.1

**Response to accelerometry, by age and sex**

Aged 4-15

2008

Response/ accelerometer wear	Age group			Total
	4-7	8-11	12-15	
	%	%	%	%
<b>Boys</b>				
Ineligible	3	2	1	2
Declined accelerometry	24	12	13	16
Spurious/unusable data <sup>a</sup>	22	25	26	24
7 valid days <sup>b</sup>	13	16	17	16
6 valid days	11	13	19	14
5 valid days	4	14	6	8
4 valid days	5	6	6	6
3 valid days	3	3	5	4
2 valid days	6	3	2	3
1 valid day	3	3	2	3
0 valid days	7	3	3	5
Any days of valid wear	44	58	57	53
4 or more days of valid wear	33	49	48	43
4 or more days of valid wear including at least one weekend day	29	43	45	39
Average daily wear (minutes) <sup>c</sup>	734	777	802	776
<b>Girls</b>				
Ineligible	5	2	2	3
Declined accelerometry	21	14	11	15
Spurious/unusable data <sup>a</sup>	18	21	25	21
7 valid days <sup>b</sup>	17	20	16	17
6 valid days	13	11	13	13
5 valid days	8	9	14	11
4 valid days	4	7	8	6
3 valid days	3	5	6	4
2 valid days	3	6	2	4
1 valid day	3	3	1	2
0 valid days	6	3	2	4
Any days of valid wear	51	61	60	57
4 or more days of valid wear	42	47	51	47
4 or more days of valid wear including at least one weekend day	38	42	42	41
Average daily wear (minutes) <sup>c</sup>	735	761	803	769
<b>Bases (unweighted)</b>				
<i>Selected for accelerometer sample</i>				
Boys	271	296	276	843
Girls	267	307	290	864
<b>4 days of valid accelerometer wear</b>				
Boys	89	144	132	365
Girls	112	145	148	405

<sup>a</sup> Some accelerometers failed to record data and so no usable results were obtained; spurious data were recorded in a small number of cases, with implausibly high readings.

<sup>b</sup> Days were included as valid if the accelerometer was worn for at least 600 minutes (10 hours).

<sup>c</sup> This outcome variable was calculated for participants with 4 or more valid days.

Table 6.2

**Average daily physical activity profile,<sup>a</sup> by age and sex**Aged 4-15 with 4 or more days' valid  
accelerometry data

2008

Mean daily minutes spent in each intensity category <sup>b</sup>	Age group			Total
	4-7	8-11	12-15	
Boys				
Sedentary	374	424	484	427
Standard error of the mean	4.84	4.65	6.58	3.32
Light PA	273	270	237	260
Standard error of the mean	3.59	3.19	5.32	2.44
Moderate PA	111	71	47	76
Standard error of the mean	2.53	2.01	2.11	1.72
Vigorous PA	13	8	5	9
Standard error of the mean	0.91	0.58	0.72	0.56
MVPA	124	79	52	85
Standard error of the mean	3.09	2.28	2.46	2.03
Girls				
Sedentary	398	449	534	460
Standard error of the mean	4.41	3.86	4.83	2.46
Light PA	274	267	209	250
Standard error of the mean	2.91	3.00	4.20	1.85
Moderate PA	90	50	26	55
Standard error of the mean	2.16	1.58	1.52	1.07
Vigorous PA	11	6	2	6
Standard error of the mean	0.80	0.44	0.45	0.31
MVPA	101	55	28	61
Standard error of the mean	2.61	1.81	1.75	1.25
Bases (unweighted)				
Boys	89	144	132	365
Girls	112	145	148	405
Bases (weighted)				
Boys	116	138	138	392
Girls	123	121	141	385

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light PA (physical activity): 1.5 to below 4 METs

Moderate physical activity (MPA): 4 to below 7 METs

Vigorous physical activity (VPA): 7 or more METs

Moderate or vigorous activity (MVPA): All activity at 4 or more METs.

Table 6.3

**Average daily physical activity profile<sup>a</sup> for weekdays and weekend days, by age and sex**

Aged 4-15 with 4 or more days' valid accelerometry data

2008

Mean daily minutes spent in each intensity category <sup>b</sup>	Age group			Total
	4-7	8-11	12-15	
Boys				
Weekdays				
Sedentary	382	430	487	433
Standard error of the mean	5.76	4.68	7.08	3.53
Light PA	275	271	239	262
Standard error of the mean	4.10	3.25	5.55	2.58
Moderate PA	110	73	49	77
Standard error of the mean	2.76	2.05	2.29	1.78
Vigorous PA	13	8	5	9
Standard error of the mean	0.91	0.59	0.79	0.57
MVPA	123	81	55	86
Standard error of the mean	3.36	2.35	2.70	2.12
Weekend days				
Sedentary	347	400	473	407
Standard error of the mean	5.58	5.06	5.57	4.16
Light PA	267	270	225	254
Standard error of the mean	3.69	4.00	4.64	3.20
Moderate PA	111	62	38	70
Standard error of the mean	3.36	2.54	2.29	2.06
Vigorous PA	15	8	4	9
Standard error of the mean	1.29	0.85	0.68	0.74
MVPA	126	70	43	79
Standard error of the mean	4.02	2.88	2.56	2.40
Bases (unweighted)				
Weekdays	89	144	132	365
Weekend days	90	130	128	348
Bases (weighted)				
Weekdays	116	138	138	392
Weekend days	117	124	136	377

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.  
 Sedentary: below 1.5 METs  
 Light PA (physical activity): 1.5 to below 4 METs  
 Moderate physical activity (MPA): 4 to below 7 METs  
 Vigorous physical activity (VPA): 7 or more METs  
 Moderate or vigorous activity (MVPA): All activity at 4 or more METs.

Continued...

Table 6.3 continued

Aged 4-15 with 4 or more days' valid accelerometry data

2008

Mean daily minutes spent in each intensity category <sup>b</sup>	Age group			Total
	4-7	8-11	12-15	
Girls				
Weekdays				
Sedentary	405	454	542	467
Standard error of the mean	4.42	4.32	5.21	2.57
Light PA	277	268	209	251
Standard error of the mean	3.04	3.16	4.50	1.94
Moderate PA	89	52	28	57
Standard error of the mean	2.29	1.71	1.76	1.11
Vigorous PA	11	6	3	6
Standard error of the mean	0.82	0.45	0.49	0.32
MVPA	99	58	31	63
Standard error of the mean	2.80	1.94	2.02	1.31
Weekend days				
Sedentary	375	429	502	435
Standard error of the mean	5.81	4.99	4.08	3.63
Light PA	261	264	219	248
Standard error of the mean	3.46	3.83	3.54	2.50
Moderate PA	92	42	18	51
Standard error of the mean	3.15	2.25	1.69	1.59
Vigorous PA	12	6	2	6
Standard error of the mean	1.03	0.66	0.51	0.43
MVPA	103	47	20	57
Standard error of the mean	3.72	2.48	1.88	1.81
Bases (unweighted)				
Weekdays	112	145	148	405
Weekend days	106	140	132	378
Bases (weighted)				
Weekdays	123	121	141	385
Weekend days	115	115	119	349

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.  
 Sedentary: below 1.5 METs  
 Light PA (physical activity): 1.5 to below 4 METs  
 Moderate physical activity (MPA): 4 to below 7 METs  
 Vigorous physical activity (VPA): 7 or more METs  
 Moderate or vigorous activity (MVPA): All activity at 4 or more METs.



Table 6.4			
Average daily physical activity profile, <sup>a</sup> by tertile of equivalised household income and sex			
Aged 4-15 with 4 or more days' valid accelerometry data			2008
Average daily minutes spent in each intensity category <sup>b</sup>	Equivalised household income tertile		
	Highest	Middle	Lowest
<b>Boys</b>			
Sedentary	426	424	413
Standard error of the mean	6.98	4.94	6.57
Light PA	256	261	267
Standard error of the mean	4.85	3.40	4.26
Moderate PA	79	76	80
Standard error of the mean	2.62	2.66	3.79
Vigorous PA	7	9	9
Standard error of the mean	0.56	0.93	1.10
MVPA	81	85	93
Standard error of the mean	3.60	3.48	6.11
<b>Girls</b>			
Sedentary	464	463	452
Standard error of the mean	6.22	5.09	5.60
Light PA	243	248	255
Standard error of the mean	4.01	3.43	3.82
Moderate PA	56	52	57
Standard error of the mean	2.57	2.46	2.66
Vigorous PA	7	6	6
Standard error of the mean	0.60	0.68	0.61
MVPA	67	58	59
Standard error of the mean	3.45	3.50	2.69
<i>Bases (unweighted)</i>			
Boys	76	146	80
Girls	106	126	117
<i>Bases (weighted)</i>			
Boys	80	161	88
Girls	97	126	114

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light PA (physical activity): 1.5 to below 4 METs

Moderate physical activity (MPA): 4 to below 7 METs

Vigorous physical activity (VPA): 7 or more METs

Moderate or vigorous activity (MVPA): All activity at 4 or more METs.

Table 6.5		
Average daily physical activity profile, <sup>a</sup> by Spearhead status <sup>b</sup> and sex		
Aged 4-15 with 4 or more days' valid accelerometry data		2008
Average daily minutes spent in each intensity category <sup>c</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Boys</b>		
Sedentary	428	430
Standard error of the mean	4.55	5.92
Light PA	260	258
Standard error of the mean	3.04	3.80
Moderate PA	75	75
Standard error of the mean	2.32	3.15
Vigorous PA	9	8
Standard error of the mean	0.65	0.72
MVPA	84	83
Standard error of the mean	2.74	3.58
<b>Girls</b>		
Sedentary	465	468
Standard error of the mean	3.94	5.94
Light PA	248	246
Standard error of the mean	2.57	3.84
Moderate PA	53	53
Standard error of the mean	1.69	2.87
Vigorous PA	6	6
Standard error of the mean	0.42	0.55
MVPA	59	58
Standard error of the mean	1.99	3.24
<i>Bases (unweighted)</i>		
Boys	237	126
Girls	274	128
<i>Bases (weighted)</i>		
Boys	260	130
Girls	260	122

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>c</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light PA (physical activity): 1.5 to below 4 METs

Moderate physical activity (MPA): 4 to below 7 METs

Vigorous physical activity (VPA): 7 or more METs

Moderate or vigorous activity (MVPA): All activity at 4 or more METs.



Table 6.6

### Average daily physical activity profile,<sup>a</sup> by BMI category and sex

Aged 4-15 with 4 or more days' valid accelerometry data

2008

Average daily minutes spent in each intensity category<sup>b</sup> within BMI category<sup>c</sup>

Boys Girls

#### Not overweight or obese

Sedentary	423	464
Standard error of the mean	3.30	2.80
Light PA	260	249
Standard error of the mean	2.56	1.98
MVPA	86	63
Standard error of the mean	1.96	1.39
VPA	9	7
Standard error of the mean	0.60	0.36

#### Overweight

Sedentary	444	[461]
Standard error of the mean	8.37	6.55
Light PA	256	[245]
Standard error of the mean	4.83	4.67
MVPA	81	[58]
Standard error of the mean	4.12	3.87
VPA	8	[6]
Standard error of the mean	0.82	0.74

#### Obese

Sedentary	429	449
Standard error of the mean	9.59	6.42
Light PA	269	258
Standard error of the mean	5.02	4.79
MVPA	84	61
Standard error of the mean	2.51	2.31
VPA	7	5
Standard error of the mean	0.63	0.60

#### Bases (unweighted)

Not overweight or obese	240	279
Overweight	51	48
Obese	58	63

#### Bases (weighted)

Not overweight or obese	265	261
Overweight	52	48
Obese	60	61

<sup>a</sup> The data in this table have been adjusted for average wear time using regression techniques, to allow comparisons between groups with different average wear time.

<sup>b</sup> Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting.

Sedentary: below 1.5 METs

Light PA (physical activity): 1.5 to below 4 METs

Moderate physical activity (MPA): 4 to below 7 METs

Vigorous physical activity (VPA): 7 or more METs

Moderate or vigorous activity (MVPA): All activity at 4 or more METs.

<sup>c</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

[ ] Results in brackets should be treated with caution because of the low base size (below 50).

Table 6.7

**Objective summary activity levels, by age and sex**

Aged 4-15 with 7 days' valid accelerometry data

2008

Objective summary activity level <sup>a</sup>	Age group		Total
	4-10	11-15	
	%	%	%
<b>Boys</b>			
Meets recommendations	51	7	33
Some activity	22	18	20
Low activity	28	75	47
<b>Girls</b>			
Meets recommendations	34	-	21
Some activity	28	4	18
Low activity	39	96	61
<i>Bases (unweighted)</i>			
Boys	74	58	132
Girls	90	61	151
<i>Bases (weighted)</i>			
Boys	83	59	142
Girls	86	56	141

<sup>a</sup> Meets recommendations: 60 minutes or more at least moderate activity on all seven days  
 Some activity: 30-59 minutes on all seven days  
 Low activity: lower level of activity.

Table 6.8

**Objective summary activity levels, by tertile of equivalised household income and sex**

Aged 4-15 with 7 days' valid accelerometry data

2008

Objective summary activity level <sup>a</sup>	Equivalised household income tertile		
	Highest	Middle	Lowest
	%	%	%
<b>Boys</b>			
Meets recommendations	[32]	33	b
Some activity	[12]	23	b
Low activity	[55]	45	b
<b>Girls</b>			
Meets recommendations	[27]	[17]	[19]
Some activity	[22]	[18]	[14]
Low activity	[51]	[65]	[68]
<i>Bases (unweighted)</i>			
Boys	33	58	27
Girls	45	44	43
<i>Bases (weighted) 7 days of valid data</i>			
Boys	35	67	25
Girls	41	44	40

<sup>a</sup> Meets recommendations: 60 minutes or more at least moderate activity on all seven days

Some activity: 30-59 minutes on all seven days

Low activity: lower level of activity.

<sup>b</sup> Data not shown because of small base size (below 30).

[ ] Results in brackets should be treated with caution because of the low base size (below 50).

Table 6.9

**Objective summary activity levels, by Spearhead status<sup>a</sup> and sex**

Aged 4-15 with 7 days' valid  
accelerometry data

2008

Objective summary activity level <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
	%	%
<b>Boys</b>		
Meets recommendations	30	[39]
Some activity	19	[23]
Low activity	51	[38]
<b>Girls</b>		
Meets recommendations	20	[20]
Some activity	17	[22]
Low activity	63	[58]
<i>Bases (unweighted)</i>		
Boys	87	45
Girls	101	47
<i>Bases (weighted)</i>		
Boys	97	45
Girls	94	44

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Meets recommendations: 60 minutes or more at least moderate activity on all seven days  
Some activity: 30-59 minutes on all seven days  
Low activity: lower level of activity.

[ ] Results in brackets should be treated with caution because of the low base size (below 50).

Table 6.10

**Objective summary activity levels, by self-reported summary activity levels and sex**

Aged 4-15 with 7 days' valid  
accelerometry data

2008

Objective summary activity level (accelerometer) <sup>a</sup>	Self-reported summary activity levels		
	Meets recommendations	Some activity	Low activity
	%	%	%
<b>Boys</b>			
Meets recommendations	[53]	26	[14]
Some activity	[16]	25	[18]
Low activity	[32]	49	[68]
<b>Girls</b>			
Meets recommendations	[34]	21	[7]
Some activity	[26]	17	[16]
Low activity	[40]	62	[77]
<i>Bases (unweighted)</i>			
Boys	42	57	32
Girls	30	87	33
<i>Bases (weighted)</i>			
Boys	47	60	34
Girls	28	81	32

<sup>a</sup> Meets recommendations: 60 minutes or more at least moderate activity on all seven days  
Some activity: 30-59 minutes on all seven days  
Low activity: lower level of activity.

[ ] Results in brackets should be treated with caution because of the low base size (below 50).

Table 6.11

**Comparison of objective<sup>a</sup> and self-reported average daily MVPA time, by age and sex***Aged 4-15 with 4 or more days' valid accelerometry data (accelerometry)/ aged 4-15 (self-reported)*

2008

Average daily minutes spent in MVPA <sup>b</sup>	Age group			Total
	4-7	8-11	12-15	
Boys				
Objective				
MVPA	124.0	78.7	51.7	84.8
Standard error of the mean	3.09	2.28	2.46	2.03
Self-reported				
MVPA	82.9	81.4	83.9	82.8
Standard error of the mean	2.95	2.84	2.91	1.92
Girls				
Objective				
MVPA	100.5	55.2	28.2	61.3
Standard error of the mean	2.61	1.81	1.75	1.25
Self-reported				
MVPA	81.4	73.8	57.5	70.5
Standard error of the mean	2.92	2.65	2.22	1.8
Bases (unweighted)				
Boys				
Objective	89	144	132	365
Self-reported	972	989	1042	3003
Girls				
Objective	112	145	148	405
Self-reported	944	1068	1021	3033
Bases (weighted)				
Boys				
Objective	116	138	138	392
Self-reported	895	953	1008	2856
Girls				
Objective	123	121	141	385
Self-reported	856	908	951	2715

<sup>a</sup> Measured by accelerometer.<sup>b</sup> MVPA: moderate to vigorous physical activity. Metabolic Equivalent (MET) is defined as the ratio of work metabolic rate to a standard resting metabolic rate. 1 MET is considered a resting metabolic rate obtained during quiet sitting. MVPA: All activity at 4 or more METs.

# Anthropometric measures, overweight and obesity

## 7

Vasant Hirani

### Summary

- This chapter reports on measurements relevant to obesity: body mass index (BMI), prevalence of overweight and obesity, and waist circumference.
- Body mass index (BMI), defined as weight in kilograms divided by the square of the height in metres ( $\text{kg}/\text{m}^2$ ), was used to assign adult participants into categories such as overweight or obese.
- Mean BMI was higher in men than women,  $27.2\text{kg}/\text{m}^2$  compared with  $26.9\text{kg}/\text{m}^2$ . Mean BMI increased with age in both sexes up to the age group 65-74.
- 66% of men and 57% of women were overweight or obese. Almost a quarter of adults (24% of men and 25% of women) were obese.
- Mean waist circumference was 97.2cm in men and 87.4cm in women. The prevalence of raised waist circumference increased with age in both sexes. The proportion of participants with a raised waist circumference was higher in women (44%) than men (34%).
- Among women, age-standardised mean BMI and the prevalence of obesity and raised waist circumference increased from highest to lowest quintile of equivalised household income. These measures were not related to income in men.
- National Institute for Health and Clinical Excellence (NICE) guidelines define low, high and very high waist measurements for men and women. A high or very high waist circumference is associated with increased health risks for those with a BMI below  $35\text{kg}/\text{m}^2$ ; health risks are very high for those with a BMI of  $35\text{kg}/\text{m}^2$  or more with any waist circumference.
- Using the NICE categories, most men and women who were overweight or obese tended also to have a high or very high waist circumference, and were therefore at increased health risk. Using combined categories of BMI and waist circumference to assess risk, 20% of men were estimated to be at increased risk, 14% at high risk and 21% at very high risk. The equivalent proportions for women were 15% at increased risk, 17% at high risk and 24% at very high risk.
- The proportion who were obese has gradually increased over the period examined by the HSE, from 13% of men in 1993 to 24% in 2008 and from 16% of women in 1993 to 25% in 2008.
- Among men, the proportion who were overweight or obese increased from 58% in 1993 to 66% in 2008, while the proportion of overweight or obese women increased from 49% in 1993 to 57% in 2008. Most of the increase in men and women occurred in the first half of this period.

## 7.1. Introduction

### 7.1.1. Contents of the chapter

The anthropometric measures presented in this chapter for adults (aged 16 and over) focus on measurements relevant to obesity. Height and weight data have been collected in each year of the Health Survey series, and waist circumference in most years. Height and weight data were used to calculate Body Mass Index (BMI); waist circumference was used to assess central obesity. First, the methods and definitions of these measurements are described. Relationships are examined between BMI, overweight, obesity and raised waist circumference prevalence, and Strategic Health Authority (SHA), equivalised household income and Spearhead PCT status. Participants are then classified according to the National Institute for Health and Clinical Excellence (NICE) obesity categories for health risk.

### 7.1.2. Context

The prevalence of obesity in England is increasing at all ages; almost two-thirds of adults and a third of children are either overweight or obese.<sup>1</sup> In 2007, 41% of men and 32% of women were overweight and 24% were classified as obese, i.e. 65% of men and 56% of women were either overweight or obese.<sup>2</sup> The UK has the highest levels of obesity in Europe.<sup>3</sup> Based on trends up to 2003, it has been forecast that by the year 2010 almost one third of all English adults will be obese.<sup>4</sup> However, there has been little change in the levels of obesity in the last five years, and it is possible that the rising trend may be slowing, or (at least temporarily) flattening.

Obesity is a major public health problem due to its association with serious chronic diseases such as type 2 diabetes, hypertension (high blood pressure), and hyperlipidaemia (high levels of fats in the blood that can lead to narrowing and blockages of blood vessels), which are major risk factors for cardiovascular disease<sup>5</sup> and cardiovascular related mortality. Obesity is also associated with cancer, disability, reduced quality of life, and can lead to premature death.<sup>6,7,8,9</sup> The annual cost of treating co-morbidities related to overweight and obesity is estimated to be £4.2 billion and is forecast to more than double by 2050.<sup>10</sup>

It is generally recognised that the central deposition of fat (abdominal or visceral obesity) is closely associated with chronic diseases and is a key constituent of the metabolic syndrome,<sup>11</sup> a disorder characterised by increased risk of developing diabetes and cardiovascular disease. It was highlighted in a World Health Organisation (WHO) report in 2000<sup>12</sup> that the co-morbidities of obesity would be more easily predicted if intra-abdominal fat were also monitored, in addition to BMI, by simple measures such as waist circumference. The NICE guidance in 2006<sup>13</sup> includes a combination of BMI and waist circumference in order to classify health risk from obesity.

It is well established that the increase in prevalence of obesity in the United Kingdom is mostly due to lifestyle factors such as a high energy intake, reflecting the modern diet, and a sedentary lifestyle.<sup>10</sup> Evidence indicates that the incorporation of physical activity into individuals' lifestyles will result in health benefits. In the UK, the government's aim is to be the first major country to reverse the rise in overweight and obesity in the population, with an initial focus on children. The government has acknowledged in its latest obesity strategy the importance of incorporating physical activity into daily life to tackle obesity.<sup>10</sup> The public health white paper *Choosing Health: Making healthy choices easier*<sup>14</sup> set out the government's commitments for action on obesity. *Choosing a Better Diet, Food and Health Action Plan*<sup>15</sup> and *Choosing Activity: a physical activity action plan*<sup>16</sup> specified the action that needs to be taken at national, regional and local level to combat obesity and improve people's health through better diet and nutrition and increasing physical activity. It was also highlighted in the 2008 *UK Obesity Strategy* that there is a need for individuals to increase their knowledge and understanding of healthy eating, lifestyle factors, and causes and consequences of the rise in unhealthy weight.<sup>10</sup> Moreover, NICE has developed national guidance<sup>13</sup> for healthcare organisations (both within and external to the NHS) on prevention, identification, assessment and management of overweight and obesity.

### 7.1.3. Trend data

This chapter examines 2008 data in detail, and also looks at trends in obesity and overweight since 1993. Trend data on adult and child obesity, and other key measures, can also be found in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre website.<sup>17</sup> Previous years' reports have included more detailed exploration of the factors associated with obesity measures. The 2007 report included a regression analysis of the risk factors for those classified as 'most at risk' according to the NICE categories using BMI and waist circumference criteria;<sup>2</sup> the 2006 report included a regression analysis exploring the risk factors associated with a raised waist circumference;<sup>18</sup> and the 2003 report included a regression analysis of risk factors associated with overweight and obesity.<sup>19</sup>

## 7.2. Methods and definitions

Full details of the protocols for carrying out all the measurements are contained in Volume 2 of this report, Methods and documentation, Appendix B, and are briefly summarised here. Height and weight were measured during the interviewer visit while waist and hip circumferences were measured during the nurse visit.<sup>20</sup>

### 7.2.1. Methods

#### Height

Height was measured using a portable stadiometer with a sliding head plate, a base plate and three connecting rods marked with a metric measuring scale. Participants were asked to remove their shoes. One measurement was taken, with the participant stretching to the maximum height and the head positioned in the Frankfort plane.<sup>21</sup> The reading was recorded to the nearest millimetre. Participants who were unable to stand or were unsteady on their feet were not measured.

#### Weight

Weight was measured using Soehnle, Seca or Tanita electronic scales with a digital display. Participants were asked to remove their shoes and any bulky clothing. A single measurement was recorded to the nearest 100g. Participants who were pregnant, unable to stand, or unsteady on their feet were not weighed. Participants who weighed more than 130kg were asked for their estimated weights because the scales are inaccurate above this level. These estimated weights were included in the analysis.

In the analysis of height and weight, data from those who were considered by the interviewer to have unreliable measurements, for example those who had excessive clothing on, were excluded from the analysis.

#### Waist circumference

The waist was defined as the midpoint between the lower rib and the upper margin of the iliac crest. It was measured using a tape with an insertion buckle at one end. The measurement was taken twice, using the same tape, and was recorded to the nearest millimetre. Those whose two waist measurements differed by more than 3cm had a third measurement taken. The mean of the two valid measurements (the two out of the three measurements that were the closest to each other, if there were three measurements) were used in the analysis.

Participants were excluded from waist measurements if they reported that they had a colostomy or ileostomy, or were pregnant or unable to stand. All those with measurements considered unreliable by the nurse, for example due to excessive clothing or movement, were also excluded from the analysis.



## Response to anthropometric measures

Response rates to anthropometric measurements are shown in Table 7.1. Generally, the response rate to anthropometric measurements varied between 85% and 98%, and there was little variation by age, except among those aged 75 and over where response was lowest. This reflected inability to provide the measurements, rather than unwillingness, among the older age group.

Table 7.1

### 7.2.2. Definitions

#### Body mass index (BMI)

In order to define overweight or obesity, a measurement is required that allows for differences in weight due to height. A widely accepted measure of weight for height, the Body Mass Index (BMI), defined as weight in kilograms divided by the square of the height in metres ( $\text{kg/m}^2$ ), has been used for this purpose in the Health Survey series.

BMI was calculated for all those participants for whom both a valid height and weight measurement were recorded. Adult participants were classified into the following BMI groups according to the WHO and NICE BMI classification.<sup>13,22</sup>

BMI ( $\text{kg/m}^2$ )	Description
Less than 18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight
30 or more	Obese
40 or more	Morbidly obese

BMI categories of overweight and obesity have frequently been combined to show the proportion who are either overweight or obese. As in the 1998, 2003, 2005, 2006 and 2007 reports, a sub-set of the obese category has also been defined, namely those with morbid obesity (BMI  $40\text{kg/m}^2$  or more) who are at highest risk of morbidity and mortality.<sup>23</sup>

#### Waist measurement

BMI does not distinguish between mass due to body fat and mass due to muscular physique. It also does not take account of the distribution of fat. It has therefore been postulated that waist circumference may be a better measure than BMI or waist to hip ratio (WHR)<sup>24</sup> to identify those with a health risk from being overweight.

A raised waist circumference has been taken to be greater than 102cm in men and greater than 88cm in women, in accordance with the definition of abdominal obesity used by the National Institutes of Health (USA) ATP (Adult Treatment Panel) III.<sup>25</sup> These levels identified people at risk of the metabolic syndrome, a disorder characterised by increased risk of developing diabetes and cardiovascular disease. It has been shown recently that these cut-offs corresponded fairly closely to the 95th percentile of waist circumference for healthy people, indicating that few healthy people have a waist circumference above these cut-offs.<sup>26</sup>

#### Combined assessment of health risk from obesity

The NICE evidence-based guidelines include details on prevention, identification, assessment and management of overweight and obesity, with one aim being to increase health professionals' awareness of how to manage overweight and obesity in primary care.<sup>13</sup> The guidelines highlight the impact of overweight and obesity on risk factors for developing other long-term health problems such as coronary heart disease, type 2 diabetes, osteoarthritis and some cancers. It states that risk of these co-morbidities should be identified using both BMI and waist circumference as assessment tools in those with a BMI less than  $35\text{kg/m}^2$ . The NICE guidance states that 'waist circumference is a valid measure of abdominal fat mass and disease risk in individuals with a BMI less than 35. If BMI is 35 or more, waist circumference adds little to the absolute measure of risk provided by BMI'. The NICE categories are defined as follows:

BMI classification	Waist circumference		
	Low	High	Very high
Normal weight	No increased risk	No increased risk	Increased risk
Overweight (25 to less than 30kg/m <sup>2</sup> )	No increased risk	Increased risk	High risk
Obesity I (30 to less than 35kg/m <sup>2</sup> )	Increased risk	High risk	Very high risk

Source: NICE guidelines<sup>13</sup>

For men, low waist circumference is defined as less than 94cm, high as 94–102cm, and very high as greater than 102cm. For women, low waist circumference is less than 80cm, high is 80–88cm and very high is greater than 88cm.

NICE also defines categories of Obesity II (35 to less than 40kg/m<sup>2</sup>) and Obesity III (40kg/m<sup>2</sup> or more). For adults with a BMI of 35kg/m<sup>2</sup> or more, risks are assumed to be very high with any waist circumference.<sup>13</sup>

Note that these combined measures (Table 7.10) are based on all adults with valid height, weight and waist circumference measurements. The data therefore may vary slightly from those for mean BMI and BMI categories (Table 7.2) which are based on adults with valid height and weight measurements.

## 7.3. Prevalence of overweight, obesity and raised waist circumference

### 7.3.1. Prevalence of overweight, obesity and raised waist circumference by age

Table 7.2 shows mean BMI and BMI status (WHO categories) by age and sex. Mean BMI was higher in men than women, 27.2kg/m<sup>2</sup> compared with 26.9kg/m<sup>2</sup>. Mean BMI increased with age in both sexes from age group 16-24 up to the age group 65-74; in men from 23.7kg/m<sup>2</sup> to 28.7kg/m<sup>2</sup> and in women from 24.3kg/m<sup>2</sup> to 28.5kg/m<sup>2</sup>.

Figure 7A shows the prevalence of overweight and obesity by age. Almost a quarter of adults (24% of men and 25% of women) were obese, and 66% of men and 57% of women were overweight or obese. 33% of men and 41% of women had a BMI in the normal range. Prevalence of overweight and obesity was lowest in the 16-24 age group, and generally higher in the older age groups among both men and women.

Table 7.2, Figure 7A

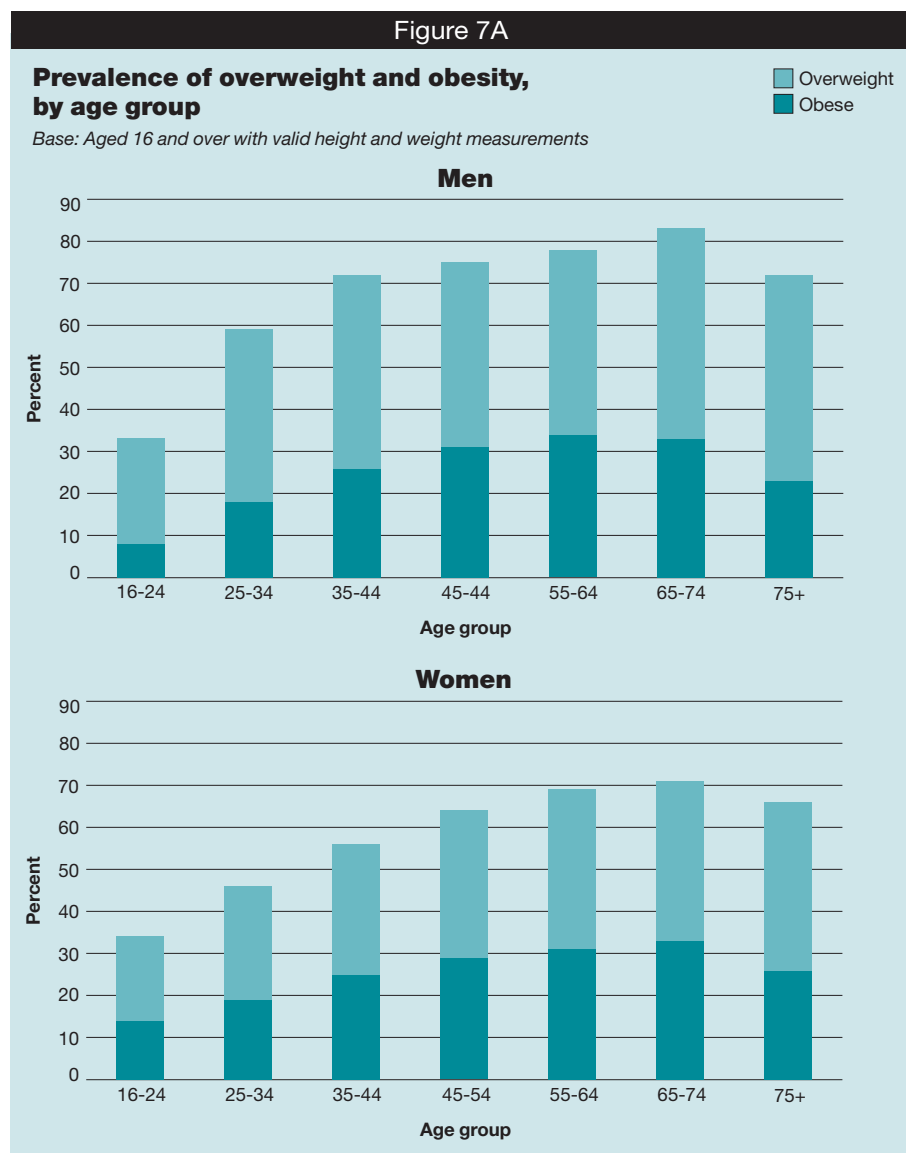
Table 7.6 shows the distribution of mean waist circumference and prevalence of raised waist circumference by age and sex. Mean waist circumference and prevalence of raised waist circumference increased with age in both sexes. In men, mean waist circumference was 84.7cm among those aged 16-24 and 102.2cm among those aged 75 and over; among women the equivalent figures were 79.4cm and 91.5cm. The proportion with a raised waist circumference ranged from 9% to 48% among men and from 23% to 61% among women in the same age groups. Overall, women were significantly more likely than men to have a raised waist circumference (44% and 34% respectively, and this was seen for each age group.

Table 7.6

### 7.3.2. Prevalence of overweight, obesity and raised waist circumference by Strategic Health Authority (SHA)

Table 7.3 presents the observed and age-standardised prevalence of overweight and obesity by Strategic Health Authority (SHA). There was no significant difference in age-standardised mean BMI, prevalence of overweight including obesity or obesity by SHA.

The distribution of waist circumference by SHA is presented in Table 7.7. As with BMI measures, there was no significant variation in the distribution of age-standardised mean



waist circumference by SHA. Similarly, there was no significant variation in the age-standardised prevalence of raised waist circumference by SHA in women, but this varied significantly by SHA in men, although no particular region stood out. **Tables 7.3, 7.7**

### 7.3.3. Prevalence of overweight, obesity and raised waist circumference by equivalised household income

Table 7.4 presents age-standardised BMI by equivalised household income. Mean BMI varied significantly with income in women, increasing as income decreased, from 26.0kg/m<sup>2</sup> in the highest income quintile to 27.7kg/m<sup>2</sup> in the lowest income quintile. Mean BMI did not vary with income in men.

The prevalence of obesity also showed an inverse relationship with income in women; obesity was more prevalent among those in the lowest income quintile (31%) than those in the highest income quintile (20%). This pattern was not apparent in men. Prevalence of overweight including obesity did not vary by income. **Table 7.4, Figure 7B**

Table 7.8 shows age-standardised mean waist circumference and the prevalence of raised waist circumference by equivalised household income, and Figure 7C shows these data for raised waist circumference. Corresponding with the BMI measures, there were different patterns for men and women. In women, mean waist circumference was highest for those in the lowest income quintile (89.8cm) and lowest in those in the highest income quintile (85.0cm). Likewise, the prevalence of raised waist circumference was higher among women in the lowest quintile (51%) and lowest in women in the highest quintile of income (37%). As for the BMI measures, there was no equivalent pattern in men. **Table 7.8, Figure 7C**

Figure 7B

**Age-standardised prevalence of overweight and obesity, by equivalised household income and sex**

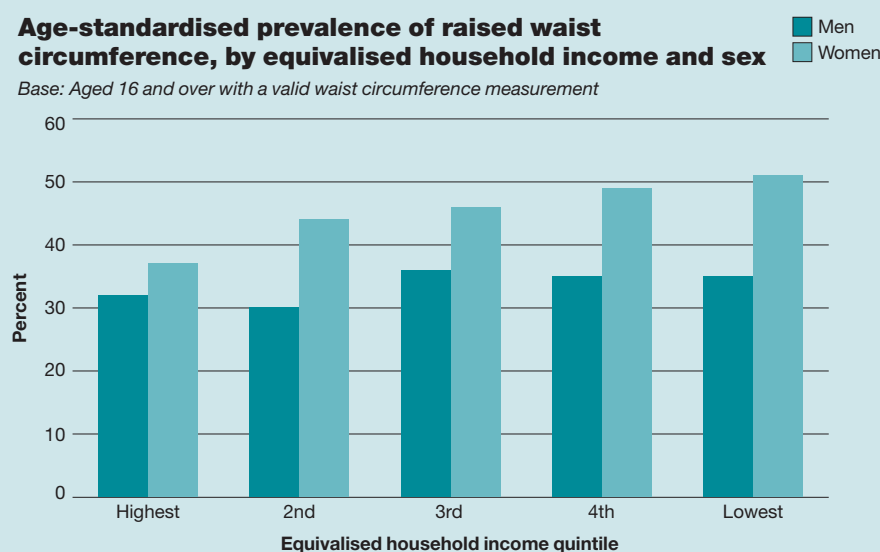
Base: Aged 16 and over with valid height and weight measurements



Figure 7C

**Age-standardised prevalence of raised waist circumference, by equivalised household income and sex**

Base: Aged 16 and over with a valid waist circumference measurement



7.3.4. Prevalence of overweight, obesity and raised waist circumference by Spearhead status

There was no significant variation in mean BMI, prevalence of overweight, or prevalence of obesity by Spearhead status.<sup>27</sup> Mean waist circumference did not vary by Spearhead status, nor was there any variation in the proportion with raised waist circumference by Spearhead status.

Tables 7.5, 7.9

7.4 Health risk category with overweight, obesity and waist circumference

NICE guidelines on prevention, identification, assessment and management of overweight and obesity highlight the impact of overweight and obesity on risk factors for developing other long-term health problems. The recommendation is to use both BMI and waist circumference as assessment tools to identify the risk of co-morbidities, and different levels of health risk have been defined for different combinations of these two measures (as outlined in section 7.2.2). The NICE guidance states that for those with a BMI of 35 or more, waist circumference adds little to the absolute measure of risk provided by BMI.<sup>13</sup>

Table 7.10 shows the proportion by age and sex that were in different health risk categories, as determined by the combination of measures of generalised obesity (BMI) and abdominal obesity (waist circumference). Using combined categories of BMI and waist circumference to assess risk, 20% of men were at increased risk, 14% at high risk and 21% at very high risk. The equivalent proportions for women were 15% at increased risk, 17% at high risk and 24% at very high risk.

Those who were overweight and had a high waist circumference were defined as being at **increased risk** of health problems from obesity. This group also included the very small proportions who were normal weight but with a very high waist circumference (less than 1% of men and 3% of women), or obese I but with a low waist circumference (less than 1% of both men and women). The proportion with increased risk was 20% for men and 15% for women. The prevalence of increased risk was lowest among the youngest age groups.

Those who were overweight with a very high waist circumference were defined as being at **high risk** of health problems (11% of men and 16% of women). In addition small proportions who were in the obesity I group with a high waist circumference (3% of men and 1% of women) were also defined as high risk, so that overall 14% of men and 17% of women were in this category. Prevalence increased with age.

As indicated above, those who were obese (category I) had **increased health risks**, even with a low waist circumference (less than 1% of men and women). 3% of men and 1% of women were categorised as obese I with a high waist circumference (**high risk**). A further 16% of men and 15% of women were categorised as obese I with a very high waist circumference (**very high risk**).

People who are obese II or III (BMI 35 and over) are defined as being at **very high risk** of health problems, regardless of their waist circumference. 5% of men and 6% of women were in the obese II group; 1% of men and 2% of women were in the obese III group.

Table 7.10

7.5 Trends in obesity

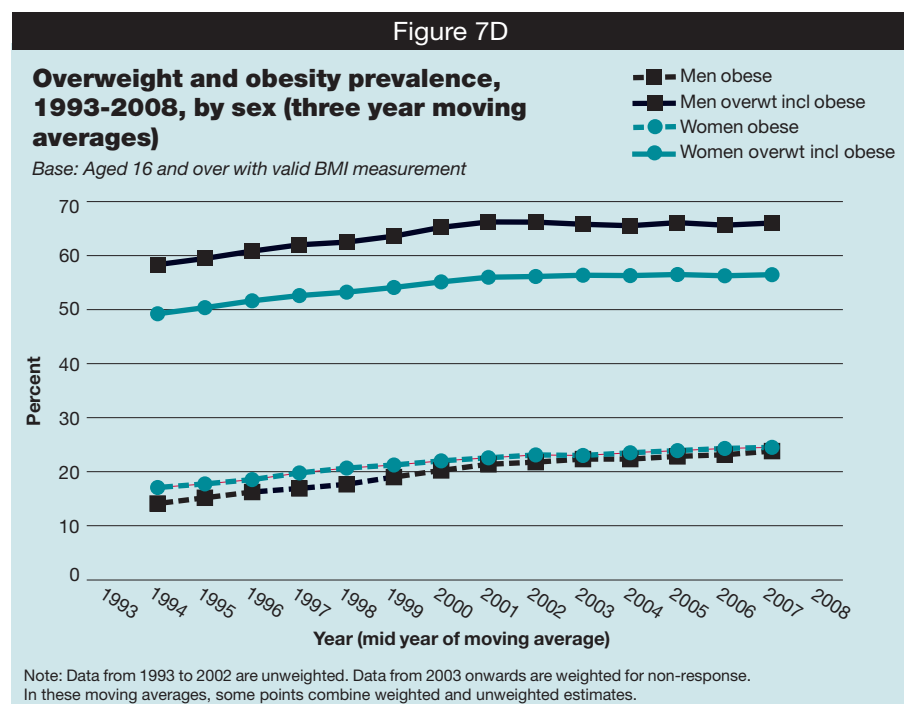
Between 1993 (the first year of HSE measures) and 2008, there has been a marked increase in the proportion who were obese, a proportion that has gradually increased over the period examined. The proportion who were categorised as obese (BMI 30kg/m<sup>2</sup> or over) increased from 13% of men in 1993 to 24% in 2008 and from 16% of women in 1993 to 25% in 2008. However, the rate of increase in obesity prevalence has been slower in the second half of the period than the first half, and there are indications that the trend may be flattening out,

at least temporarily. However, it is too soon to tell whether there continues to be a very gradual upward trend, with obesity in women in 2008 at its highest level since 1993 (though not significantly different from 2007).

Among men, the proportion who were overweight or obese (BMI 25kg/m<sup>2</sup> or more) increased from 58% in 1993 to 68% in 2001, since when it has fluctuated between 65% and 67% each year, being 66% in 2008. Similarly, the proportion of women who were overweight or obese increased from 49% in 1993 to 57% in 2001, fluctuating at around this level since then; it was 57% in 2008. This pattern therefore broadly matches the pattern for obesity.

Figure 7D shows the trends in obesity, and overweight including obesity, using three year moving averages to smooth out any unusually high or low values in individual years.

Table 7.11, Figure 7D



## References and notes

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- 21 The Frankfort Plane is an imaginary line passing through the external ear canal and across the top of the lower bone of the eye socket, immediately under the eye. A participant's head is positioned so that the Frankfort Plane is horizontal. In this position the headplate of the stadiometer will rest on the crown of the head.
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- 7.1 Response to anthropometric measurements, by age and sex
- 7.2 Body Mass Index (BMI), overweight and obesity prevalence, by age and sex.
- 7.3 Body Mass Index (BMI), overweight and obesity prevalence (observed and age-standardised), by Strategic Health Authority and sex
- 7.4 Body Mass Index (BMI), overweight and obesity prevalence (age-standardised), by equivalised household income and sex
- 7.5 Body Mass Index (BMI), overweight and obesity prevalence (age-standardised), by Spearhead status and sex
- 7.6 Waist circumference, by age and sex
- 7.7 Waist circumference (observed and age-standardised), by Strategic Health Authority and sex
- 7.8 Waist circumference (age-standardised), by equivalised household income and sex
- 7.9 Waist circumference (age-standardised), by Spearhead status and sex
- 7.10 Health risk category associated with overweight and obesity based on Body Mass Index (BMI) and waist circumference, by age and sex
- 7.11 Trends in overweight and obesity prevalence, 1993 to 2008, by age and sex

Table 7.1

**Response to anthropometric measurements, by age and sex***Aged 16 and over who were interviewed/had a nurse visit<sup>a</sup>*

2008

Proportion providing valid measurement	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Height	92	89	89	89	90	85	77	88
Weight	90	88	87	88	89	87	83	88
BMI	90	88	87	87	89	84	76	87
Waist circumference	98	98	98	98	98	96	96	98
<b>Women</b>								
Height	91	93	92	89	90	85	72	89
Weight	88	91	88	87	88	85	80	87
BMI	88	91	88	86	87	83	70	85
Waist circumference	99	97	97	97	98	96	93	97
<i>Bases (unweighted)</i>								
<i>Men</i>								
Height, weight, BMI (interviewed)	774	955	1222	1101	1184	875	649	6760
Waist circumference (saw nurse)	498	620	848	802	890	641	490	4789
<i>Women</i>								
Height (interviewed)	920	1220	1514	1374	1367	1000	947	8342
Weight, BMI (interviewed)	897	1131	1482	1371	1367	1000	947	8195
Waist circumference (saw nurse)	566	803	1056	1004	1056	706	653	5844
<i>Bases (weighted)</i>								
<i>Men</i>								
Height, weight, BMI (interviewed)	1137	1213	1416	1211	1087	726	540	7330
Waist circumference (saw nurse)	805	859	1006	862	773	515	384	5204
<i>Women</i>								
Height (interviewed)	1091	1216	1433	1233	1124	800	785	7682
Weight, BMI (interviewed)	1067	1123	1401	1230	1124	800	785	7530
Waist circumference (saw nurse)	749	802	997	876	802	569	557	5352

<sup>a</sup> Excluding pregnant women.

Table 7.2

**Body Mass Index (BMI), overweight and obesity prevalence, by age and sex**

Aged 16 and over with both valid height and weight measurements

2008

BMI (kg/m <sup>2</sup> ) and BMI status (%) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
Mean BMI (kg/m <sup>2</sup> )	23.7	26.5	27.8	28.1	28.5	28.7	27.4	27.2
Standard error of the mean	0.18	0.17	0.14	0.15	0.14	0.17	0.18	0.07
% Underweight	7	1	1	0	0	0	0	2
% Normal	60	41	27	25	21	17	28	33
% Overweight	25	41	46	44	44	50	49	42
% Obese, excluding morbidly obese	7	17	24	30	32	31	22	23
% Morbidly obese	0	1	2	1	2	2	0	1
% Overweight, including obese	33	58	73	74	78	83	72	66
% Obese	8	18	26	31	34	33	23	24
Women								
Mean BMI (kg/m <sup>2</sup> )	24.3	25.8	27.1	27.7	28.0	28.5	27.2	26.9
Standard error of the mean	0.19	0.17	0.17	0.17	0.16	0.18	0.19	0.07
% Underweight	5	2	2	1	1	1	2	2
% Normal	60	53	42	35	31	27	32	41
% Overweight	20	27	31	35	38	38	40	32
% Obese, excluding morbidly obese	13	16	21	26	28	30	25	22
% Morbidly obese	1	3	4	3	3	4	1	3
% Overweight, including obese	34	45	56	64	69	72	66	57
% Obese	14	19	25	29	31	33	26	25
Bases (unweighted)								
Men	695	848	1071	959	1053	737	490	5853
Women	787	1026	1309	1176	1196	828	661	6983
Bases (weighted)								
Men	1029	1068	1243	1059	968	610	409	6385
Women	935	1020	1241	1057	985	663	549	6450

<sup>a</sup> Underweight: less than 18.5 kg/m<sup>2</sup>Normal weight : 18.5 to less than 25 kg/m<sup>2</sup>Overweight: 25 to less than 30 kg/m<sup>2</sup>Obese, excluding morbidly obese: 30 to less than 40 kg/m<sup>2</sup>Morbidly obese: 40 kg/m<sup>2</sup> or moreOverweight, including obese: 25 kg/m<sup>2</sup> or moreObese: 30 kg/m<sup>2</sup> or more

Table 7.3

**Body Mass Index (BMI), overweight and obesity prevalence (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with both valid height and weight measurements

2008

BMI (kg/m <sup>2</sup> ) and BMI status (%) <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Mean BMI (kg/m <sup>2</sup> )	26.9	27.3	27.2	27.0	27.3	27.1	26.6	27.5	27.1	27.7
Standard error of the mean	0.41	0.16	0.20	0.22	0.23	0.20	0.19	0.27	0.23	0.19
% Underweight	1	1	1	3	3	1	2	1	0	1
% Normal	35	30	33	31	30	33	38	30	35	30
% Overweight	41	45	39	45	41	43	39	43	40	42
% Obese, excluding morbidly obese	22	22	26	21	25	21	21	25	24	26
% Morbidly obese	2	1	1	1	1	1	1	1	1	2
% Overweight, including obese	64	68	66	67	67	65	60	69	65	69
% Obese	23	23	26	22	26	23	21	26	25	27
<b>Standardised</b>										
Mean BMI (kg/m <sup>2</sup> )	27.2	27.3	27.2	27.0	27.2	27.0	26.8	27.3	27.1	27.5
Standard error of the mean	0.32	0.16	0.20	0.22	0.23	0.20	0.19	0.29	0.22	0.20
% Underweight	1	1	1	3	3	1	2	1	0	1
% Normal	33	30	33	31	30	34	35	32	34	31
% Overweight	41	45	40	45	41	43	39	42	40	41
% Obese, excluding morbidly obese	23	22	25	20	25	21	22	24	24	25
% Morbidly obese	2	1	1	1	1	1	1	1	1	1
% Overweight, including obese	66	68	66	67	67	64	63	67	65	68
% Obese	25	24	26	21	26	22	23	25	25	27
<b>Bases (unweighted)</b>										
Men	363	828	607	561	595	700	670	459	451	619
<b>Bases (weighted)</b>										
Men	342	830	629	568	679	723	935	503	502	675

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Underweight: less than 18.5 kg/m<sup>2</sup>

Normal weight : 18.5 to less than 25 kg/m<sup>2</sup>

Overweight: 25 to less than 30 kg/m<sup>2</sup>

Obese, excluding morbidly obese: 30 to less than 40 kg/m<sup>2</sup>

Morbidly obese: 40 kg/m<sup>2</sup> or more

Overweight, including obese: 25 kg/m<sup>2</sup> or more

Obese: 30 kg/m<sup>2</sup> or more

Continued...

Table 7.3 continued

Aged 16 and over with both valid height and weight measurements

2008

BMI (kg/m <sup>2</sup> ) and BMI status (%) <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Women</b>										
<b>Observed</b>										
Mean BMI (kg/m <sup>2</sup> )	27.1	26.8	27.1	27.2	27.3	26.8	26.1	26.8	26.9	26.9
Standard error of the mean	0.31	0.19	0.20	0.24	0.20	0.21	0.22	0.25	0.24	0.20
% Underweight	2	2	1	1	2	3	3	2	1	1
% Normal	40	42	39	38	37	40	47	44	42	41
% Overweight	30	32	33	36	32	33	29	29	32	34
% Obese, excluding morbidly obese	24	22	24	22	26	21	20	22	22	20
% Morbidly obese	4	3	3	3	3	3	2	3	3	3
% Overweight, including obese	57	56	60	61	60	57	50	54	57	58
% Obese	28	24	26	25	28	24	22	25	25	23
<b>Standardised</b>										
Mean BMI (kg/m <sup>2</sup> )	27.4	26.8	27.1	27.1	27.3	26.8	26.4	26.8	26.9	26.9
Standard error of the mean	0.28	0.19	0.20	0.24	0.20	0.21	0.23	0.26	0.23	0.21
% Underweight	2	2	2	1	2	2	3	2	1	1
% Normal	39	42	39	38	38	40	44	44	41	41
% Overweight	30	32	34	35	32	33	30	29	32	34
% Obese, excluding morbidly obese	24	22	23	22	25	21	21	22	22	20
% Morbidly obese	4	3	3	3	3	3	2	3	3	3
% Overweight, including obese	59	56	59	60	60	58	53	54	57	57
% Obese	29	25	26	25	28	24	23	25	25	23
<b>Bases (unweighted)</b>										
Women	416	1003	772	680	738	764	759	571	518	762
<b>Bases (weighted)</b>										
Women	321	875	683	581	713	682	862	534	487	711

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Underweight: less than 18.5 kg/m<sup>2</sup>

Normal weight : 18.5 to less than 25 kg/m<sup>2</sup>

Overweight: 25 to less than 30 kg/m<sup>2</sup>

Obese, excluding morbidly obese: 30 to less than 40 kg/m<sup>2</sup>

Morbidly obese: 40 kg/m<sup>2</sup> or more

Overweight, including obese: 25 kg/m<sup>2</sup> or more

Obese: 30 kg/m<sup>2</sup> or more

Table 7.4

**Body Mass Index (BMI), overweight and obesity prevalence (age-standardised), by equivalised household income and sex**

*Aged 16 and over with both valid height and weight measurements* *2008*

BMI (kg/m <sup>2</sup> ) and BMI status (%) <sup>a</sup>	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Mean BMI (kg/m <sup>2</sup> )	27.2	27.0	27.3	27.2	27.1
Standard error of the mean	0.17	0.16	0.18	0.19	0.22
% Underweight	1	1	1	2	2
% Normal	33	33	31	33	33
% Overweight	42	45	42	39	42
% Obese, excluding morbidly obese	24	20	24	26	21
% Morbidly obese	1	1	2	1	2
% Overweight, including obese	66	66	67	65	65
% Obese	24	21	25	27	22
<b>Women</b>					
Mean BMI (kg/m <sup>2</sup> )	26.0	26.9	27.0	27.5	27.7
Standard error of the mean	0.18	0.19	0.17	0.19	0.22
% Underweight	2	2	2	2	2
% Normal	46	42	40	37	36
% Overweight	32	31	35	32	30
% Obese, excluding morbidly obese	18	23	22	25	26
% Morbidly obese	1	3	3	4	5
% Overweight, including obese	52	56	59	61	62
% Obese	20	26	24	29	31
<i>Bases (unweighted)</i>					
<i>Men</i>	1200	1077	926	893	730
<i>Women</i>	1139	1136	1134	1206	1065
<i>Bases (weighted)</i>					
<i>Men</i>	1297	1198	983	940	782
<i>Women</i>	1075	1071	1034	1077	961

<sup>a</sup> Underweight: less than 18.5 kg/m<sup>2</sup>

Normal weight : 18.5 to less than 25 kg/m<sup>2</sup>

Overweight: 25 to less than 30 kg/m<sup>2</sup>

Obese, excluding morbidly obese: 30 to less than 40 kg/m<sup>2</sup>

Morbidly obese: 40 kg/m<sup>2</sup> or more

Overweight, including obese: 25 kg/m<sup>2</sup> or more

Obese: 30 kg/m<sup>2</sup> or more

Table 7.5

**Body Mass Index (BMI), overweight and obesity prevalence (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over with both valid height and weight measurements

2008

BMI (kg/m <sup>2</sup> ) and BMI status (%) <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean BMI (kg/m <sup>2</sup> )	27.2	27.2
Standard error of the mean	0.09	0.12
% Underweight	1	2
% Normal	33	31
% Overweight	41	43
% Obese, excluding morbidly obese	23	23
% Morbidly obese	1	1
% Overweight, including obese	65	67
% Obese	24	24
<b>Women</b>		
Mean BMI (kg/m <sup>2</sup> )	26.8	27.1
Standard error of the mean	0.09	0.12
% Underweight	2	2
% Normal	42	39
% Overweight	32	32
% Obese, excluding morbidly obese	21	23
% Morbidly obese	3	3
% Overweight, including obese	56	59
% Obese	24	27
<i>Bases (unweighted)</i>		
Men	3663	2167
Women	4348	2603
<i>Bases (weighted)</i>		
Men	4056	2306
Women	4086	2335

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Underweight: less than 18.5 kg/m<sup>2</sup>  
 Normal weight : 18.5 to less than 25 kg/m<sup>2</sup>  
 Overweight: 25 to less than 30 kg/m<sup>2</sup>  
 Obese, excluding morbidly obese: 30 to less than 40 kg/m<sup>2</sup>  
 Morbidly obese: 40 kg/m<sup>2</sup> or more  
 Overweight, including obese: 25 kg/m<sup>2</sup> or more  
 Obese: 30 kg/m<sup>2</sup> or more



Table 7.6

**Waist circumference, by age and sex***Aged 16 and over with a valid waist measurement**2008*

Waist circumference (cm) and raised waist circumference (%)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
Mean waist circumference (cm)	84.7	93.1	98.6	100.3	102.9	103.6	102.2	97.2
Standard error of the mean	0.64	0.55	0.45	0.45	0.41	0.49	0.54	0.25
% with raised waist circumference <sup>a</sup>	9	19	33	40	51	51	48	34
Women								
Mean waist circumference (cm)	79.4	83.2	86.7	89.3	91.6	92.8	91.5	87.4
Standard error of the mean	0.65	0.47	0.45	0.44	0.46	0.50	0.49	0.20
% with raised waist circumference <sup>a</sup>	23	31	39	49	56	62	61	44
Bases (unweighted)								
Men	488	604	830	786	871	617	469	4665
Women	558	782	1027	973	1033	680	607	5660
Bases (weighted)								
Men	789	838	986	845	755	496	368	5077
Women	738	781	971	850	784	546	518	5188

<sup>a</sup> Raised waist circumference has been taken to be greater than 102cm in men and greater than 88cm in women.

Table 7.7

**Waist circumference, (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with a valid waist measurement

2008

Waist circumference (cm) and raised waist circumference (%)	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Mean waist circumference (cm)	95.9	97.9	98.0	95.6	96.7	97.5	95.0	99.5	97.6	99.1
Standard error of the mean	1.89	0.47	0.64	0.77	0.70	0.74	0.66	0.88	0.65	0.64
% with raised waist circumference <sup>b</sup>	32	37	37	28	31	34	28	42	32	37
<b>Standardised</b>										
Mean waist circumference (cm)	96.9	98.0	97.8	95.5	96.2	97.1	96.3	98.8	97.3	98.6
Standard error of the mean	1.44	0.48	0.65	0.77	0.73	0.77	0.64	0.96	0.69	0.65
% with raised waist circumference <sup>b</sup>	34	38	36	28	30	33	31	41	31	36
<b>Women</b>										
<b>Observed</b>										
Mean waist circumference (cm)	88.9	87.2	88.3	86.2	86.9	87.7	86.3	88.3	87.7	87.6
Standard error of the mean	0.89	0.49	0.61	0.76	0.57	0.69	0.60	0.70	0.55	0.46
% with raised waist circumference <sup>b</sup>	49	42	46	40	43	45	40	48	45	47
<b>Standardised</b>										
Mean waist circumference (cm)	89.0	87.2	88.2	85.9	86.9	87.6	87.4	88.0	87.4	87.5
Standard error of the mean	0.83	0.49	0.63	0.77	0.58	0.68	0.60	0.72	0.57	0.46
% with raised waist circumference <sup>b</sup>	49	42	46	40	43	45	43	47	45	47
<b>Bases (unweighted)</b>										
Men	341	649	507	487	438	528	506	375	349	485
Women	394	803	635	565	541	600	600	486	426	610
<b>Bases (weighted)</b>										
Men	288	666	511	466	536	578	741	408	381	502
Women	268	705	547	454	561	563	706	452	393	539

a This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

b Raised waist circumference: greater than 102cm in men and greater than 88cm in women

Table 7.8

**Waist circumference (age-standardised), by equivalised household income and sex**

Aged 16 and over with a valid waist measurement

2008

	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Mean waist circumference (cm)	97.0	96.7	97.6	97.5	97.5
Standard error of the mean	0.52	0.56	0.57	0.60	0.71
% with raised waist circumference <sup>a</sup>	32	30	36	35	35
<b>Women</b>					
Mean waist circumference (cm)	85.0	87.8	87.8	88.7	89.8
Standard error of the mean	0.51	0.52	0.45	0.47	0.54
% with raised waist circumference <sup>a</sup>	37	44	46	49	51
<i>Bases (unweighted)</i>					
Men	959	875	777	741	598
Women	927	948	973	990	877
<i>Bases (weighted)</i>					
Men	1036	983	810	783	655
Women	848	882	879	897	796

<sup>a</sup> Raised waist circumference has been taken to be greater than 102cm in men and greater than 88cm in women.

Table 7.9

**Waist circumference (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over with a valid waist measurement

2008

Waist circumference (cm) and raised waist circumference (%)	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean waist circumference (cm)	97.3	97.0
Standard error of the mean	0.29	0.44
% with raised waist circumference <sup>b</sup>	34	34
<b>Women</b>		
Mean waist circumference (cm)	87.2	87.9
Standard error of the mean	0.24	0.37
% with raised waist circumference <sup>b</sup>	44	44
<i>Bases (unweighted)</i>		
Men	2899	1742
Women	3539	2094
<i>Bases (weighted)</i>		
Men	3219	1833
Women	3320	1844

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Raised waist circumference: greater than 102cm in men and greater than 88cm in women.

Table 7.10

**Health risk category associated with overweight and obesity in adults based on Body Mass Index (BMI) and waist circumference, by age and sex**
Aged 16 and over with valid height, weight and waist circumference measurements<sup>a</sup>

2008

Waist circumference <sup>b</sup> and BMI classification <sup>c</sup>	Health risk category <sup>d</sup>	Age group							Total
		16-24	25-34	35-44	45-54	55-64	65-74	75+	
		%	%	%	%	%	%	%	
Men									
% underweight									
Low waist circumference	Not applicable	8	1	0	-	0	1	0	2
High waist circumference	Not applicable	-	-	-	-	-	-	-	-
Very high waist circumference	Not applicable	-	-	-	-	-	-	-	-
All underweight		8	1	0	-	0	1	0	2
% Normal									
Low waist circumference	No increased risk	59	39	21	20	16	13	18	28
High waist circumference	No increased risk	1	3	4	4	6	3	7	4
Very high waist circumference	Increased risk	-	0	1	0	-	0	2	0
All normal		60	42	25	25	22	17	27	32
Overweight									
Low waist circumference	No increased risk	15	18	15	10	7	6	7	12
High waist circumference	Increased risk	8	15	24	24	20	25	19	19
Very high waist circumference	High risk	1	6	10	10	19	19	24	11
All overweight		25	39	48	45	45	50	50	42
Obesity I									
Low waist circumference	Increased risk	-	-	0	0	0	-	0	0
High waist circumference	High risk	1	6	4	1	1	2	1	3
Very high waist circumference	Very high risk	4	7	15	24	24	21	19	16
All obese I		5	12	20	25	25	23	20	18
Obesity II									
Low waist circumference	Very high risk	-	0	-	-	-	-	-	0
High waist circumference	Very high risk	-	0	-	-	-	-	-	0
Very high waist circumference	Very high risk	3	5	5	4	6	8	3	5
All obese II	Very high risk	3	5	5	4	6	8	3	5
Obesity III									
Low waist circumference	Very high risk	-	-	-	-	-	-	-	-
High waist circumference	Very high risk	-	-	-	-	-	-	-	-
Very high waist circumference	Very high risk	1	1	2	1	2	1	0	1
All obese III	Very high risk	1	1	2	1	2	1	0	1
Men – Overall risk <sup>d</sup>	Not applicable	8	1	0	-	0	1	0	2
	No increased risk	75	60	39	35	28	22	32	44
	Increased risk	8	16	25	25	20	26	21	20
	High risk	2	11	14	12	20	21	25	14
	Very high risk	7	12	22	29	31	30	22	21
Bases (unweighted)									
Men		464	562	781	727	816	565	383	4298
Bases (weighted)									
Men		751	778	927	782	711	454	301	4705

<sup>a</sup> Percentages and bases in this table are based on those who have a valid measurement for waist circumference, in addition to valid measurements of height and weight. Therefore subtotals for BMI categories by age and sex in this table are not definitive and may vary from estimates shown in Table 7.2.

<sup>b</sup> Waist circumference categories according to NICE guidelines: for men, less than 94cm is low, 94–102cm is high, and more than 102cm is very high. For women, less than 80cm is low, 80–88cm is high, and more than 88cm is very high.

<sup>c</sup> BMI categories according to NICE guidelines: Underweight: Less than 18.5 kg/m<sup>2</sup>, Normal: 18.5 to less than 25 kg/m<sup>2</sup>, Overweight: 25 to less than 30 kg/m<sup>2</sup>, Obesity I: 30 to less than 35 kg/m<sup>2</sup>, Obesity II: 35 to less than 40 kg/m<sup>2</sup>, Obesity III: 40 kg/m<sup>2</sup> or more.

<sup>d</sup> Health risk category according to NICE guidelines.

Continued...

Table 7.10

Table 7.10 continued

Aged 16 and over with valid height, weight and waist circumference measurements<sup>a</sup>

2008

Waist circumference <sup>b</sup> and BMI classification <sup>c</sup>	Health risk category <sup>d</sup>	Age group							Total
		16-24	25-34	35-44	45-54	55-64	65-74	75+	
		%	%	%	%	%	%	%	%
<b>Women</b>									
<b>% underweight</b>									
Low waist circumference	Not applicable	6	2	1	1	1	1	2	2
High waist circumference	Not applicable	-	0	-	-	-	0	0	0
Very high waist circumference	Not applicable	-	-	-	-	-	-	-	-
<i>All underweight</i>		6	2	1	1	1	1	2	2
<b>% Normal</b>									
Low waist circumference	No increased risk	49	42	30	21	18	14	13	28
High waist circumference	No increased risk	6	8	10	11	9	11	12	9
Very high waist circumference	Increased risk	3	2	2	3	3	5	6	3
<i>All normal</i>		58	52	42	35	31	30	31	41
<b>Overweight</b>									
Low waist circumference	No increased risk	7	5	4	5	3	1	2	4
High waist circumference	Increased risk	8	12	14	14	13	11	11	12
Very high waist circumference	High risk	4	11	13	18	20	26	27	16
<i>All overweight</i>		19	28	31	36	37	39	41	32
<b>Obesity I</b>									
Low waist circumference	Increased risk	0	0	0	-	0	-	-	0
High waist circumference	High risk	2	1	1	-	0	-	-	1
Very high waist circumference	Very high risk	9	10	14	17	20	19	19	15
<i>All obese I</i>		11	11	15	19	21	20	19	16
<b>Obesity II</b>									
Low waist circumference	Very high risk	-	-	-	-	-	-	-	-
High waist circumference	Very high risk	-	-	-	0	-	-	-	0
Very high waist circumference	Very high risk	4	4	7	7	8	7	6	6
<i>All obese II</i>	<i>Very high risk</i>	4	4	7	8	8	7	6	6
<b>Obesity III</b>									
Low waist circumference	Very high risk	-	-	-	-	-	-	-	-
High waist circumference	Very high risk	-	-	-	-	-	-	-	-
Very high waist circumference	Very high risk	2	3	3	2	3	4	1	2
<i>All obese III</i>	<i>Very high risk</i>	2	3	3	2	3	4	1	2
<b>Women - Overall risk<sup>d</sup></b>									
	Not applicable	6	2	1	1	1	1	2	2
	No increased risk	61	56	44	37	31	26	27	42
	Increased risk	12	14	16	16	17	16	17	15
	High risk	6	12	14	19	20	27	28	17
	Very high risk	14	16	24	27	31	30	26	24
<b>Bases (unweighted)</b>									
<i>Women</i>		512	740	963	896	954	617	483	5165
<b>Bases (weighted)</b>									
<i>Women</i>		677	739	912	785	725	497	413	4749

<sup>a</sup> Percentages and bases in this table are based on those who have a valid measurement for waist circumference, in addition to valid measurements of height and weight. Therefore subtotals for BMI categories by age and sex in this table are not definitive and may vary from estimates shown in Table 7.2.

<sup>b</sup> Waist circumference categories according to NICE guidelines: for men, less than 94cm is low, 94–102cm is high, and more than 102cm is very high. For women, less than 80cm is low, 80–88cm is high, and more than 88cm is very high.

<sup>c</sup> BMI categories according to NICE guidelines: Underweight: Less than 18.5 kg/m<sup>2</sup>, Normal: 18.5 to less than 25 kg/m<sup>2</sup>, Overweight: 25 to less than 30 kg/m<sup>2</sup>, Obesity I: 30 to less than 35 kg/m<sup>2</sup>, Obesity II: 35 to less than 40 kg/m<sup>2</sup>, Obesity III: 40 kg/m<sup>2</sup> or more.

<sup>d</sup> Health risk category according to NICE guidelines.

Table 7.11

# Trends in overweight and obesity prevalence, 1993 to 2008, by age and sex

Aged 16 and over with both valid height and weight measurements

1993-2008

BMI status (%) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>1993</b>								
% Overweight	21	39	48	52	51	54	46	44
% Obese	5	10	14	17	20	15	11	13
<b>1994</b>								
% Overweight	25	40	46	51	51	53	48	44
% Obese	6	10	16	17	18	18	15	14
<b>1995</b>								
% Overweight	24	40	47	49	51	50	49	44
% Obese	6	12	16	19	22	18	14	15
<b>1996</b>								
% Overweight	22	43	48	49	51	52	47	45
% Obese	6	13	16	21	24	20	16	16
<b>1997</b>								
% Overweight	22	43	48	52	47	56	50	45
% Obese	5	13	18	22	27	18	12	17
<b>1998</b>								
% Overweight	23	40	48	52	52	55	48	46
% Obese	5	16	17	21	23	21	16	17
<b>1999</b>								
% Overweight	21	39	46	49	52	49	52	44
% Obese	6	16	21	23	21	22	18	19
<b>2000</b>								
% Overweight	18	41	48	49	53	50	52	45
% Obese	9	20	21	25	26	24	17	21
<b>2001</b>								
% Overweight	27	44	48	51	51	52	52	47
% Obese	10	16	23	26	27	24	18	21
<b>2002</b>								
% Overweight	21	42	47	48	47	52	52	43
% Obese	9	18	24	28	28	26	19	22
<b>2003 (weighted)<sup>b</sup></b>								
% Overweight	23	41	47	48	50	49	50	43
% Obese	9	18	25	28	27	29	21	22
<b>2004</b>								
% Overweight	23	41	50	48	48	48	54	44
% Obese	8	18	25	30	30	28	19	23
<b>2005</b>								
% Overweight	24	44	46	47	47	47	49	43
% Obese	8	17	27	28	29	28	17	22
<b>2006</b>								
% Overweight	25	41	48	48	47	49	51	43
% Obese	9	21	25	28	33	31	18	24
<b>2007</b>								
% Overweight	24	39	47	40	48	49	50	41
% Obese	9	16	25	35	31	28	22	24
<b>2008</b>								
% Overweight	25	41	46	44	44	50	49	42
% Obese	8	18	26	31	34	33	23	24

<sup>a</sup> Overweight: 25 to less than 30kg/m<sup>2</sup>; Obese, including morbidly obese: 30kg/m<sup>2</sup> or more.<sup>b</sup> From 2003, data have been weighted for non-response.

Continued...

Table 7.11 continued

Aged 16 and over with both valid height and weight measurements

1993-2008

BMI status (%) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Women</b>								
<b>1993</b>								
% Overweight	20	25	29	37	39	41	42	32
% Obese	8	11	17	19	24	22	16	16
<b>1994</b>								
% Overweight	20	25	28	36	39	41	36	31
% Obese	8	13	17	18	26	25	16	17
<b>1995</b>								
% Overweight	19	25	31	36	42	45	41	33
% Obese	8	13	17	22	23	24	17	18
<b>1996</b>								
% Overweight	19	28	30	39	41	43	40	34
% Obese	8	15	18	19	28	25	20	18
<b>1997</b>								
% Overweight	19	27	32	36	37	44	41	33
% Obese	9	15	18	23	30	25	22	20
<b>1998</b>								
% Overweight	17	27	30	36	39	41	35	32
% Obese	11	16	21	24	29	29	21	21
<b>1999</b>								
% Overweight	19	27	34	35	40	40	40	33
% Obese	10	16	19	26	29	30	20	21
<b>2000</b>								
% Overweight	22	27	31	36	41	41	41	34
% Obese	9	16	19	24	29	30	23	21
<b>2001</b>								
% Overweight	22	26	31	36	38	41	41	33
% Obese	12	19	22	28	31	30	20	23
<b>2002</b>								
% Overweight	21	27	34	38	36	38	43	34
% Obese	11	21	23	25	29	28	22	23
<b>2003 (weighted)<sup>b</sup></b>								
% Overweight	18	28	33	33	39	41	40	33
% Obese	13	18	22	26	28	30	26	23
<b>2004</b>								
% Overweight	24	31	30	36	37	40	46	34
% Obese	12	17	24	27	32	29	21	23
<b>2005</b>								
% Overweight	19	27	30	35	37	42	40	32
% Obese	12	19	25	28	28	34	26	24
<b>2006</b>								
% Overweight	20	29	30	35	36	38	42	32
% Obese	12	18	24	27	30	35	27	24
<b>2007</b>								
% Overweight	22	25	35	32	37	37	40	32
% Obese	10	19	24	30	31	32	27	24
<b>2008</b>								
% Overweight	20	27	31	35	38	38	40	32
% Obese	14	19	25	29	31	33	26	25

<sup>a</sup> Overweight: 25 to less than 30kg/m<sup>2</sup>; Obese, including morbidly obese: 30kg/m<sup>2</sup> or more.<sup>b</sup> From 2003, data have been weighted for non-response.

Continued...



Table 7.11 continued

Aged 16 and over with both valid height and weight measurements 1993-2008

BMI status (%) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<i>Bases (unweighted)</i>								
Men 1993	990	1444	1313	1231	1020	841	408	7247
Men 1994	935	1373	1288	1076	925	816	382	6795
Men 1995	869	1309	1296	1078	919	820	416	6707
Men 1996	908	1290	1348	1247	938	831	435	6997
Men 1997	476	710	714	667	511	414	193	3685
Men 1998	825	1261	1229	1197	910	745	433	6600
Men 1999	389	566	626	579	466	383	195	3204
Men 2000	400	591	662	528	469	376	234	3260
Men 2001	757	1051	1220	1112	958	766	403	6267
Men 2002	1553	464	629	485	445	329	203	2969
Men 2003	686	962	1178	1001	997	736	406	5966
Men 2004	255	388	478	390	424	319	190	2444
Men 2005	367	463	505	531	501	355	208	2930
Men 2006	577	762	1084	933	986	735	446	5523
Men 2007	321	383	518	463	436	370	231	2722
Men 2008	695	848	1071	959	1053	737	490	5853
Women 1993	1020	1544	1459	1306	1060	991	657	8037
Women 1994	990	1524	1418	1227	988	1048	689	7884
Women 1995	979	1521	1394	1258	1028	936	613	7729
Women 1996	1016	1500	1493	1385	1007	986	677	8064
Women 1997	510	816	780	766	552	479	351	4254
Women 1998	903	1433	1449	1373	1043	853	676	7730
Women 1999	459	647	744	689	465	410	285	3699
Women 2000	362	674	778	632	509	422	326	3703
Women 2001	856	1221	1513	1331	1038	871	584	7414
Women 2002	1719	513	737	590	519	403	300	3509
Women 2003	788	1088	1452	1142	1194	810	616	7090
Women 2004	294	453	649	527	538	393	281	3135
Women 2005	385	531	668	614	588	364	259	3409
Women 2006	679	935	1308	1125	1106	776	575	6504
Women 2007	324	474	632	559	522	415	281	3207
Women 2008	787	1026	1309	1176	1196	828	661	6983
<i>Bases (weighted)</i>								
Men 2003	960	1194	1316	1073	943	664	369	6519
Men 2004	418	481	573	465	399	276	160	2772
Men 2005	491	552	620	521	462	311	187	3144
Men 2006	930	991	1246	993	888	599	368	6014
Men 2007	461	499	603	514	446	296	189	3008
Men 2008	1029	1068	1243	1059	968	610	409	6385
Women 2003	912	1085	1289	1073	982	694	536	6570
Women 2004	378	460	564	459	425	295	231	2812
Women 2005	432	524	628	517	489	322	272	3184
Women 2006	866	942	1207	996	914	637	511	6074
Women 2007	405	466	599	497	452	312	252	2983
Women 2008	935	1020	1241	1057	985	663	549	6450

<sup>a</sup> Overweight: 25 to less than 30kg/m<sup>2</sup>; Obese, including morbidly obese: 30kg/m<sup>2</sup> or more.<sup>b</sup> From 2003, data have been weighted for non-response.

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*Moushumi Chaudhury*

## Summary

- This chapter looks at the prevalence of hypertension in adults aged 16 and over. Treatment and control rates are also reported.
- Overall the prevalence of hypertension was 32% in men and 29% in women. The prevalence of hypertension increased with age in both sexes.
- Prevalence of hypertension did not show a significant relationship with Strategic Health Authority or income.
- The prevalence of hypertension varied significantly by Spearhead status for women, being 31% in those living in Spearhead PCTs and 26% among those not living in Spearhead PCTs. There was no such difference for men.
- The treatment rate among participants with survey-defined hypertension was 46% in men and 57% in women. Among those on treatment, the control rate (BP below 140/90 mmHg) was 57% for both men and women.

## 8.1 Introduction

This chapter reports on the prevalence of hypertension (high blood pressure) in the adult population in England aged 16 and over. Prevalence is analysed in relation to socio-demographic characteristics and further analysis examines the treatment and control of hypertension in the Health Survey for England (HSE) 2008 participants.

Hypertension is an important public health challenge worldwide because of its high prevalence and the concomitant increase in risk of disease. It is the most important modifiable risk factor for cardiovascular, cerebrovascular and renal disease. A recent systematic review on worldwide prevalence of hypertension concluded that significant numbers of individuals with hypertension are unaware of their condition and, among those with diagnosed hypertension, treatment is frequently inadequate. Measures are required at a population level to prevent the development of hypertension and to improve awareness, treatment and control of hypertension in the community.<sup>1</sup>

The systolic arterial pressure is defined as the peak pressure in the arteries, which occurs near the beginning of the cardiac cycle; the diastolic arterial pressure is the lowest pressure at the resting phase of the cardiac cycle. The latest guidelines from the British Hypertension Society state that antihypertensive therapy should be initiated in people with sustained levels of systolic blood pressure (SBP) at or greater than 160 mmHg or diastolic blood pressure (DBP) at or greater than 100 mmHg. In people with levels of SBP between 140 and 159 mmHg and/or DBP between 90 and 99 mmHg, drug treatment should be decided on the basis of presence or absence of cardiovascular disease (CVD) or diabetes, other target organ damage (e.g. kidney) or an estimated CVD risk of 20% or more over 10 years.<sup>2</sup> The guidance recommends the use of more than one drug if blood pressure is otherwise not well controlled, and advises on choice of drug(s) by age and ethnicity.<sup>3</sup> The guidance was updated in 2006, jointly by the British Hypertension Society and the National Institute for Clinical Excellence (NICE), to reduce the use of beta-blockers because of the risk of precipitating diabetes.<sup>4</sup>

Hypertension, cholesterol, and smoking together account for 80% of all cardiovascular (CVD) events.<sup>5</sup> Management of people with hypertension, diabetes, or otherwise at substantial CVD risk includes assessing their risk of CVD and addressing other modifiable risk factors. Initially this involves lifestyle changes (smoking cessation, reducing alcohol consumption, increasing physical activity, weight loss if overweight, improved diet), followed by drug treatment of hypercholesterolaemia (high blood cholesterol), hyperglycaemia (high blood sugar levels), and/or hypertension, as appropriate.<sup>4,5</sup>

This chapter presents 2008 data. Trend tables of key variables including blood pressure are available in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre's website.<sup>6</sup>

## 8.2 Methods and definitions

### 8.2.1 Measurements

Blood pressure was measured with the Omron HEM 907, an oscillometric automated device. It was introduced in the HSE 2003 as a replacement for the Dinamap 8100, which had become obsolete.

The survey definition of hypertension, based on blood pressure levels and medication, also changed in 2003. Prior to HSE 2003, taking any medication which *may affect* blood pressure was used in the definition, whereas from HSE 2003 onwards, taking medication for high blood pressure has been used in the definition (see section 8.2.2 below).

The protocol for the measurement of blood pressure has remained unchanged. As in previous years, three blood pressure readings were taken, at one-minute intervals, using an appropriately sized cuff on the right arm, with the participant in a seated position after five

minutes' rest. Systolic and diastolic pressures were displayed on the Omron from each measurement. As in previous reports, participants were excluded if they were pregnant.

The blood pressure variables used in this chapter are the means of the second and third measurements obtained from the participants in whom three readings were successfully obtained, excluding those who had eaten, drunk alcohol, exercised, or smoked in the 30 minutes before the measurement was taken.

### 8.2.2 Classification of blood pressure levels

The levels of blood pressure used to define hypertension in HSE 2008 are in accordance with the current guidelines on hypertension management.<sup>4</sup> Adult participants were classified in one of four groups on the basis of their SBP and DBP readings and their current use of anti-hypertensive medication.

Normotensive untreated	SBP below 140 mmHg and DBP below 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat high blood pressure
Hypertensive controlled	SBP below 140 mmHg and DBP below 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive uncontrolled	SBP at least 140 mmHg or DBP at least 90 mmHg, currently taking medication specifically prescribed to treat their high blood pressure
Hypertensive untreated	SBP at least 140 mmHg or DBP at least 90 mmHg, <b>not</b> currently taking medication specifically prescribed to treat their high blood pressure

The last three categories together are considered as 'hypertensive' for the purpose of this report.

The threshold of 140/90 mmHg used in the Health Survey for England (HSE) is in accordance with the guidelines on hypertension management.<sup>2</sup>

An additional more severe category of 'hypertensive untreated (160/100 mmHg)' has also been defined and is used in this report, as treatment is always indicated for persistent hypertension at this level.

### 8.2.3 Definitions of treatment and control

Treatment rates were estimated by examining the proportion of all those defined as having high blood pressure (at least 140 mmHg systolic or 90 mmHg diastolic or on treatment for hypertension) who were on treatment at the time of the survey.

The control of hypertension was estimated by calculating, among those on treatment for hypertension at the time of the survey, the proportion with measured BP below 140/90 mmHg. Control rates among those with hypertension were also calculated.

### 8.2.4 Interpretation of results

The definition of hypertension used for clinical purposes is based on 'sustained' levels of high blood pressure. HSE measures blood pressure at one point in time only, since no repeated measurements are possible, and the survey definition of hypertension will include some whose blood pressure may not be high when checked later by healthcare professionals. The HSE may therefore slightly overestimate the prevalence of hypertension. This needs to be taken into account when interpreting the results.

### 8.3 Prevalence, treatment and control of hypertension

#### 8.3.1 Prevalence of hypertension by age and sex

Overall the prevalence of hypertension was 32% in men and 29% in women. It increased with age in both sexes, ranging from 7% of men and 2% of women aged 16-24 to 68% of men and 73% of women aged 75 and over. The prevalence of hypertension was higher among men than women in those up to the age of 64, but higher among women than men in those aged 75 and over.

Table 8.2, Figure 8A



There was no significant variation in the prevalence of hypertension across Strategic Health Authority for either sex. Similarly, the age-standardised prevalence of hypertension did not show a significant relationship with equivalised household income.

Tables 8.3, 8.4

The prevalence of hypertension varied by Spearhead status<sup>7</sup> and sex. Hypertension was more common in women living in Spearhead PCTs (31%) than in those not living in Spearhead areas (26%), but there was no such difference for men.

Table 8.5

#### 8.3.2 Treatment and control of hypertension

Among participants with survey-defined hypertension, 46% of men and 57% of women were on treatment for hypertension, and 26% of men and 32% of women had their hypertension controlled (BP below 140/90 mmHg). The treatment rate ranged from 32% of men and 41% of women aged 35-54 to 66% of men and 69% of women aged 75 and over, but this age-related increase was not statistically significant.

57% of both men and women who were on treatment for hypertension had their blood pressure controlled.

Tables 8.6, 8.7, Figure 8B



## 8.4 Comparison with results from Quality and Outcomes Framework (QOF)

Primary care (GP) practices have been submitting data to the Quality Management Analysis System (QMAS) since April 2004. These data are used to calculate individual practices' Quality and Outcomes Framework (QOF) achievement to support practice payment processes. Prevalence in 19 clinical areas is also available, and the fourth year of the QOF (April 2008 to March 2009) used data from 8,299 practices, representing 98.9% of registered patients in England.<sup>8,9</sup>

Using data from QOF, in 2008/09 the national prevalence of hypertension was 13.1% in the whole population (assuming that nobody younger than 16 is hypertensive, this prevalence is equivalent to 16% among those aged 16 and over, who represent 80% of the population). The figure is similar to previous years and it is still about half the prevalence of survey-defined hypertension among HSE informants (32% of men and 29% of women). It is impossible to ascertain from these data to what extent the survey is over-estimating hypertension, to what extent GPs are under-reporting it in their QOF returns, and to what extent the survey is identifying undiagnosed hypertension.



## References and notes

- 1 Kearney P, Whelton M, Reynolds K, et al. *Worldwide prevalence of hypertension: a systematic review*. J Hypertens 2004; **22**:11–19.
- 2 Williams B, Poulter NR, Brown MJ, et al. *Guidelines for management of hypertension: report of the fourth working party of the British Hypertension Society, 2004-BHS IV*. J Hum Hypertens. 2004; **18**:139–85. [www.bhsoc.org/Latest\\_BHS\\_management\\_Guidelines.stm](http://www.bhsoc.org/Latest_BHS_management_Guidelines.stm)
- 3 National Institute for Clinical Excellence (NICE). *Essential hypertension: managing adult patients in primary care*. Evidence-based Clinical Practice Guideline. NICE, London, 2004. <http://guidance.nice.org.uk/page.aspx?o=cg018background>
- 4 National Institute for Health and Clinical Excellence (NICE and British Hypertension Society). *Hypertension: Management of Hypertension in Adults in Primary Care: pharmacological update*. Royal College of Physicians, London, 2006. [www.nice.org.uk/CG034](http://www.nice.org.uk/CG034)
- 5 National Institute for Health and Clinical Excellence. *Cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular disease*. NICE, London, 2008. [www.nice.org.uk/guidance/CG67](http://www.nice.org.uk/guidance/CG67)
- 6 [www.ic.nhs.uk/pubs/hse08trends](http://www.ic.nhs.uk/pubs/hse08trends)
- 7 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 8 The Information Centre Prescribing Support Unit. *National Quality and Outcomes Framework Statistics for England 2008-09*. The Information Centre, 2009 <http://www.ic.nhs.uk/webfiles/QOF/2008-09/QOF%20Achievement%20and%20Prevalence%20Bulletin%202008-09.pdf>
- 9 Figures published by the Information Centre are derived from the Quality Management Analysis System (QMAS), a national system developed by NHS Connecting for Health. QMAS uses data from general practices to calculate individual practices' QOF achievement. Users of data derived from QMAS should recognise that QMAS was established as a mechanism to support the calculation of practice QOF payments. It is not a comprehensive source of data on quality of care in general practice, but it is potentially a rich and valuable source of such information, providing that the limitations of the data are acknowledged.

The 2008/09 disease prevalence tables were based on prevalence submissions to QMAS at the end of the 2008/09 financial year. The disease prevalence figures are therefore based on 8,229 general practices. These practices covered 98.9% of registered patients in England (based on registration data from the Prescription Pricing Division of the NHS Business Services Authority for the quarter January to March 2009).

- 8.1 Response to blood pressure measurement, by age and sex
- 8.2 Hypertension categories, by age and sex
- 8.3 Hypertension categories (observed and age-standardised), by Strategic Health Authority and sex
- 8.4 Hypertension categories (age-standardised), by equivalised household income and sex
- 8.5 Hypertension categories (age-standardised), by Spearhead status and sex
- 8.6 Treatment and control of hypertension among participants with survey-defined hypertension, by age and sex
- 8.7 Control of hypertension among participants on treatment for hypertension, by age and sex

Table 8.1

**Response to blood pressure measurement, by age and sex***Aged 16 and over with a nurse visit*

2008

Response to blood pressure	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Valid blood pressure measurement <sup>a</sup>	82	81	83	81	87	90	88	84
Ate, drank, smoked, exercised in previous half hour	16	17	16	16	11	8	8	13
Three valid readings not obtained	1	1	1	2	1	2	3	2
Refused, attempted but not obtained, not attempted	1	1	0	1	1	0	1	1
<b>Women</b>								
Valid blood pressure measurement <sup>a</sup>	77	77	81	85	86	87	88	83
Ate, drank, smoked, exercised in previous half hour	16	13	15	13	12	8	6	12
Three valid readings not obtained	3	2	2	2	2	4	5	2
Pregnant	4	7	2	0	-	-	-	2
Refused, attempted but not obtained, not attempted	1	1	0	0	0	1	1	1
<i>Bases (unweighted)</i>								
<i>Men</i>	498	620	848	802	890	641	490	4789
<i>Women</i>	587	864	1080	1005	1056	706	653	5951

<sup>a</sup> Three valid readings of systolic and diastolic blood pressure.

Table 8.2

**Hypertension categories, by age and sex**

Aged 16 and over with three valid BP measurements

2008

Hypertension levels (mmHg)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Normotensive untreated <sup>a</sup>	93	87	82	67	48	38	32	68
Hypertensive controlled <sup>a</sup>	-	0	1	7	16	22	25	8
Hypertensive uncontrolled <sup>a</sup>	-	0	3	5	11	17	20	6
Hypertensive untreated <sup>a</sup>	7	12	14	20	26	23	23	17
<i>All with hypertension</i>	7	13	18	33	52	62	68	32
Hypertensive untreated (160/100) <sup>b</sup>	-	0	3	4	5	6	6	3
<b>Women</b>								
Normotensive untreated <sup>a</sup>	98	95	87	75	59	38	27	71
Hypertensive controlled <sup>a</sup>	-	0	3	7	14	21	27	9
Hypertensive uncontrolled <sup>a</sup>	-	0	2	4	9	19	23	7
Hypertensive untreated <sup>a</sup>	2	5	9	14	18	22	23	12
<i>All with hypertension</i>	2	5	13	25	41	62	73	29
Hypertensive untreated (160/100) <sup>b</sup>	-	1	1	2	5	6	8	3
<i>Bases (unweighted)</i>								
<i>Men</i>	406	503	702	650	774	575	431	4041
<i>Women</i>	450	662	875	855	906	616	572	4936
<i>Bases (weighted)</i>								
<i>Men</i>	657	697	827	697	672	462	338	4350
<i>Women</i>	604	661	827	742	689	496	488	4507

<sup>a</sup> Normotensive untreated: SBP <140mmHg and DBP <90mmHg and **not** taking medication prescribed for high blood pressure

Hypertensive controlled: SBP <140mmHg and DBP <90mmHg and taking medication prescribed for high blood pressure

Hypertensive uncontrolled: SBP ≥ 140mmHg or DBP ≥ 90mmHg and taking medication prescribed for high blood pressure

Hypertensive untreated: SBP ≥ 140mmHg or DBP ≥ 90mmHg and **not** taking medication prescribed for high blood pressure

*All with hypertension* SBP ≥ 140mmHg or DBP ≥ 90mmHg or taking medication prescribed for high blood pressure.

<sup>b</sup> Hypertensive untreated (160/100): SBP ≥ 160mmHg or DBP ≥ 100mmHg and **not** taking medication prescribed for high blood pressure; if this level of BP is sustained, it always warrants treatment, according to current guidelines.

Table 8.3

**Hypertension categories (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with three valid BP measurements

2008

Hypertension levels	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Men</b>										
<b>Observed</b>										
Normotensive untreated <sup>b</sup>	71	71	63	62	71	66	76	66	68	66
Hypertensive controlled <sup>b</sup>	7	6	7	8	10	8	9	10	9	9
Hypertensive uncontrolled <sup>b</sup>	6	5	9	8	5	6	4	8	8	6
Hypertensive untreated <sup>b</sup>	16	18	21	22	14	19	12	16	15	20
<i>All with hypertension</i>	29	29	37	38	29	34	24	34	32	34
Hypertensive untreated (160/100) <sup>c</sup>	3	4	3	5	2	3	2	3	2	3
<b>Standardised</b>										
Normotensive untreated <sup>b</sup>	70	71	64	64	73	68	72	69	70	69
Hypertensive controlled <sup>b</sup>	7	6	7	7	9	8	11	9	8	7
Hypertensive uncontrolled <sup>b</sup>	7	5	8	8	5	6	5	7	7	5
Hypertensive untreated <sup>b</sup>	16	18	20	21	13	19	12	15	15	19
<i>All with hypertension</i>	30	29	36	36	27	32	28	31	30	31
Hypertensive untreated (160/100) <sup>c</sup>	3	4	3	4	2	3	2	3	2	2
<i>Bases (unweighted)</i>										
<i>Men</i>	294	530	428	425	396	468	417	338	323	422
<i>Bases (weighted)</i>										
<i>Men</i>	249	536	426	400	480	513	605	364	350	429

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Normotensive untreated: SBP <140mmHg and DBP <90mmHg and **not** taking medication prescribed for high blood pressure  
 Hypertensive controlled: SBP <140mmHg and DBP <90mmHg and taking medication prescribed for high blood pressure  
 Hypertensive uncontrolled: SBP ≥ 140mmHg or DBP ≥ 90mmHg and taking medication prescribed for high blood pressure  
 Hypertensive untreated: SBP ≥ 140mmHg or DBP ≥ 90mmHg and **not** taking medication prescribed for high blood pressure  
*All with hypertension* SBP ≥ 140mmHg or DBP ≥ 90mmHg or taking medication prescribed for high blood pressure.

<sup>c</sup> Hypertensive untreated (160/100): SBP ≥ 160mmHg or DBP ≥ 100mmHg and **not** taking medication prescribed for high blood pressure: if this level of BP is sustained, it always warrants treatment, according to current guidelines.

Continued...

Table 8.3 continued

Aged 16 and over with three valid BP measurements

2008

Hypertension levels	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Women</b>										
<b>Observed</b>										
Normotensive untreated <sup>b</sup>	68	69	68	67	70	68	79	73	74	73
Hypertensive controlled <sup>b</sup>	12	7	10	9	11	10	9	10	9	7
Hypertensive uncontrolled <sup>b</sup>	7	7	9	9	6	8	6	5	7	7
Hypertensive untreated <sup>b</sup>	14	17	13	15	13	13	6	13	10	12
<i>All with hypertension</i>	32	31	32	33	30	32	21	27	26	27
Hypertensive untreated (160/100) <sup>c</sup>	4	4	3	5	3	3	2	3	2	3
<b>Standardised</b>										
Normotensive untreated <sup>b</sup>	67	70	71	69	70	70	75	75	75	75
Hypertensive controlled <sup>b</sup>	11	7	9	9	11	10	11	8	8	7
Hypertensive uncontrolled <sup>b</sup>	7	7	8	8	6	8	7	4	7	7
Hypertensive untreated <sup>b</sup>	14	16	12	14	13	12	7	12	10	12
<i>All with hypertension</i>	33	30	29	31	30	30	25	25	25	25
Hypertensive untreated (160/100) <sup>c</sup>	4	4	3	5	3	3	2	3	2	3
<b>Bases (unweighted)</b>										
<i>Women</i>	340	681	542	508	479	536	511	437	397	505
<b>Bases (weighted)</b>										
<i>Women</i>	232	593	463	405	496	499	602	407	365	444

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> Normotensive untreated: SBP <140mmHg and DBP <90mmHg and **not** taking medication prescribed for high blood pressure  
 Hypertensive controlled: SBP <140mmHg and DBP <90mmHg and taking medication prescribed for high blood pressure  
 Hypertensive uncontrolled: SBP ≥ 140mmHg or DBP ≥ 90mmHg and taking medication prescribed for high blood pressure  
 Hypertensive untreated: SBP ≥ 140mmHg or DBP ≥ 90mmHg and **not** taking medication prescribed for high blood pressure  
*All with hypertension* SBP ≥ 140mmHg or DBP ≥ 90mmHg or taking medication prescribed for high blood pressure.

<sup>c</sup> Hypertensive untreated (160/100): SBP ≥ 160mmHg or DBP ≥ 100mmHg and **not** taking medication prescribed for high blood pressure: if this level of BP is sustained, it always warrants treatment, according to current guidelines.

Table 8.4

**Hypertension categories (age-standardised), by equivalised household income and sex**

Aged 16 and over with three valid BP measurements

2008

Hypertension levels	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Men</b>					
Normotensive untreated <sup>a</sup>	71	72	69	67	66
Hypertensive controlled <sup>a</sup>	6	7	9	7	13
Hypertensive uncontrolled <sup>a</sup>	6	5	5	7	8
Hypertensive untreated <sup>a</sup>	16	16	17	19	13
<i>All with hypertension</i>	29	28	31	33	34
Hypertensive untreated (160/100) <sup>b</sup>	3	4	2	3	3
<b>Women</b>					
Normotensive untreated <sup>a</sup>	76	76	72	67	69
Hypertensive controlled <sup>a</sup>	7	8	9	11	9
Hypertensive uncontrolled <sup>a</sup>	7	5	5	9	8
Hypertensive untreated <sup>a</sup>	10	11	13	13	13
<i>All with hypertension</i>	24	24	28	33	31
Hypertensive untreated (160/100) <sup>b</sup>	3	2	3	4	4
<i>Bases (unweighted)</i>					
<i>Men</i>	838	771	691	648	487
<i>Women</i>	827	824	857	856	726
<i>Bases (weighted)</i>					
<i>Men</i>	898	855	713	678	535
<i>Women</i>	754	762	771	772	658

- <sup>a</sup> Normotensive untreated: SBP <140mmHg and DBP <90mmHg and **not** taking medication prescribed for high blood pressure
- Hypertensive controlled: SBP <140mmHg and DBP <90mmHg and taking medication prescribed for high blood pressure
- Hypertensive uncontrolled: SBP ≥ 140mmHg or DBP ≥ 90mmHg and taking medication prescribed for high blood pressure
- Hypertensive untreated: SBP ≥ 140mmHg or DBP ≥ 90mmHg and **not** taking medication prescribed for high blood pressure
- All with hypertension* SBP ≥ 140mmHg or DBP ≥ 90mmHg or taking medication prescribed for high blood pressure.

- <sup>b</sup> Hypertensive untreated (160/100): SBP ≥ 160mmHg or DBP ≥ 100mmHg and **not** taking medication prescribed for high blood pressure: if this level of BP is sustained, it always warrants treatment, according to current guidelines.

Table 8.5

**Hypertension categories (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over with three valid BP measurements

2008

Hypertension levels (mmHg)	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Normotensive untreated <sup>b</sup>	69	68
Hypertensive controlled <sup>b</sup>	8	8
Hypertensive uncontrolled <sup>b</sup>	6	6
Hypertensive untreated <sup>b</sup>	168	18
<i>All with hypertension</i>	31	32
Hypertensive untreated (160/100) <sup>c</sup>	3	3
<b>Women</b>		
Normotensive untreated <sup>b</sup>	74	69
Hypertensive controlled <sup>b</sup>	9	10
Hypertensive uncontrolled <sup>b</sup>	7	8
<i>Hypertensive untreated<sup>b</sup></i>	11	14
<i>All with hypertension (160/100)<sup>c</sup></i>	26	31
	3	4
<i>Bases (unweighted)</i>		
<i>Men</i>	2573	1452
<i>Women</i>	3118	1798
<i>Bases (weighted)</i>		
<i>Men</i>	2828	1506
<i>Women</i>	2919	1570

- <sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

- <sup>b</sup> Normotensive untreated: SBP <140mmHg and DBP <90mmHg and **not** taking medication prescribed for high blood pressure

Hypertensive controlled: SBP <140mmHg and DBP <90mmHg and taking medication prescribed for high blood pressure

Hypertensive uncontrolled: SBP ≥ 140mmHg or DBP ≥ 90mmHg and taking medication prescribed for high blood pressure

Hypertensive untreated: SBP ≥ 140mmHg or DBP ≥ 90mmHg and **not** taking medication prescribed for high blood pressure

*All with hypertension*: SBP ≥ 140mmHg or DBP ≥ 90mmHg or taking medication prescribed for high blood pressure.

- <sup>c</sup> Hypertensive untreated (160/100): SBP ≥ 160mmHg or DBP ≥ 100mmHg and **not** taking medication prescribed for high blood pressure: if this level of BP is sustained, it always warrants treatment, according to current guidelines.



Table 8.6

**Treatment and control of hypertension among participants with survey-defined hypertension, by age and sex**

Aged 16 and over with survey-defined hypertension

2008

Treatment and control levels	Age group					Total
	16-34	35-54	55-64	65-74	75+	
	%	%	%	%	%	%
<b>Men</b>						
Treatment rate (proportion with hypertension who were on treatment)	3	32	51	63	66	46
Control rate among those with hypertension <sup>a</sup>	1	17	31	36	36	26
<b>Women</b>						
Treatment rate (proportion with hypertension who were on treatment) [10]		41	57	65	69	57
Control rate among those with hypertension <sup>a</sup>	[6]	26	35	33	37	32
<i>Bases (unweighted)</i>						
Men	90	343	399	353	296	1481
Women	44	322	380	382	415	1543
<i>Bases (weighted)</i>						
Men	136	378	351	285	231	1380
Women	47	293	286	306	356	1288

<sup>a</sup> Control rate among those with hypertension: the proportion of those with survey-defined hypertension whose blood pressure was controlled (BP less than 140/90mmHg).

Table 8.7

**Control of hypertension among participants on treatment for hypertension, by age and sex**

Aged 35 and over on treatment for hypertension

2008

Control levels	Age group				Total
	35-54	55-64	65-74	75+	
	%	%	%	%	%
<b>Men</b>					
Control rate <sup>a</sup>	53	61	57	55	57
<b>Women</b>					
Control rate <sup>a</sup>	65	60	51	54	57
<i>Bases (unweighted)</i>					
Men	111	200	221	194	726
Women	130	217	245	284	876
<i>Bases (weighted)</i>					
Men	121	179	180	152	633
Women	119	164	198	245	727

<sup>a</sup> Control rate: the proportion of those on treatment for hypertension whose blood pressure was controlled (BP less than 140/90mmHg).

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Laia Bécaries, Jennifer Mindell

## Summary

- This chapter presents findings on total and HDL-cholesterol, and glycated haemoglobin (HbA1c), which were taken from a non-fasting blood sample collected during the nurse visit. Total and HDL-cholesterol are used in predicting risk of developing cardiovascular disease (CVD). Total cholesterol can be reduced by drug treatment, while the levels of beneficial HDL-cholesterol are increased by taking exercise and reducing alcohol consumption. Glycated haemoglobin is an indicator of the medium-term glucose level in the blood (glycaemia) and therefore provides an indication of the presence and control of diabetes.
- Mean levels of total cholesterol were 5.2mmol/l for men and 5.4mmol/l for women.
- The proportions of men and women with raised total cholesterol levels (5.0mmol/l or above) were 58% and 61% respectively.
- No significant differences in mean levels of total cholesterol by equivalised household income were found.
- Mean levels of HDL-cholesterol were 1.3mmol/l in men and 1.6mmol/l in women. Men continue to be more likely than women to have low levels of HDL-cholesterol (below 1.0mmol/l).
- Mean HDL-cholesterol levels were found to decrease from higher to lower income quintiles for both men and women. A similar association was found for prevalence of low HDL levels, which increased as income levels decreased in both sexes.
- Mean glycated haemoglobin levels increased with age in both sexes.
- Glycated haemoglobin levels above 7% were more frequent in men than in women (3.9% and 2.6% respectively), and also increased with age for both sexes.
- Glycated haemoglobin levels varied by equivalised household income, where highest levels were reported in the lowest quintile for both men and women (5.9% and 5.7% respectively).
- Prevalence of raised total cholesterol has decreased over time in both sexes; in men from 74% in 1994 to 58% in 2008 and in women from 77% to 61%, respectively. This is likely to be largely due to use of lipid-lowering drugs.

## 9.1 Introduction

This chapter presents findings on the three blood analytes measured from a non-fasting blood sample collected during the nurse visit in HSE 2008. The three analytes were total cholesterol, high-density lipoprotein cholesterol (HDL-cholesterol), and glycated haemoglobin (HbA1c).

Hypertension (high blood pressure), high cholesterol levels and smoking together account for 80% of all cardiovascular (CVD) events.<sup>1</sup> Management of people with hypertension or diabetes, or otherwise at substantial risk of CVD, includes assessing their risk and addressing other modifiable risk factors. This may initially be through lifestyle changes (such as smoking cessation, reducing alcohol consumption, increasing physical activity, weight loss if overweight, improved diet), followed by drug treatment of hypercholesterolaemia (high blood cholesterol), hyperglycaemia (high blood sugar), and/or hypertension, as appropriate.<sup>1</sup>

### 9.1.1 Total and HDL-Cholesterol

Total cholesterol comprises three components: LDL-cholesterol (low density lipoprotein); VLDL-cholesterol (very low density lipoprotein), and HDL-cholesterol (high density lipoprotein). These fats in the blood are also referred to as lipids. The majority of the cholesterol in the blood is carried as LDL-cholesterol. It is this that contributes to atherosclerosis ('furring' of the arteries). VLDL-cholesterol is involved in clearing fat from the bowel after eating. HDL-cholesterol carries cholesterol away from the arteries back to the liver, and is considered to be beneficial cholesterol. High total and LDL-cholesterol and low HDL-cholesterol increase the risk of developing or dying from cardiovascular disease (CVD).<sup>2,3,4</sup>

Statins are powerful lipid-lowering drugs that reduce LDL, and therefore total, cholesterol levels effectively, with resulting reductions in cardiovascular and total mortality,<sup>5</sup> through prevention of ischaemic heart disease (IHD) and strokes.<sup>6</sup> Reductions are achieved both in those with<sup>7</sup> and without<sup>8</sup> pre-existing disease. In 2000 the National Service Framework for Coronary Heart Disease was published. Total Cholesterol in those with, or at high risk of developing, cardiovascular disease, should be treated and reduced to 5.0mmol/l or lower.<sup>9</sup> The Joint British Societies produced their second national treatment guidelines (JBS 2) in December 2005 for those at risk of CVD.<sup>10</sup> A lower cholesterol value was recommended for high risk individuals (at or below 4.0mmol/l, instead of 5.0mmol/l). NICE Guidance for the primary and secondary prevention of CVD was published in May 2008. Statin therapy is recommended as part of the management strategy for the primary prevention of CVD for adults who have a 20% or greater 10-year risk of developing CVD and for those with established CVD.<sup>1</sup>

### 9.1.2 Glycated haemoglobin (HbA1c)

Diabetes is characterised by high blood glucose levels (hyperglycaemia). Hyperglycaemia is associated with damage to and possible failure of many organs, especially the eyes, kidneys, nerves, heart and blood vessels. Glycated haemoglobin (HbA1c), measured in the blood sample, reflects medium-term blood glucose levels and is used for assessing diabetic control. The percentage of HbA1c is the proportion of haemoglobin in the circulation to which glucose is bound. It reflects blood glucose levels during the three months (approximately) preceding the measurement. Although it has been suggested as a diagnostic or screening tool for diabetes,<sup>11</sup> there is no agreement yet on the best threshold to identify probable or definite diabetes.<sup>12</sup>

## 9.2 Methods and definitions

### 9.2.1 Measurement of blood analytes

Following written consent from eligible participants, two non-fasting blood samples (in 6ml plain and 4ml EDTA tubes) were collected from adults aged 16 and over by survey nurses. After collection, the tubes were despatched to the Department of Clinical Biochemistry at the Royal Victoria Infirmary (RVI) Newcastle for analysis, and storage where relevant. Three analytes were measured for HSE 2008 but a 6ml plain sample was collected, more than that needed for these analytes, to increase the volume that could be stored as part of the HSE Bloodbank<sup>13</sup> for future use. Where written consent had been obtained and sufficient volume remained after analysis, serum was stored at -40°C and EDTA whole blood at -20°C. Details of laboratory techniques, and Internal Quality Control and External Quality Assessment tables can be found in the Methods and documentation volume of this report (Volume 2, Chapter 9).

All blood data from 2003 onwards have been weighted for non-response, with a weight specifically applied to those who gave a blood sample (see Volume 2, Chapter 7 for more information).

### 9.2.2 Definitions

For total cholesterol the definition of raised cholesterol was 5.0mmol/l or above.<sup>9</sup> A low HDL-cholesterol level was defined as less than 1.0mmol/l (in line with recommendations set by a panel of international experts in 2002).<sup>14</sup> The results for cholesterol include participants who were taking lipid-lowering drugs.

In this report, a raised glycated haemoglobin level is taken to be 7% or more in the general population, while HbA1c below 7% in people with doctor-diagnosed diabetes is indicative of good control of diabetes.<sup>15</sup> The range of control is set individually for diabetics between 6.5% and 7.5%.<sup>16</sup> As no questions were asked in HSE 2008 about diabetes, the results are provided for all participants and are not sub-divided into those with or without self-reported diabetes.

## 9.3 Response to non-fasting blood samples and proportion of valid samples for each analyte

A valid non-fasting blood sample was obtained from 72% of men and 67% of women who had a nurse visit. The remainder of the participants either refused to give a blood sample, or the nurse was unable to obtain a blood sample from them. Men were more likely than women to provide valid non-fasting blood samples. This was the case across all age groups, except for participants aged 65-74, where more women provided valid non-fasting blood samples.

Valid samples for total and HDL-cholesterol were provided by 70% of men and 65% of women, whereas 69% of men and 64% of women provided valid samples for glycated haemoglobin.

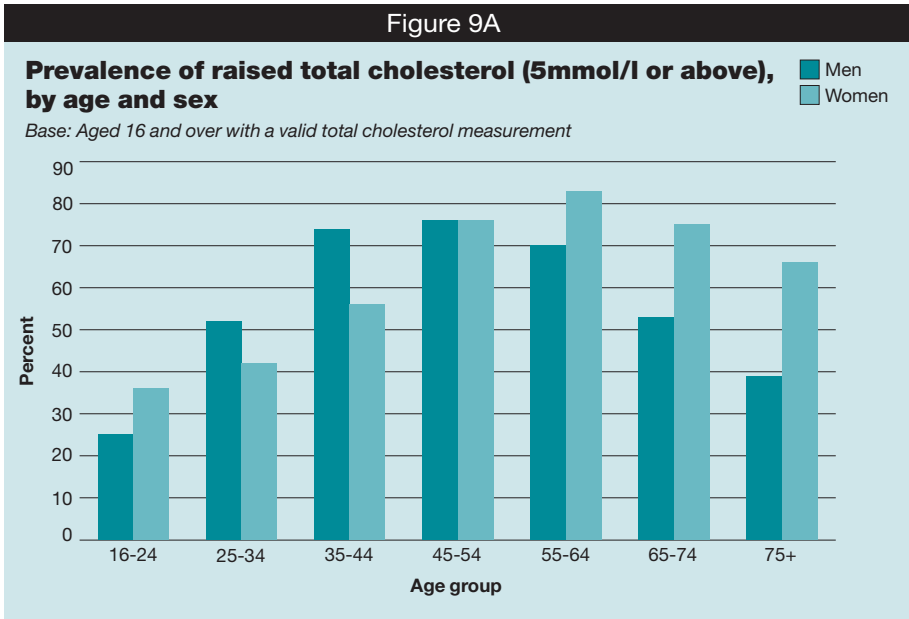
Tables 9.1, 9.2

## 9.4 Cholesterol levels and glycated haemoglobin levels

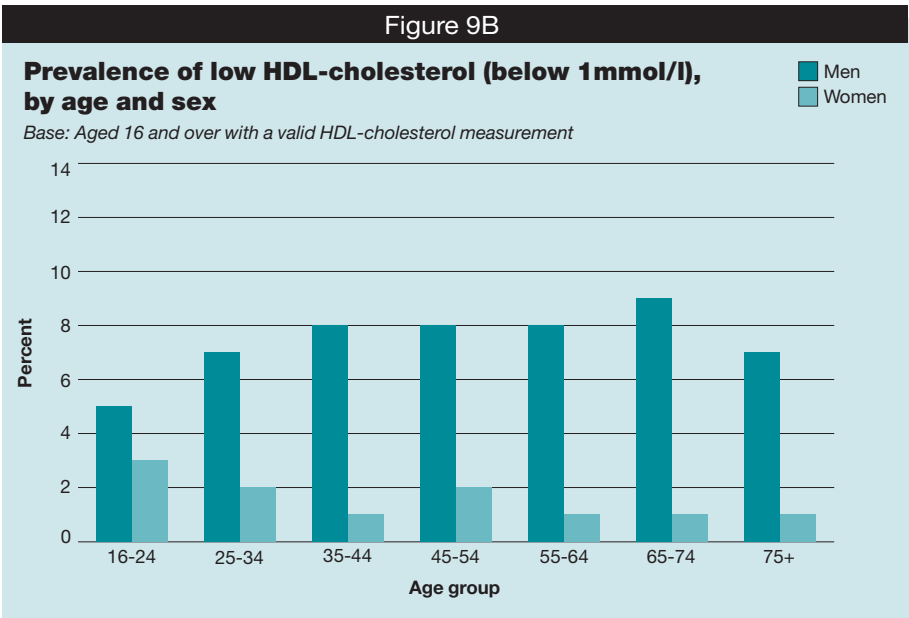
### 9.4.1 Cholesterol levels and glycated haemoglobin levels by age and sex

Mean levels of total cholesterol were 5.2mmol/l for men and 5.4mmol/l for women. Total cholesterol levels increased with age in both sexes, reaching a peak in the middle age ranges (up to 5.8 mmol/l in men aged 45 to 54 years, and 6.0 mmol/l in women aged 55 to 64 years), and then decreasing for older age groups.

The proportions of men and women with raised cholesterol levels (5.0mmol/l or above) were 58% and 61% respectively. This also increased with age up to the middle age ranges, and declined slightly among men aged 55 and older, and among women aged 65 and older, as illustrated in Figure 9A.



There was a significant variation in mean HDL-cholesterol levels by sex, with higher levels observed in women (1.6mmol/l) than in men (1.3mmol/l). This pattern was observed across all age groups. Prevalence of low HDL-cholesterol was much greater in men than in women, with 7.2% of men and 1.7% of women having HDL less than 1 mmol/l. As shown in Figure 9B, a different pattern was observed between prevalence of low HDL-cholesterol and sex as age increased. Whereas for women there was a tendency for low HDL-cholesterol levels to decrease as age increased, the opposite was found for men, for whom low HDL-cholesterol levels increased with age.

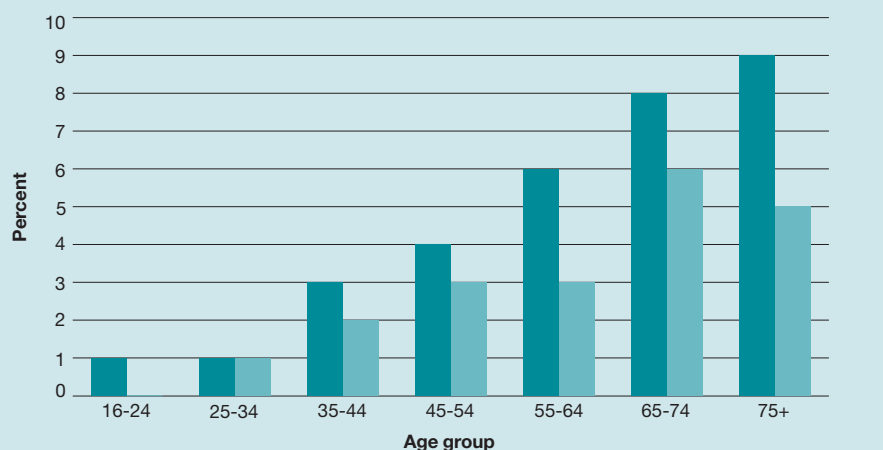


Mean glycated haemoglobin levels increased with age in both sexes.<sup>17</sup> The prevalence of glycated haemoglobin levels of 7% or more, indicative of uncontrolled diabetes or possible undiagnosed diabetes, was slightly higher in men than in women, and followed the same pattern of increasing with age, as shown in Figure 9C. **Tables 9.3, 9.8, 9.13, Figures 9A, 9B, 9C**

Figure 9C

### Prevalence of glycated haemoglobin levels of 7% or more, by age and sex

Base: Aged 16 and over with a valid glycated haemoglobin measurement



#### 9.4.2 Cholesterol and glycated haemoglobin levels by Strategic Health Authority

No statistically significant differences were observed in age-standardised mean levels of total cholesterol by Strategic Health Authority.

There was a significant variation in the prevalence of age-standardised raised cholesterol levels (5mmol/l or above) by SHA, although no particular region stood out.

No statistically significant differences were observed in age-standardised mean HDL-cholesterol levels, prevalence of low HDL-cholesterol, or prevalence of age-standardised glycated haemoglobin levels of 7% or above by SHA. However, regional differences were observed for age-standardised mean glycated haemoglobin levels, with higher levels observed in London for both men and women (5.8% and 5.7% respectively).

Tables 9.4, 9.9, 9.14

#### 9.4.3 Cholesterol and glycated haemoglobin levels by equivalised household income

No significant differences in mean cholesterol levels or prevalence of raised cholesterol levels by equivalised income were found.

Mean HDL-cholesterol levels were found to vary by equivalised household income in both sexes, with levels declining from higher to lower income quintiles. The prevalence of low HDL cholesterol was also found to increase as income levels decreased in both sexes, as shown in Figure 9D.

Variations by equivalised household income were also found for mean glycated haemoglobin levels, where highest levels were reported in the lowest quintile for both men and women (5.9% and 5.7% respectively). The same pattern was apparent for those with glycated haemoglobin values of 7% or more, as illustrated in Figure 9E. 8% of men and 4% of women in the lowest income quintile had glycated haemoglobin at this level. More men than women had glycated haemoglobin levels of 7% or more in each income quintile except the third quintile, where prevalence was higher for women. Tables 9.5, 9.10, 9.15, Figures 9D, 9E

#### 9.4.4 Cholesterol and glycated haemoglobin levels by Spearhead status

Spearhead status<sup>18</sup> was not found to be related to mean cholesterol levels, raised cholesterol levels, or glycated haemoglobin levels. Mean HDL-cholesterol levels varied by Spearhead status for women, but this difference was not clinically significant.<sup>19</sup>

Tables 9.6, 9.11, 9.16



Figure 9D

### Age-standardised prevalence of low HDL-cholesterol (below 1mmol/l), by equivalised household income and sex

Base: Aged 16 and over with a valid HDL-cholesterol measurement

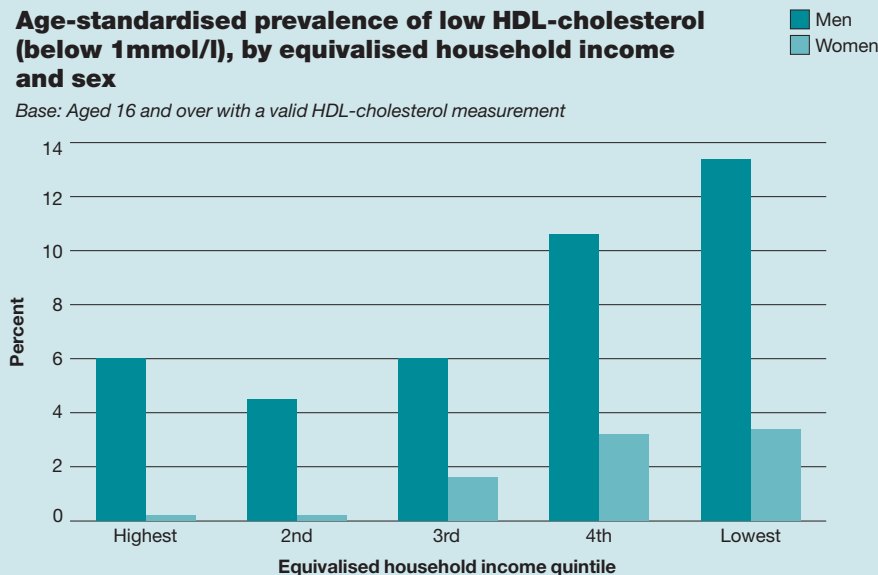
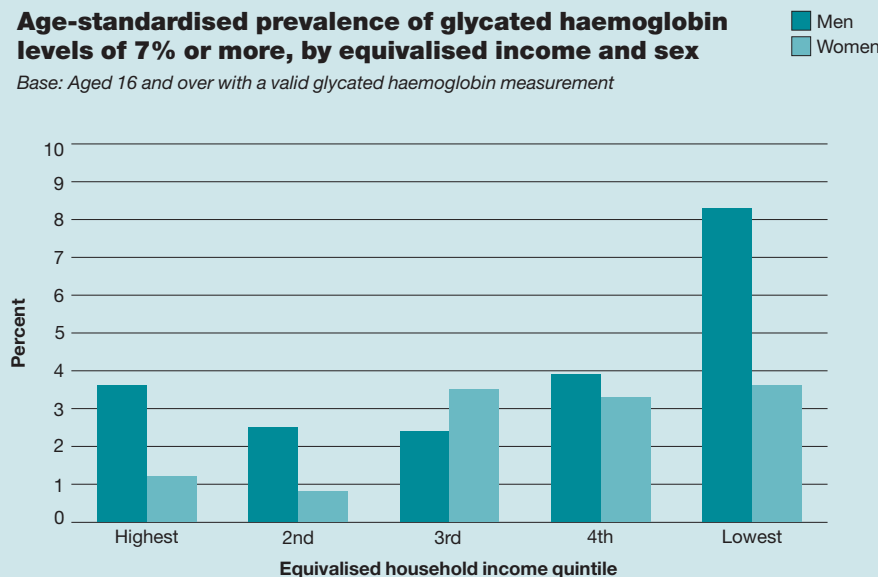


Figure 9E

### Age-standardised prevalence of glycated haemoglobin levels of 7% or more, by equivalised income and sex

Base: Aged 16 and over with a valid glycated haemoglobin measurement



## 9.5 Changes over time

Tables 9.7, 9.12 and 9.17 present trends over time in total cholesterol, HDL-cholesterol, and glycated haemoglobin levels. Measures were taken in 1994 (total cholesterol), 1998 (total and HDL-cholesterol), and in 2003, 2006 and 2008 (all three analytes).

Mean HDL-cholesterol levels have remained stable, and glycated haemoglobin levels have increased slightly over the periods examined. In contrast, mean cholesterol levels and the prevalence of raised cholesterol (levels above 5.0mmol/l) have decreased over time for both men and women. In 1994 74% of men and 77% of women had raised cholesterol levels, whereas in 2008 the equivalent figures were 58% and 61%. This is likely to be largely due to use of lipid-lowering drugs, which has increased dramatically among high risk populations since 1998.<sup>20</sup>

Tables 9.7, 9.12, 9.17

## References and notes

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- 17 Mean glycated haemoglobin levels were slightly higher in men than in women (5.63% and 5.58% respectively;  $p < 0.001$ ) but although highly statistically significant, a difference of 0.05% is of limited clinical significance.
- 18 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 19 While there was a statistically significant difference in mean HDL-cholesterol levels for women by Spearhead status (1.56mmol/l in non-Spearhead areas, 1.61mmol/l in Spearhead areas), this is not a clinically significant finding, and may ascribe greater precision to the laboratory measurements than is justified.
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- 9.1 Response rates for blood sample, by age and sex
- 9.2 Proportion providing valid samples for each analyte, by age and sex
- 9.3 Total cholesterol levels, by age and sex
- 9.4 Total cholesterol levels (observed and age-standardised), by Strategic Health Authority and sex
- 9.5 Total cholesterol levels (age-standardised), by equivalised household income and sex
- 9.6 Total cholesterol levels (age-standardised), by Spearhead status and sex
- 9.7 Trends in total cholesterol levels, 1994-2008, by sex
- 9.8 HDL-cholesterol levels, by age and sex
- 9.9 HDL-cholesterol levels (observed and age-standardised), by Strategic Health Authority and sex
- 9.10 HDL-cholesterol levels (age-standardised), by equivalised household income and sex
- 9.11 HDL-cholesterol levels (age-standardised), by Spearhead status and sex
- 9.12 Trends in HDL-cholesterol levels, 1998 - 2008, by sex
- 9.13 Glycated haemoglobin levels, by age and sex
- 9.14 Glycated haemoglobin levels (observed and age-standardised), by Strategic Health Authority and sex
- 9.15 Glycated haemoglobin levels (age-standardised), by equivalised household income and sex
- 9.16 Glycated haemoglobin levels (age-standardised), by Spearhead status and sex
- 9.17 Comparison of glycated haemoglobin levels, 2003, 2006 and 2008, by age and sex

Table 9.1

**Total cholesterol levels, by age and sex**

Aged 16 and over who had a nurse visit

2008

Total cholesterol (mmol/l) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Valid non-fasting blood sample taken	62	71	75	77	78	71	67	72
Agreed, not obtained	3	2	4	4	5	6	6	4
Refused	31	22	16	14	12	14	15	18
Not applicable <sup>a</sup>	5	5	4	4	4	9	13	6
<b>Women</b>								
Valid non-fasting blood sample taken	51	61	70	75	77	73	65	67
Agreed, not obtained	8	6	7	7	6	5	5	6
Refused	35	21	16	13	12	15	19	19
Not applicable <sup>a</sup>	7	12	7	6	5	7	10	8
<i>Bases (unweighted)</i>								
Men	498	620	848	802	890	641	490	4789
Women	587	864	1080	1005	1056	706	653	5951
<i>Bases (weighted)</i>								
Men	805	859	1006	862	773	515	384	5204
Women	775	866	1021	877	802	569	557	5466

<sup>a</sup> On anticoagulants or had fits in the past, and among women, pregnant.

Table 9.2

**Proportion providing valid samples for each analyte, by age and sex**

Aged 16 and over who had a nurse visit

2008

Blood analytes	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Total cholesterol	60	68	73	74	76	68	63	70
HDL-cholesterol	60	68	73	74	76	68	63	70
Glycated haemoglobin	59	67	71	74	76	68	63	69
<b>Women</b>								
Total cholesterol	48	58	68	72	74	70	63	65
HDL-cholesterol	48	58	68	72	74	70	63	65
Glycated haemoglobin	48	58	68	71	74	69	61	64
<i>Bases (unweighted)</i>								
Men	498	620	848	802	890	641	490	4789
Women	587	864	1080	1005	1056	706	653	5951
<i>Bases (weighted)</i>								
Men	805	859	1006	862	773	515	384	5204
Women	775	866	1021	877	802	569	557	5466

Table 9.3

**Total cholesterol levels, by age and sex***Aged 16 and over who had a nurse visit*

2008

Total cholesterol (mmol/l) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Mean (mmol/l)	4.4	5.1	5.7	5.8	5.5	5.1	4.8	5.2
Standard error of the mean	0.05	0.06	0.05	0.05	0.05	0.06	0.07	0.02
10th percentile (mmol/l)	3.4	3.9	4.3	4.4	4.1	3.6	3.5	3.8
90th percentile (mmol/l)	5.5	6.5	7.1	7.2	7.0	6.7	6.3	6.7
% 5.0mmol/l or more	25	52	74	76	70	53	39	58
<b>Women</b>								
Mean (mmol/l)	4.6	4.8	5.1	5.7	6.0	5.8	5.6	5.4
Standard error of the mean	0.06	0.04	0.03	0.04	0.04	0.05	0.06	0.02
10th percentile (mmol/l)	3.5	3.7	4.0	4.5	4.6	4.3	4.1	4.0
90th percentile (mmol/l)	5.7	5.9	6.4	7.0	7.5	7.3	7.3	6.9
% 5.0mmol/l or more	36	42	56	76	83	75	66	61
<i>Bases (unweighted)</i>								
Men	295	418	613	597	675	440	311	3349
Women	276	501	741	730	781	489	407	3925
<i>Bases (weighted)</i>								
Men	557	581	688	587	532	352	258	3555
Women	515	585	705	602	551	386	380	3725

<sup>a</sup> Including those taking lipid-lowering drugs.

Table 9.4

**Total cholesterol levels (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with a valid total cholesterol measurement

2008

Total cholesterol (mmol/l) <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Mean (mmol/l)	5.2	5.2	5.3	5.3	5.3	5.1	5.2	5.3	5.4	5.3
Standard error of the mean	0.14	0.07	0.08	0.08	0.06	0.07	0.07	0.07	0.07	0.07
10th percentile (mmol/l)	3.7	3.8	3.6	3.8	3.9	3.7	3.8	3.8	3.9	3.7
90th percentile (mmol/l)	6.9	6.7	7.0	6.7	6.9	6.7	6.7	6.6	6.8	6.7
% 5.0mmol/l or more	53	57	59	59	60	54	53	64	65	58
<b>Standardised</b>										
Mean (mmol/l)	5.3	5.2	5.3	5.3	5.3	5.1	5.2	5.2	5.3	5.3
Standard error of the mean	0.11	0.07	0.08	0.08	0.06	0.07	0.07	0.07	0.08	0.07
10th percentile (mmol/l)	3.9	3.8	3.6	3.8	3.7	3.7	3.8	3.8	3.9	3.7
90th percentile (mmol/l)	7.0	6.7	6.9	6.7	6.9	6.7	6.7	6.6	6.8	6.7
% 5.0mmol/l or more	57	57	58	58	58	54	52	62	64	59
<b>Women</b>										
<b>Observed</b>										
Mean (mmol/l)	5.4	5.3	5.4	5.5	5.4	5.3	5.1	5.4	5.4	5.4
Standard error of the mean	0.09	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.06
10th percentile (mmol/l)	3.9	4.0	4.0	3.9	4.0	3.9	3.8	4.0	4.1	3.9
90th percentile (mmol/l)	7.2	6.8	7.0	7.0	6.9	6.8	6.5	7.0	6.9	7.1
% 5.0mmol/l or more	56	61	62	68	61	61	53	66	63	64
<b>Standardised</b>										
Mean (mmol/l)	5.4	5.3	5.3	5.4	5.4	5.3	5.2	5.4	5.4	5.4
Standard error of the mean	0.08	0.05	0.06	0.07	0.06	0.06	0.06	0.06	0.07	0.07
10th percentile (mmol/l)	4.1	4.0	4.0	3.9	4.0	4.0	3.9	4.0	4.1	3.9
90th percentile (mmol/l)	7.2	6.8	6.9	7.0	6.9	6.8	6.7	6.9	6.9	7.1
% 5.0mmol/l or more	56	60	61	68	61	61	57	65	61	64
<b>Bases (unweighted)</b>										
Men	242	476	375	307	318	366	368	299	249	349
Women	260	558	448	353	402	374	410	380	299	441
<b>Bases (weighted)</b>										
Men	200	472	356	308	365	418	524	305	251	356
Women	177	502	389	321	421	395	509	344	270	398

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.<sup>b</sup> Including those taking lipid-lowering drugs.

Table 9.5

**Total cholesterol levels (age-standardised), by equivalised household income and sex***Aged 16 and over with a valid total cholesterol measurement* 2008

Total cholesterol (mmol/l) <sup>a</sup>	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Mean (mmol/l)	5.2	5.3	5.2	5.2	5.2
Standard error of the mean	0.05	0.05	0.05	0.07	0.09
10th percentile (mmol/l)	3.8	3.7	3.8	3.7	3.7
90th percentile (mmol/l)	6.7	6.9	6.6	6.7	7.0
% 5.0mmol/l or more	57	60	60	58	52
<b>Women</b>					
Mean (mmol/l)	5.4	5.4	5.3	5.3	5.4
Standard error of the mean	0.05	0.05	0.05	0.04	0.05
10th percentile (mmol/l)	4.1	4.0	3.8	4.1	3.9
90th percentile (mmol/l)	6.8	7.1	6.8	6.8	6.9
% 5.0mmol/l or more	61	64	60	59	62
<i>Bases (unweighted)</i>					
Men	717	661	560	513	373
Women	690	694	666	671	563
<i>Bases (weighted)</i>					
Men	723	717	560	543	434
Women	624	655	618	652	565

<sup>a</sup> Including those taking lipid-lowering drugs.

Table 9.6

**Total cholesterol levels (age-standardised), by Spearhead status<sup>a</sup> and sex***Aged 16 and over with a valid total cholesterol measurement* 2008

Total cholesterol (mmol/l) <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean (mmol/l)	5.2	5.3
Standard error of the mean	0.03	0.04
10th percentile (mmol/l)	3.8	3.8
90th percentile (mmol/l)	6.7	6.8
% 5.0mmol/l or more	56	59
<b>Women</b>		
Mean (mmol/l)	5.4	5.4
Standard error of the mean	0.02	0.03
10th percentile (mmol/l)	4.0	4.0
90th percentile (mmol/l)	6.9	6.9
% 5.0mmol/l or more	62	60
<i>Bases (unweighted)</i>		
Men	2103	1227
Women	2481	1423
<i>Bases (weighted)</i>		
Men	2274	1262
Women	2381	1325

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.<sup>b</sup> Including those taking lipid-lowering drugs.



Table 9.7

**Trends in total cholesterol levels, 1994-2008, by sex**

*Aged 16 and over with a valid total cholesterol measurement*

*1994, 1998, 2003, 2006, 2008*

Total cholesterol (mmol/l) <sup>a</sup>	Survey year				
	1994 unweighted <sup>b</sup>	1998 unweighted	2003 weighted <sup>c</sup>	2006 weighted	2008 weighted
<b>Men</b>					
Mean (mmol/l)	5.8	5.5	5.5	5.3	5.2
Standard error of the mean	0.02	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	4.3	4.1	4.0	3.9	3.8
90th percentile (mmol/l)	7.4	6.9	7.0	6.8	6.7
% 5.0 mmol/l or more	74	66	66	57	58
<b>Women</b>					
Mean (mmol/l)	6.0	5.6	5.6	5.4	5.4
Standard error of the mean	0.02	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	4.4	4.1	4.1	4.0	4.0
90th percentile (mmol/l)	7.8	7.2	7.2	6.9	6.9
% 5.0 mmol/l or more	77	67	66	61	61
<i>Bases (unweighted)</i>					
<i>Men</i>	5345	5001	3814	3410	3349
<i>Women</i>	5817	5568	4460	3618	3925
<i>Bases (weighted)</i>					
<i>Men</i>	-	-	4020	4061	3555
<i>Women</i>	-	-	4249	3850	3725

<sup>a</sup> Including those taking lipid-lowering drugs.

<sup>b</sup> Blood samples were analysed at a different laboratory in 1994 (West Middlesex); comparison of split samples showed that readings were slightly higher than those made at the Royal Victoria Infirmary, Newcastle (for each of the subsequent years).

<sup>c</sup> Data since 2003 have been weighted for non-response.

Table 9.8

**HDL-cholesterol levels, by age and sex***Aged 16 and over with a valid HDL-cholesterol measurement*

2008

HDL-cholesterol (mmol/l) <sup>a</sup>	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
Mean (mmol/l)	1.3	1.3	1.3	1.4	1.3	1.4	1.3	1.3
Standard error of the mean	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01
10th percentile (mmol/l)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
90th percentile (mmol/l)	1.6	1.7	1.7	1.8	1.8	1.9	1.8	1.7
% less than 1.0mmol/l	4.8	7.4	7.5	7.6	7.6	8.8	6.9	7.2
Women								
Mean (mmol/l)	1.5	1.5	1.6	1.7	1.7	1.7	1.7	1.6
Standard error of the mean	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01
10th percentile (mmol/l)	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.1
90th percentile (mmol/l)	2.0	2.0	2.1	2.2	2.2	2.2	2.3	2.1
% less than 1.0mmol/l	3.4	2.1	1.1	1.6	1.0	1.1	1.4	1.7
Bases (unweighted)								
Men	295	418	613	597	675	440	311	3349
Women	276	501	741	730	780	489	407	3924
Bases (weighted)								
Men	557	581	688	587	532	352	258	3555
Women	515	585	705	602	550	386	380	3724

<sup>a</sup> Including those taking lipid-lowering drugs.

Table 9.9

**HDL-cholesterol levels (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with a valid HDL-cholesterol measurement

2008

HDL-cholesterol (mmol/l) <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Mean (mmol/l)	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.3
Standard error of the mean	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
90th percentile (mmol/l)	1.8	1.7	1.8	1.8	1.8	1.7	1.8	1.8	1.8	1.7
% less than 0.1mmol/l	7.1	7.3	4.6	8.0	7.4	8.6	7.1	9.1	4.9	7.2
<b>Standardised</b>										
Mean (mmol/l)	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.3
Standard error of the mean	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
90th percentile (mmol/l)	1.9	1.7	1.8	1.7	1.8	1.7	1.8	1.8	1.8	1.7
% less than 0.1mmol/l	7.9	7.3	4.6	7.8	7.3	8.5	7.6	9.0	4.7	7.4
<b>Women</b>										
<b>Observed</b>										
Mean (mmol/l)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7
Standard error of the mean	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.2	1.1	1.2
90th percentile (mmol/l)	2.1	2.1	2.1	2.2	2.1	2.2	2.1	2.1	2.0	2.2
% less than 0.1mmol/l	3.2	2.0	1.8	1.2	1.4	1.8	2.8	0.6	1.6	0.5
<b>Standardised</b>										
Mean (mmol/l)	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Standard error of the mean	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.02
10th percentile (mmol/l)	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.2	1.1	1.2
90th percentile (mmol/l)	2.1	2.1	2.1	2.2	2.1	2.2	2.1	2.1	2.0	2.2
% less than 0.1mmol/l	3.1	2.0	1.6	1.2	1.5	1.6	2.5	0.7	1.5	0.4
<b>Bases (unweighted)</b>										
Men	242	476	375	307	318	366	368	299	249	349
Women	260	558	448	353	402	374	409	380	299	441
<b>Bases (weighted)</b>										
Men	200	472	356	308	365	418	524	305	251	356
Women	177	502	389	321	421	395	508	344	270	398

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.<sup>b</sup> Including those taking lipid-lowering drugs.

Table 9.10

**HDL-cholesterol levels (age-standardised), by equivalised household income and sex***Aged 16 and over with a valid HDL-cholesterol measurement 2008*

HDL-cholesterol (mmol/l) <sup>a</sup>	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Mean (mmol/l)	1.4	1.4	1.3	1.3	1.3
Standard error of the mean	0.01	0.01	0.01	0.02	0.02
10th percentile (mmol/l)	1.0	1.0	1.0	0.9	0.9
90th percentile (mmol/l)	1.8	1.8	1.8	1.6	1.7
% less than 1.0mmol/l	6.0	4.5	6.0	10.6	13.4
<b>Women</b>					
Mean (mmol/l)	1.7	1.6	1.6	1.5	1.5
Standard error of the mean	0.02	0.02	0.02	0.02	0.02
10th percentile (mmol/l)	1.2	1.2	1.1	1.1	1.0
90th percentile (mmol/l)	2.2	2.2	2.1	2.0	2.0
% less than 1.0mmol/l	0.2	0.2	1.6	3.2	3.4
<i>Bases (unweighted)</i>					
Men	717	661	560	513	373
Women	690	694	666	671	563
<i>Bases (weighted)</i>					
Men	723	717	560	543	434
Women	624	655	618	652	565

<sup>a</sup> Including those taking lipid-lowering drugs.

Table 9.11

**HDL-cholesterol levels (age-standardised), by Spearhead status<sup>a</sup> and sex***Aged 16 and over with a valid HDL-cholesterol measurement 2008*

HDL-cholesterol (mmol/l) <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean (mmol/l)	1.3	1.3
Standard error of the mean	0.01	0.01
10th percentile (mmol/l)	1.0	1.0
90th percentile (mmol/l)	1.8	1.7
% less than 1.0mmol/l	6.9	7.7
<b>Women</b>		
Mean (mmol/l)	1.6	1.6
Standard error of the mean	0.01	0.01
10th percentile (mmol/l)	1.2	1.1
90th percentile (mmol/l)	2.1	2.1
% less than 1.0mmol/l	1.4	2.1
<i>Bases (unweighted)</i>		
Men	2103	1227
Women	2480	1423
<i>Bases (weighted)</i>		
Men	2274	1262
Women	2380	1325

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.<sup>b</sup> Including those taking lipid-lowering drugs.

Table 9.12

**Trends in HDL-cholesterol levels, 1998-2008, by sex**

Aged 16 and over with a valid HDL-cholesterol measurement

1998, 2003, 2006, 2008

HDL-cholesterol (mmol/l) <sup>b</sup>	Survey year			
	1998	2003 <sup>a</sup>	2006	2008
	Unweighted	Unweighted	Weighted	Weighted
<b>Men</b>				
Mean (mmol/l)	1.3	1.4	1.3	1.3
Standard error of the mean	0.01	0.01	0.01	0.01
10th percentile (mmol/l)	0.9	1.0	1.0	1.0
90th percentile (mmol/l)	1.8	1.8	1.7	1.7
<b>Women</b>				
Mean (mmol/l)	1.6	1.6	1.6	1.6
Standard error of the mean	0.01	0.01	0.01	0.01
10th percentile (mmol/l)	1.1	1.2	1.1	1.1
90th percentile (mmol/l)	2.1	2.1	2.1	2.1
<i>Bases (unweighted)</i>				
Men	4989	3814	3410	3349
Women	5552	4460	4061	3924
<i>Bases (weighted)</i>				
Men	-	4020	3618	3555
Women	-	4249	3850	3724

<sup>a</sup> Data since 2003 have been weighted for non-response.<sup>b</sup> Including those taking lipid-lowering drugs.

Table 9.13

**Glycated haemoglobin levels, by age and sex**

Aged 16 and over with a valid glycated haemoglobin measurement

2008

Glycated haemoglobin	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Mean	5.3	5.4	5.6	5.7	5.8	6.0	6.0	5.6
Standard error of the mean	0.02	0.03	0.03	0.04	0.03	0.05	0.04	0.01
7% or more <sup>a</sup>	0.6	1.0	3.1	3.7	6.1	8.4	9.1	3.9
<b>Women</b>								
Mean	5.3	5.3	5.4	5.6	5.8	5.9	6.0	5.6
Standard error of the mean	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.01
7% or more <sup>a</sup>	-	0.8	2.2	3.1	3.2	5.9	4.8	2.6
<i>Bases (unweighted)</i>								
Men	291	410	604	594	675	436	308	3318
Women	276	501	734	723	773	486	400	3893
<i>Bases (weighted)</i>								
Men	546	570	676	586	531	348	256	3514
Women	513	587	699	597	545	384	370	3694

<sup>a</sup> Indicating uncontrolled diabetes or possible undiagnosed diabetes.

Table 9.14

**Glycated haemoglobin levels (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over with a valid glycated haemoglobin measurement

2008

Glycated haemoglobin	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Men</b>										
<b>Observed</b>										
Mean	5.5	5.6	5.6	5.7	5.6	5.7	5.7	5.6	5.6	5.7
Standard error of the mean	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1
7% or more <sup>b</sup>	3.6	3.0	4.0	4.9	2.1	4.5	4.9	4.0	3.4	4.0
<b>Standardised</b>										
Mean	5.6	5.6	5.6	5.6	5.6	5.7	5.8	5.6	5.6	5.6
Standard error of the mean	0.06	0.03	0.05	0.05	0.03	0.04	0.05	0.03	0.05	0.05
7% or more <sup>b</sup>	3.9	3.0	4.0	4.5	2.1	4.4	6.4	4.0	3.1	3.8
<b>Women</b>										
<b>Observed</b>										
Mean	5.5	5.6	5.6	5.6	5.6	5.7	5.6	5.5	5.6	5.5
Standard error of the mean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7% or more <sup>b</sup>	1.7	2.3	3.0	2.2	2.9	4.6	2.8	2.3	2.8	1.0
<b>Standardised</b>										
Mean	5.5	5.5	5.6	5.6	5.6	5.6	5.7	5.5	5.6	5.5
Standard error of the mean	0.03	0.04	0.03	0.05	0.03	0.04	0.05	0.03	0.04	0.02
7% or more <sup>b</sup>	1.5	2.2	3.1	2.3	3.1	4.5	3.2	2.2	2.7	1.0
<i>Bases (unweighted)</i>										
Men	246	463	368	306	317	358	366	300	248	346
Women	261	559	444	349	401	375	400	377	296	431
<i>Bases (weighted)</i>										
Men	202	458	348	306	364	410	518	306	251	350
Women	177	502	386	319	420	396	495	340	268	391

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.<sup>b</sup> Indicating uncontrolled diabetes or possible undiagnosed diabetes.

Table 9.15

**Glycated haemoglobin levels (age-standardised), by equivalised household income and sex**

Aged 16 and over with a valid glycated haemoglobin measurement

2008

Glycated haemoglobin	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
	%	%	%	%	%
<b>Men</b>					
Mean	5.5	5.6	5.6	5.7	5.9
Standard error of the mean	0.03	0.02	0.03	0.04	0.08
7% or more <sup>a</sup>	3.6	2.5	2.4	3.9	8.3
<b>Women</b>					
Mean	5.5	5.5	5.6	5.6	5.7
Standard error of the mean	0.02	0.02	0.03	0.03	0.04
7% or more <sup>a</sup>	1.2	0.8	3.5	3.3	3.6
<i>Bases (unweighted)</i>					
Men	707	655	555	506	373
Women	687	690	665	669	554
<i>Bases (weighted)</i>					
Men	710	710	555	531	430
Women	624	654	617	645	557

<sup>a</sup> Indicating uncontrolled diabetes or possible undiagnosed diabetes.

Table 9.16

**Glycated haemoglobin levels (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over with a valid glycated haemoglobin measurement

2008

Glycated haemoglobin	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Mean	5.6	5.6
Standard error of the mean	0.02	0.02
7% or more <sup>b</sup>	4.0	3.7
<b>Women</b>		
Mean	5.6	5.6
Standard error of the mean	0.01	0.02
7% or more <sup>b</sup>	2.6	2.7
<i>Bases (unweighted)</i>		
Men	2086	1214
Women	2464	1408
<i>Bases (weighted)</i>		
Men	2255	1241
Women	2367	1309

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Indicating uncontrolled diabetes or possible undiagnosed diabetes.

Table 9.17

### Comparison of glycated haemoglobin levels, 2003, 2006 and 2008, by age and sex

Aged 16 and over with a valid glycated haemoglobin measurement

2003, 2006, 2008

Glycated haemoglobin	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
2003								
Mean (%)	4.9	5.0	5.3	5.4	5.6	5.7	5.7	5.3
Standard error of the mean	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.01
7% or more (%) <sup>a</sup>	-	-	2.5	3.1	5.3	6.8	4.7	2.
2006								
Mean (%)	5.2	5.3	5.4	5.6	5.7	6.0	6.0	5.5
Standard error of the mean	0.03	0.03	0.02	0.05	0.04	0.06	0.05	0.02
7% (%) <sup>a</sup>	1.1	1.1	2.0	4.0	5.2	10.7	9.4	3.9
2008								
Mean (%)	5.3	5.4	5.6	5.7	5.8	6.0	6.0	5.6
Standard error of the mean	0.02	0.03	0.03	0.04	0.03	0.05	0.04	0.01
7% or more (%) <sup>a</sup>	0.6	1.0	3.1	3.7	6.1	8.4	9.1	3.9
Women								
2003								
Mean (%)	5.0	5.0	5.1	5.3	5.5	5.7	5.8	5.3
Standard error of the mean	0.02	0.03	0.02	0.02	0.02	0.04	0.04	0.01
7% or more (%) <sup>a</sup>	0.3	1.3	1.4	1.2	3.0	6.2	6.1	2.4
2006								
Mean (%)	5.1	5.2	5.3	5.5	5.7	5.9	5.9	5.5
Standard error of the mean	0.03	0.02	0.02	0.02	0.02	0.04	0.04	0.01
7% or more (%) <sup>a</sup>	-	0.6	0.6	1.6	4.8	7.5	4.4	2.4
2008								
Mean (%)	5.3	5.3	5.4	5.6	5.8	5.9	6.0	5.6
Standard error of the mean	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.01
7% or more (%) <sup>a</sup>	-	0.8	2.2	3.1	3.2	5.9	4.8	2.6
Bases (unweighted)								
Men 2003	300	538	763	707	680	492	302	3782
Men 2006	261	416	667	594	680	474	283	3375
Men 2008	291	410	604	594	675	436	308	3318
Women 2003	334	593	897	806	820	540	427	4417
Women 2006	286	499	807	749	753	537	381	4012
Women 2008	276	501	734	723	773	486	400	3893
Bases (weighted)								
Men 2003	571	707	777	674	576	401	278	3985
Men 2006	537	588	707	583	534	362	259	3569
Men 2008	546	570	676	586	531	348	256	3514
Women 2003	560	707	789	667	601	449	427	4199
Women 2006	517	603	712	602	545	401	419	3799
Women 2008	513	587	699	597	545	384	370	3694

<sup>a</sup> Indicating uncontrolled diabetes or possible undiagnosed diabetes.



# Adult fruit and vegetable consumption

# 10

Melanie Doyle-Francis

## Summary

- The '5 A DAY' programme is part of a preventative strategy aimed at improving diet and nutrition in the general population. Current guidelines recommend that adults and children should aim to eat five or more portions of fruit and vegetables each day.
- Fruit and vegetable consumption is measured in portions per day, based on consumption in the day before the interview. Portions are expressed in everyday units such as whole or half fruit and tablespoons or bowls, to make it easier for respondents to recall their consumption accurately.
- 25% of men and 29% of women consumed the recommended five or more portions of fruit and vegetables daily. These proportions in 2008 are slightly lower than in 2007, when 27% of men and 31% of women consumed at least five portions daily.
- There was a significant difference between the sexes, with women being more likely than men to consume five or more portions in a day.
- Consumption also varied with age, increasing from 16-24 (18% of men and 21% of women) up to 55-64 (32% of men and 36% of women) and then decreasing again.
- The proportion of adults meeting government recommendations of five portions per day was lowest in the North East and North West, and highest in London.
- Higher consumption was also associated with higher income, and vice versa: 33% of men and 39% of women in the highest income quintile had consumed five or more portions, but only 20% of men and 21% of women in the lowest quintile had done so.
- The proportion of adults eating five or more portions of fruit and vegetables per day was higher among adults in non-Spearhead PCTs (26% of men and 31% of women) than in Spearhead PCTs (23% of men and 26% of women).

## 10.1 Introduction

This chapter examines fruit and vegetable consumption among adults.

There is a growing body of evidence for a link between poor diet and illness.<sup>1</sup> Of particular concern are the links between poor diet and cancer and coronary heart disease, which are likely to be magnified by obesity.<sup>2</sup> Recent analysis by the Cabinet Office's Strategy Unit as part of a broader project focusing on UK food policy found that not only does a poor diet have many health risks, but it also contributes to one in ten premature deaths. The social and economic costs of poor diet are clear, with recent estimates suggesting that, in 2002, treating food-related ill health cost around £6 billion, accounting for around 9% of NHS costs.<sup>3</sup> Pro-rated to 2007, it is estimated that these costs would be in the region of £7.7 billion.<sup>4</sup>

Reducing obesity and improving diet and nutrition was one of the key priorities in the government's 2004 white paper *'Choosing Health: making healthy choices easier'*.<sup>5</sup> It has also been the focus of a recent government consultation into healthy eating and the 2005 white paper *'Choosing a better diet: a food and health action plan'*.<sup>6,7</sup> The consultation and subsequent white paper identified priorities for action surrounding health and nutrition, with an emphasis on providing information to allow people to choose a better diet.

Government initiatives on healthy eating have highlighted the benefits of eating a diet high in fruit and vegetables.<sup>8</sup> The '5 A DAY' guidelines form part of a broad preventative strategy aimed at reducing the risks of chronic diseases such as obesity, diabetes, cardiovascular disease and cancer in the population. The guidelines recommend that *'everyone should eat at least 5 portions of a variety of fruit and vegetables each day'*, and the programme provides information about what constitutes a portion and foods which count towards '5 A DAY'.<sup>9</sup> Other nutritional priorities include reducing salt intake and the intake of saturated fats: fat and salt consumption have been reported in previous survey years.<sup>10</sup>

In January 2009, the 'Change4Life' initiative was launched to tackle obesity and inactivity, encouraging people to *'eat better and move more'*.<sup>11</sup> The Change4Life campaign has been widely advertised on the television, in the press, on billboards and online and has an interactive website.<sup>12</sup> Initially designed to target young families, the campaign stresses the link between 'fat in the body' and preventable illness, and highlights the impact of modern life on diet and exercise.

This chapter presents results from the 2008 survey together with some discussion of trends in adults meeting the guidelines on fruit and vegetable consumption. Trend data on key HSE measures, including fruit and vegetable consumption, are available in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre website.<sup>13</sup> The 2007 report included data on fruit and vegetable consumption, salt and fat intake; it also examined knowledge about government recommendations, and attitudes towards healthy eating.

## 10.2 Methods and definitions

### 10.2.1 Data collection in HSE

Questions about fruit and vegetable consumption have been included in HSE since 2001. All participants aged 5 and over are asked about fruit and vegetable consumption as part of the CAPI (computer assisted personal interview).

The questions are designed to assess fruit and vegetable consumption in the context of the '5 A DAY' programme. Consumption is measured in terms of the number of 'portions' of fruit and vegetables eaten per day.

Participants are asked about any fruit and vegetables consumed on the day before the interview. The time period covered, the 24 hours from midnight to midnight, means that variation in working patterns and times of meals does not affect the measure of average daily consumption. Any seasonal or weekly variation in eating habits is minimised in the

aggregate data, as interviewing is carried out throughout the year and on every day of the week.

### 10.2.2 Portion size

According to the '5 A DAY' guidelines, recommended daily consumption is 400g of fruit and vegetables, with one portion defined as 80g.<sup>14</sup>

A variety of foods contribute to daily fruit and vegetable intake. These include fresh, frozen and tinned vegetables; salads; pulses; fresh, tinned, frozen and dried fruit; and fruit or vegetables in composite dishes, such as apple crumble or vegetable curry.

Portion sizes for different food items have been converted to everyday units to make it easier for people to calculate (and monitor) their daily consumption. For example, an 80g portion is equal to three tablespoons of vegetables, a cereal bowlful of salad or a medium fruit (e.g. an apple). This approach has also been used in HSE to help participants to accurately report their consumption.

Table 10A shows the measures of portion size for different food items.

Table 10A	
Portion size for different food items	
<i><b>Food item</b></i>	<i><b>Portion size</b></i>
Vegetables (fresh, raw, tinned and frozen)	3 tablespoons
Pulses	3 tablespoons
Salad	1 cereal bowl
Vegetables in composites e.g. vegetable curry	3 tablespoons
Very large fruit e.g. melon	1 average slice
Large fruit e.g. grapefruit	Half a fruit
Medium fruit e.g. apples	1 fruit
Small fruit e.g. plums	2 fruits
Very small fruit and berries	1 average handful
Dried fruit	1 tablespoon
Frozen/tinned fruit	3 tablespoon
Fruit in composites e.g. stewed fruit	3 tablespoons
Fruit juice	1 small glass (150ml)

The '5 A DAY' guidelines also indicate which foods do not count as part of daily fruit and vegetable consumption. These guidelines were incorporated into the HSE questions. For example, potatoes do not count as these are regarded as a starchy staple. Fruit juice does count, but only as 1 portion, as juice contains less fibre than fresh fruit.<sup>9</sup>

According to the '5 A DAY' guidelines it is important to eat a variety of fruit and vegetables. Eating different fruit and vegetables provides the range of vitamins, minerals and nutrients needed. In HSE, the number of portions of fruit juice, pulses and dried fruit were capped at one portion each, even if the participant had consumed more than one portion the previous day.

### 10.2.3 Interpretation of data

The fruit and vegetable consumption module is based on self-reported information which is collected during a 24 hour recall period. Every attempt has been made to ensure that participants report an accurate picture of consumption by using everyday measures to identify portions. However, there may be variations in the way questions are interpreted by participants, for example, in assessing the number of portions in composite foods such as fruit pie.

It has also been suggested that some participants might intentionally over-report their consumption to indicate socially desirable behaviour.<sup>15</sup> Nevertheless, survey estimates can still provide useful comparisons of consumption patterns of the population.

In smaller sub-groups mean consumption might be influenced by individuals with particularly high, or particularly low, consumption. Median consumption is also shown, where appropriate, as an alternative measure not influenced by extreme values.

### 10.3 Fruit and vegetable consumption

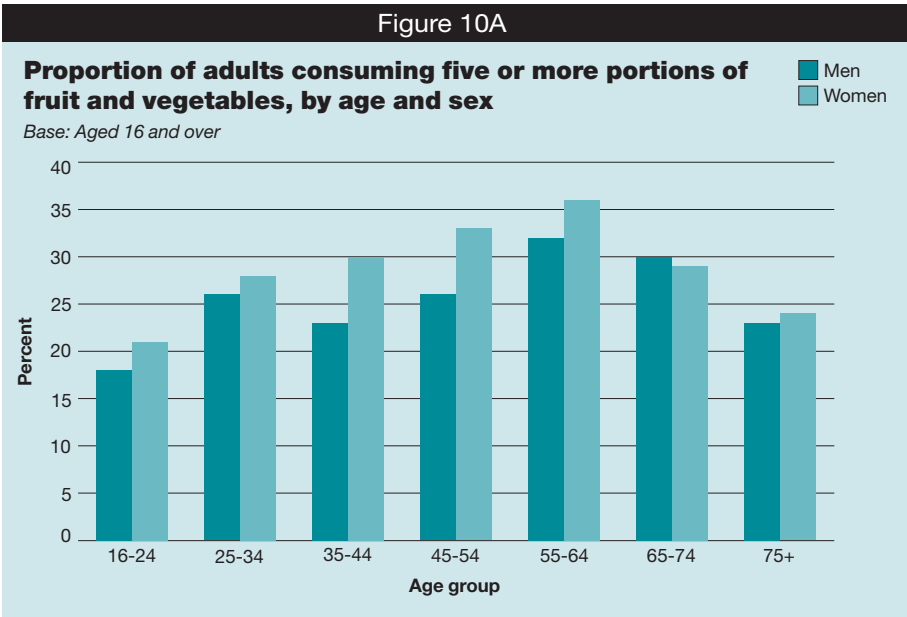
#### 10.3.1 Fruit and vegetable consumption, by age and sex

Generally, fruit and vegetable consumption was lower among men than women. This was reflected both in the proportion meeting the current guidelines of five portions per day (25% of men and 29% of women) and in the average number of portions consumed (3.5 portions for men, 3.8 portions for women).

There was significant variation in fruit and vegetable consumption by age, with a similar pattern observed for men and women. Fruit and vegetable consumption increased with age up to the 55-64 age group and then decreased among older adults. The proportion of men consuming the recommended five portions a day increased from 18% of 16-24 year olds to 32% of 55-64 year olds and then decreased to 23% of men aged 75 and over. Among women, the proportion consuming five or more portions increased from 21% of 16-24 year olds to 36% of 55-64 year olds and then declined to 24% of those aged 75 and over.

Figure 10A shows the proportion of adults in different age groups who had consumed five or more portions of fruit and vegetables the previous day, in line with government guidelines.

Table 10.1, Figure 10A



#### 10.3.2 Types of fruit and vegetable consumed, by age and sex

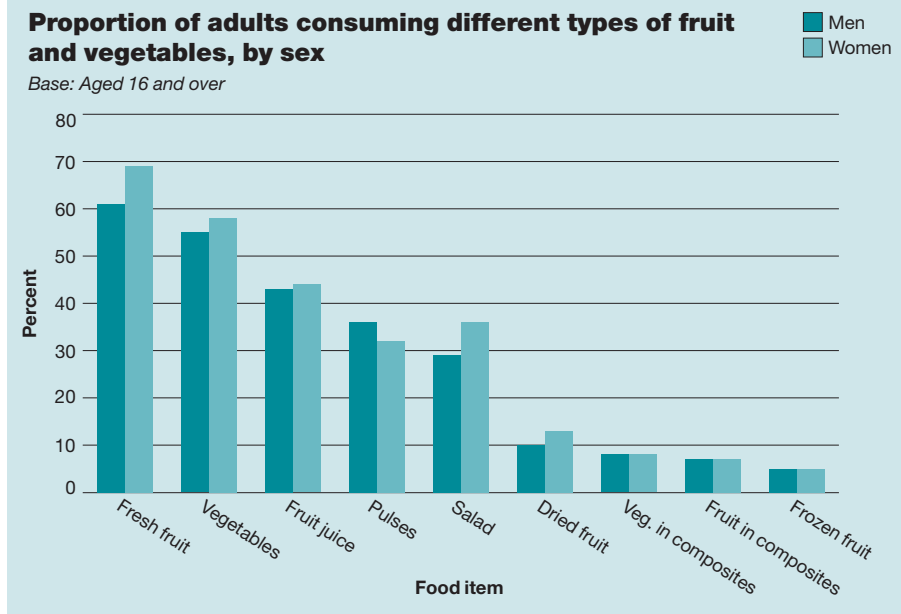
Patterns of consumption of some fruit and vegetables differed between men and women. Figure 10B shows the types of fruit and vegetables consumed, by sex.

Fresh fruit, vegetables, fruit juice, pulses and salad were the most commonly consumed types of fruit and vegetable. Women were more likely than men to consume most food types, with the exception of pulses. For example, fresh fruit was consumed by 69% of women and 61% of men, and salads by 36% of women and 29% of men. In contrast, pulses were consumed by 36% of men and 32% of women.

The pattern of consumption with age varied across categories of fruit and vegetables, but was similar for men and women. Consumption tended to increase with age for fresh fruit, vegetables and fruit in composites. However, consumption of fruit juice declined with age.

Table 10.2, Figure 10B

Figure 10B



### 10.3.3 Fruit and vegetable consumption, by Strategic Health Authority and sex

There was some variation by Strategic Health Authority among men and women, with highest consumption in London and lowest in the North East and North West. The proportion of men meeting the current guidelines of five portions a day ranged from 20% in the North East and North West to 34% in London; comparable figures for women were 23% in the North East, 25% in the North West and 36% in London. The mean number of portions of fruit and vegetables showed a similar regional pattern, with lower means in the North East (3.1 for men, 3.3 for women), and higher means in London (4.1 for men, 4.3 for women).

Tables 10.3, 10.4

### 10.3.4 Fruit and vegetable consumption, by equivalised household income and sex

There was significant variation by equivalised household income in the proportion of men and women eating five or more portions of fruit and vegetables per day; this is shown in Figure 10C.

The proportion of adults meeting the current guidelines of five portions per day increased with income, from around 20% of men in the two lowest income quintiles to 33% of men in the highest quintile and from 21% women in the lowest quintile to 39% in the highest. Although there appeared to be a sharper decline in fruit and vegetable consumption for women this was not significant. There was a similar pattern across the income quintiles for the mean daily number of portions of fruit and vegetables, with a mean of 4.0 for men and 4.4 for women in the highest quintile, and 3.1 and 3.2 respectively in the lowest quintile.

Figure 10D shows the different types of fruit and vegetables consumed for men in the highest and lowest quintiles to illustrate the pattern of consumption by income; a similar pattern was observed for women.

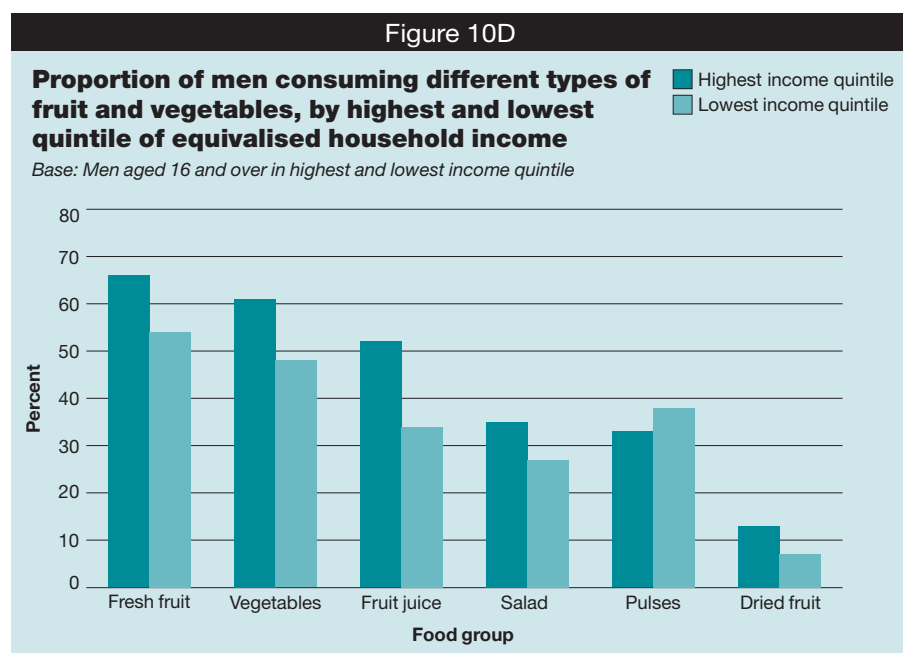
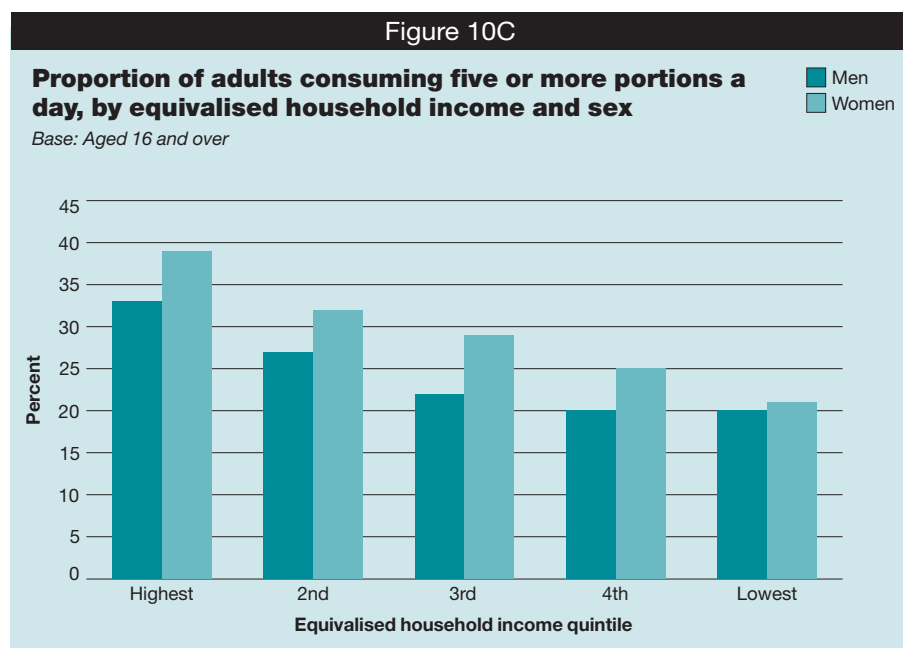
Consumption declined from the highest to the lowest income quintile for fresh fruit, vegetables, fruit juice and salad, but was similar across quintiles for pulses.

Tables 10.5, 10.6, Figures 10C, 10D

### 10.3.5 Fruit and vegetable consumption, by Spearhead status and sex

Fruit and vegetable consumption was higher among adults in non-Spearhead PCTs than those in Spearhead PCTs.<sup>16</sup> 26% of men in non-Spearhead PCTs consumed 5 or more portions, compared with 23% in Spearhead PCTs. Among women, the comparable figures were 31% in non-Spearhead PCTs and 26% in Spearhead PCTs. Similarly, the mean daily portions of fruit and vegetables were 3.6 for men and 3.9 for women in non-Spearhead PCTs, and 3.3 and 3.5 respectively in Spearhead PCTs.

Tables 10.7, 10.8



### 10.3.6 Trends in fruit and vegetable consumption

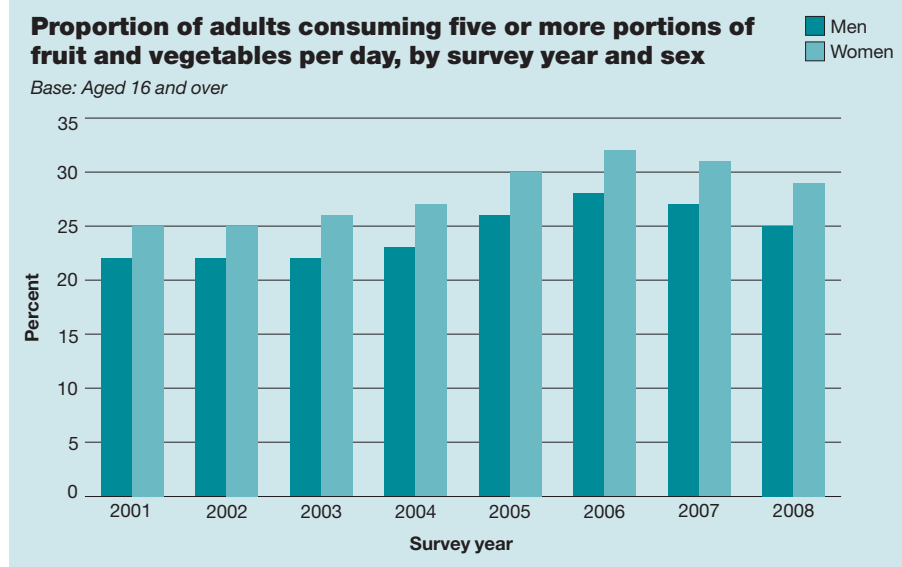
In 2008, 25% of men and 29% of women reported meeting the government guidelines for fruit and vegetable consumption. The proportion of adults consuming five or more portions a day was lower than 2007, when 27% of men and 31% of women reported consuming five or more portions.

Figure 10E shows the proportion consuming five or more portions of fruit and vegetables, by survey year and sex.<sup>13</sup>

It appears that fruit and vegetable consumption increased from 2001, when the questions were first introduced, reaching a peak in 2006 and 2007. The proportion of adults meeting the recommended five portions a day was lower in 2008 than in the preceding two years. However, further years' data would be needed to see whether or not this is an important difference representing an underlying trend in consumption.

**Figure 10E**

Figure 10E



## 10.4 Discussion

Overall, 25% of men and 29% of women reported meeting the government guidelines for fruit and vegetable consumption. The proportion of adults consuming five or more portions a day has declined since 2007, when 27% of men and 31% of women reported five or more portions.

Consumption varied with age, with adults aged 55-64 most likely to consume the recommended number of portions and younger adults least likely to do so.

The impact of income on fruit and vegetable consumption remains significant. As in previous years, fruit and vegetable consumption declined with income.

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- 16 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.



- 10.1 Daily fruit and vegetable consumption, by age and sex
- 10.2 Types of fruit and vegetables consumed daily, by age and sex
- 10.3 Daily fruit and vegetable consumption (observed and age-standardised), by Strategic Health Authority and sex
- 10.4 Types of fruit and vegetables consumed daily (observed and age-standardised), by Strategic Health Authority and sex
- 10.5 Daily fruit and vegetable consumption (age-standardised), by equivalised household income and sex
- 10.6 Types of fruit and vegetables consumed daily (age-standardised), by equivalised household income and sex
- 10.7 Daily fruit and vegetable consumption (age-standardised), by Spearhead status and sex
- 10.8 Types of fruit and vegetables consumed daily (age-standardised), by Spearhead status and sex

Table 10.1

**Daily fruit and vegetable consumption, by age and sex***Aged 16 and over**2008*

Portions per day	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
None	12	7	7	6	5	3	3	7
Less than 1 portion	3	3	3	3	3	3	2	3
1 portion or more but less than 2	20	20	16	16	11	13	14	16
2 portions or more but less than 3	21	18	18	16	17	17	19	18
3 portions or more but less than 4	14	14	17	16	18	20	21	17
4 portions or more but less than 5	12	12	15	17	15	15	18	15
5 portions or more	18	26	23	26	32	30	23	25
Mean	2.9	3.4	3.5	3.6	4.0	4.0	3.6	3.5
Standard error of the mean	0.07	0.07	0.07	0.07	0.08	0.10	0.10	0.03
Median	2.5	3.0	3.0	3.3	3.7	3.7	3.3	3.0
<b>Women</b>								
None	9	6	6	6	4	2	3	6
Less than 1 portion	4	3	3	2	2	2	4	3
1 portion or more but less than 2	19	14	15	11	11	13	13	14
2 portions or more but less than 3	18	18	16	14	14	17	20	16
3 portions or more but less than 4	17	17	17	17	16	20	19	17
4 portions or more but less than 5	12	13	14	17	15	16	17	15
5 portions or more	21	28	30	33	36	29	24	29
Mean	3.1	3.7	3.8	4.0	4.3	3.9	3.6	3.8
Standard error of the mean	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.03
Median	2.8	3.3	3.3	3.8	4.0	3.7	3.3	3.5
<i>Base (unweighted)</i>								
Men	773	954	1221	1101	1183	875	649	6756
Women	920	1220	1514	1374	1367	1000	947	8342
<i>Base (weighted)</i>								
Men	1136	1212	1414	1211	1087	726	540	7325
Women	1091	1216	1433	1233	1124	800	785	7682

Table 10.2

Types of fruit and vegetables consumed daily, by age and sex								
Aged 16 and over								2008
Types of fruit and vegetables consumed	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Any fruit and vegetables	88	93	93	94	95	97	97	93
Any vegetables including salad (excludes pulses)	60	67	72	72	76	76	75	71
Any vegetables excluding salad and pulses	50	55	60	59	65	64	66	59
Any fruit including fruit juice	74	77	74	78	83	86	88	79
Any fruit excluding fruit juice	54	59	63	70	76	80	82	67
Vegetables (fresh, raw, tinned and frozen)	45	50	56	55	62	62	63	55
Pulses	37	34	35	37	39	35	37	36
Salad	23	31	31	30	31	28	22	29
Vegetables in composites	8	9	8	8	8	6	5	8
Fresh fruit	49	54	57	65	69	73	75	61
Fruit in composites	5	5	5	7	9	14	15	7
Dried fruit	5	8	10	9	13	13	15	10
Frozen/ tinned fruit	3	3	3	4	6	8	12	5
Fruit juice	51	48	40	39	40	39	40	43
<b>Women</b>								
Any fruit and vegetables	91	94	94	94	96	98	97	94
Any vegetables including salad (excludes pulses)	63	74	77	78	79	79	77	75
Any vegetables excluding salad and pulses	51	61	62	63	66	66	66	62
Any fruit including fruit juice	77	80	81	82	86	90	89	83
Any fruit excluding fruit juice	63	70	72	76	81	84	85	75
Vegetables (fresh, raw, tinned and frozen)	47	57	59	59	63	63	64	58
Pulses	27	31	33	34	32	31	34	32
Salad	31	37	38	41	38	34	26	36
Vegetables in composites	9	8	9	9	8	6	5	8
Fresh fruit	58	65	67	71	76	77	77	69
Fruit in composites	5	5	5	6	9	13	12	7
Dried fruit	7	11	12	15	20	17	15	13
Frozen/ tinned fruit	2	3	4	3	5	7	11	5
Fruit juice	51	46	40	41	42	41	43	44
<b>Base (unweighted)</b>								
Men	773	954	1221	1101	1183	875	649	6756
Women	920	1220	1514	1374	1367	1000	947	8342
<b>Base (weighted)</b>								
Men	1136	1212	1414	1211	1087	726	540	7325
Women	1091	1216	1433	1233	1124	800	785	7682

Table 10.3

**Daily fruit and vegetable consumption (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over

2008

Portions per day	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Men</b>										
<b>Observed</b>										
None	9	10	8	7	5	7	5	5	7	5
Less than 1 portion	4	4	3	4	2	3	1	3	2	3
1 portion or more but less than 2	19	17	16	17	16	15	13	17	17	15
2 portions or more but less than 3	19	19	19	16	18	19	16	17	18	20
3 portions or more but less than 4	18	16	16	18	17	17	15	16	16	18
4 portions or more but less than 5	11	13	15	16	16	13	16	14	16	14
5 portions or more	20	20	23	22	25	26	33	27	25	25
Mean	3.1	3.1	3.3	3.4	3.6	3.6	4.1	3.6	3.6	3.6
Standard error of the mean	0.12	0.08	0.08	0.09	0.08	0.09	0.08	0.10	0.11	0.08
Median	2.7	2.7	3.0	3.0	3.3	3.0	3.8	3.3	3.2	3.3
<b>Standardised</b>										
None	9	10	8	7	5	8	4	5	7	5
Less than 1 portion	4	5	3	4	2	2	1	3	2	3
1 portion or more but less than 2	19	17	16	17	17	15	12	18	16	16
2 portions or more but less than 3	20	19	19	16	18	19	16	17	18	20
3 portions or more but less than 4	17	16	16	18	17	17	16	15	16	18
4 portions or more but less than 5	11	13	15	16	16	13	17	14	16	14
5 portions or more	20	20	23	22	25	26	34	27	25	25
Mean	3.1	3.2	3.3	3.4	3.6	3.6	4.1	3.6	3.6	3.5
Standard error of the mean	0.12	0.08	0.08	0.09	0.08	0.09	0.08	0.10	0.11	0.08
Median	2.7	2.7	3.0	3.0	3.2	3.0	4.0	3.2	3.2	3.2
<b>Bases (unweighted)</b>										
Men	430	966	716	640	679	823	758	532	528	684
<b>Bases (weighted)</b>										
Men	400	970	738	638	772	844	1050	585	588	739

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Continued...

Table 10.3 continued

Aged 16 and over

2008

Portions per day	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Women</b>										
<b>Observed</b>										
None	9	7	6	5	6	4	4	5	5	5
Less than 1 portion	4	4	3	2	3	2	2	2	3	2
1 portion or more but less than 2	17	15	17	12	17	13	11	13	14	11
2 portions or more but less than 3	18	16	16	17	18	18	14	17	15	17
3 portions or more but less than 4	18	17	17	21	16	18	17	19	14	19
4 portions or more but less than 5	12	16	13	11	15	16	16	16	17	14
5 portions or more	23	25	27	30	26	30	36	28	31	31
Mean	3.3	3.5	3.5	3.8	3.6	4.0	4.3	3.9	3.9	3.9
Standard error of the mean	0.13	0.08	0.08	0.09	0.09	0.09	0.08	0.10	0.11	0.09
Median	3.0	3.3	3.2	3.3	3.3	3.6	4.0	3.5	3.7	3.7
<b>Standardised</b>										
None	9	7	6	5	6	4	4	5	5	5
Less than 1 portion	4	4	3	3	3	2	2	2	3	2
1 portion or more but less than 2	17	15	16	12	17	13	11	13	14	11
2 portions or more but less than 3	18	16	17	18	18	18	14	17	15	17
3 portions or more but less than 4	17	17	17	21	16	18	17	20	15	19
4 portions or more but less than 5	13	16	13	11	15	16	17	16	17	14
5 portions or more	23	25	27	30	26	30	36	27	31	31
Mean	3.3	3.5	3.5	3.7	3.6	4.0	4.3	3.8	3.9	3.9
Standard error of the mean	0.13	0.08	0.08	0.09	0.09	0.09	0.08	0.10	0.11	0.09
Median	3.0	3.3	3.2	3.3	3.2	3.7	4.0	3.3	3.7	3.7
<b>Bases (unweighted)</b>										
Women	523	1197	910	801	878	940	927	676	625	865
<b>Bases (weighted)</b>										
Women	402	1041	802	683	843	838	1047	632	588	806

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 10.4

**Types of fruit and vegetables consumed daily (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over

2008

Types of fruit and vegetables consumed	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Men</b>										
<b>Observed</b>										
Any fruit and vegetables	91	90	92	93	95	93	95	95	93	95
Any vegetables including salad (excludes pulses)	63	65	67	71	75	70	75	71	71	74
Any vegetables excluding salad and pulses	53	55	57	56	60	59	62	60	61	64
Any fruit including fruit juice	72	75	77	76	80	77	83	82	82	81
Any fruit excluding fruit juice	61	60	65	66	69	65	71	73	70	71
Vegetables (fresh, raw, tinned and frozen)	50	52	53	51	54	57	57	58	57	61
Pulses	42	35	36	40	36	34	40	31	33	35
Salad	18	25	24	31	32	27	37	30	29	28
Vegetables in composites	5	7	6	7	9	7	12	5	8	7
Fresh fruit	54	55	59	61	63	61	63	66	64	66
Fruit in composites	7	6	8	9	8	6	6	9	9	8
Dried fruit	8	7	8	8	12	10	13	11	9	10
Frozen/ tinned fruit	4	5	4	5	5	5	4	7	5	5
Fruit juice	36	41	41	39	41	42	49	45	46	41
<b>Standardised</b>										
Any fruit and vegetables	91	90	92	93	95	92	96	95	93	95
Any vegetables including salad (excludes pulses)	63	65	67	71	75	69	76	70	71	73
Any vegetables excluding salad and pulses	53	55	56	55	59	59	63	60	61	63
Any fruit including fruit juice	72	75	77	75	80	76	83	82	82	81
Any fruit excluding fruit juice	61	60	65	65	69	65	72	72	70	71
Vegetables (fresh, raw, tinned and frozen)	50	52	53	51	54	56	58	57	58	60
Pulses	42	35	36	39	36	34	40	31	33	35
Salad	18	25	24	30	33	27	37	30	29	28
Vegetables in composites	5	7	6	7	9	7	12	5	8	7
Fresh fruit	54	55	59	60	63	61	65	66	64	66
Fruit in composites	6	6	8	8	8	6	6	9	9	8
Dried fruit	8	7	8	7	11	9	14	11	9	9
Frozen/ tinned fruit	4	5	4	5	5	5	4	7	5	4
Fruit juice	36	41	41	40	41	43	48	46	46	41
<b>Bases (unweighted)</b>										
Men	430	966	716	640	679	823	758	532	528	684
<b>Bases (weighted)</b>										
Men	400	970	738	638	772	844	1050	585	588	739

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Continued...

Table 10.4 continued

Aged 16 and over

2008

Types of fruit and vegetables consumed	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Women</b>										
<b>Observed</b>										
Any fruit and vegetables	91	90	92	93	95	92	96	95	93	95
Any vegetables including salad (excludes pulses)	63	65	67	71	75	69	76	70	71	73
Any vegetables excluding salad and pulses	53	55	56	55	59	59	63	60	61	63
Any fruit including fruit juice	72	75	77	75	80	76	83	82	82	81
Any fruit excluding fruit juice	61	60	65	65	69	65	72	72	70	71
Vegetables (fresh, raw, tinned and frozen)	50	52	53	51	54	56	58	57	58	60
Pulses	42	35	36	39	36	34	40	31	33	35
Salad	18	25	24	30	33	27	37	30	29	28
Vegetables in composites	5	7	6	7	9	7	12	5	8	7
Fresh fruit	54	55	59	60	63	61	65	66	64	66
Fruit in composites	6	6	8	8	8	6	6	9	9	8
Dried fruit	8	7	8	7	11	9	14	11	9	9
Frozen/ tinned fruit	4	5	4	5	5	5	4	7	5	4
Fruit juice	36	41	41	40	41	43	48	46	46	41
<b>Standardised</b>										
Any fruit and vegetables	91	93	94	95	94	96	96	95	95	95
Any vegetables including salad (excludes pulses)	68	73	72	75	75	77	79	75	76	77
Any vegetables excluding salad and pulses	57	60	60	61	58	63	67	62	64	63
Any fruit including fruit juice	78	80	81	84	81	84	86	87	83	85
Any fruit excluding fruit juice	70	71	72	75	72	78	78	78	76	79
Vegetables (fresh, raw, tinned and frozen)	55	57	57	57	54	60	62	59	61	59
Pulses	35	33	32	34	34	32	33	27	29	31
Salad	28	34	32	36	39	37	43	35	34	34
Vegetables in composites	4	8	7	6	7	8	12	8	8	7
Fresh fruit	65	66	65	69	67	72	73	72	70	74
Fruit in composites	5	7	8	8	6	8	7	9	9	8
Dried fruit	9	12	12	12	12	15	16	14	15	15
Frozen/ tinned fruit	6	3	6	6	5	4	3	5	5	6
Fruit juice	39	40	42	43	40	44	49	48	44	45
<b>Bases (unweighted)</b>										
Women	523	1197	910	801	878	940	927	676	625	865
<b>Bases (weighted)</b>										
Women	402	1041	802	683	843	838	1047	632	588	806

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 10.5

**Daily fruit and vegetable consumption (age-standardised),  
by equivalised household income and sex**

Aged 16 and over

2008

Portions per day	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Men</b>					
None	4	5	6	9	9
Less than 1 portion	2	3	2	3	4
1 portion or more but less than 2	13	16	17	20	20
2 portions or more but less than 3	16	17	19	19	19
3 portions or more but less than 4	17	18	16	16	16
4 portions or more but less than 5	15	14	17	12	11
5 portions or more	33	27	22	20	20
Mean	4.0	3.7	3.4	3.2	3.1
Standard error of the mean	0.07	0.07	0.07	0.08	0.09
Median	3.7	3.3	3.0	2.7	2.7
<b>Women</b>					
None	2	5	5	7	10
Less than 1 portion	2	2	3	3	5
1 portion or more but less than 2	11	13	12	16	18
2 portions or more but less than 3	13	16	17	18	18
3 portions or more but less than 4	17	16	19	19	16
4 portions or more but less than 5	16	16	16	13	12
5 portions or more	39	32	29	25	21
Mean	4.4	3.9	3.8	3.5	3.2
Standard error of the mean	0.07	0.07	0.07	0.07	0.07
Median	4.2	3.7	3.5	3.0	2.7
<i>Base (unweighted)</i>					
Men	1331	1183	1045	1048	856
Women	1317	1285	1318	1401	1275
<i>Base (weighted)</i>					
Men	1442	1312	1106	1092	910
Women	1243	1211	1200	1249	1150



Table 10.6

**Types of fruit and vegetables consumed daily (age-standardised), by equivalised household income and sex**

Aged 16 and over 2008

Types of fruit and vegetables consumed	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Men</b>					
Any fruit and vegetables	96	95	94	91	91
Any vegetables including salad (excludes pulses)	76	73	69	67	65
Any vegetables excluding salad and pulses	65	62	57	56	53
Any fruit including fruit juice	83	81	79	73	72
Any fruit excluding fruit juice	72	70	67	61	61
Vegetables (fresh, raw, tinned and frozen)	61	58	54	53	48
Pulses	33	38	36	37	38
Salad	35	27	27	23	27
Vegetables in composites	8	7	7	7	9
Fresh fruit	66	64	62	56	54
Fruit in composites	8	9	7	7	7
Dried fruit	13	12	10	7	7
Frozen/ tinned fruit	4	4	4	5	5
Fruit juice	52	44	44	36	34
<b>Women</b>					
Any fruit and vegetables	98	95	95	93	90
Any vegetables including salad (excludes pulses)	83	76	76	71	65
Any vegetables excluding salad and pulses	71	62	62	57	54
Any fruit including fruit juice	89	85	84	81	74
Any fruit excluding fruit juice	82	78	77	72	66
Vegetables (fresh, raw, tinned and frozen)	67	59	60	55	51
Pulses	33	32	32	33	31
Salad	45	38	35	29	30
Vegetables in composites	10	9	6	7	7
Fresh fruit	75	73	73	67	60
Fruit in composites	9	8	7	8	6
Dried fruit	17	16	13	11	10
Frozen/ tinned fruit	4	4	5	6	4
Fruit juice	49	46	48	40	37
<i>Base (unweighted)</i>					
Men	1331	1183	1045	1048	856
Women	1317	1285	1318	1401	1275
<i>Base (weighted)</i>					
Men	1442	1312	1106	1092	910
Women	1243	1211	1200	1249	1150

Table 10.7

**Daily fruit and vegetable consumption (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over

2008

Portions per day	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
	%	%
<b>Men</b>		
None	6	8
Less than 1 portion	2	3
1 portion or more but less than 2	15	18
2 portions or more but less than 3	18	18
3 portions or more but less than 4	17	16
4 portions or more but less than 5	15	13
5 portions or more	26	23
Mean	3.6	3.3
Standard error of the mean	0.04	0.05
Median	3.3	3.0
<b>Women</b>		
None	5	7
Less than 1 portion	2	3
1 portion or more but less than 2	13	15
2 portions or more but less than 3	16	17
3 portions or more but less than 4	17	18
4 portions or more but less than 5	15	14
5 portions or more	31	26
Mean	3.9	3.5
Standard error of the mean	0.04	0.05
Median	3.7	3.3
<i>Bases (unweighted)</i>		
<i>Men</i>	4236	2495
<i>Women</i>	5202	3107
<i>Bases (weighted)</i>		
<i>Men</i>	4657	2643
<i>Women</i>	4876	2776

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

Table 10.8

**Types of fruit and vegetables consumed daily (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over

2008

Types of fruit and vegetables consumed	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
	%	%
<b>Men</b>		
<i>Any fruit and vegetables</i>	94	92
<i>Any vegetables including salad (excludes pulses)</i>	72	67
<i>Any vegetables excluding salad and pulses</i>	61	55
<i>Any fruit including fruit juice</i>	81	75
<i>Any fruit excluding fruit juice</i>	69	63
Vegetables (fresh, raw, tinned and frozen)	57	51
Pulses	35	37
Salad	30	27
Vegetables in composites	8	7
Fresh fruit	63	57
Fruit in composites	8	7
Dried fruit	10	9
Frozen/ tinned fruit	5	4
Fruit juice	44	41
<b>Women</b>		
<i>Any fruit and vegetables</i>	95	93
<i>Any vegetables including salad (excludes pulses)</i>	76	73
<i>Any vegetables excluding salad and pulses</i>	63	59
<i>Any fruit including fruit juice</i>	85	80
<i>Any fruit excluding fruit juice</i>	77	71
Vegetables (fresh, raw, tinned and frozen)	60	56
Pulses	31	33
Salad	36	35
Vegetables in composites	8	7
Fresh fruit	71	66
Fruit in composites	8	6
Dried fruit	15	12
Frozen/ tinned fruit	5	5
Fruit juice	45	41
<i>Bases (unweighted)</i>		
<i>Men</i>	4236	2495
<i>Women</i>	5202	3107
<i>Bases (weighted)</i>		
<i>Men</i>	4657	2643
<i>Women</i>	4876	2776

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

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# Adult cigarette smoking

# 11

Heather Wardle

## Summary

- This chapter presents information on cigarette smoking prevalence. It also examines data assessing the impact of smokefree legislation, introduced on 1st July 2007, upon smoking behaviour and secondary exposure to other people's smoke.
- In HSE 2008, self-reported cigarette smoking prevalence was 24% for men and 20% for women. Among those aged 16-44, men were more likely than women to report smoking cigarettes. Cigarette smoking prevalence was 9 percentage points higher among men aged 25-34 than women of the same age (34% men; 25% women).
- Male smokers also reported smoking more cigarettes than women. On average, male smokers smoked 13.7 cigarettes per day whereas women smoked 12.2 .
- Cigarette smoking prevalence varied by socio-economic sub-group. Prevalence of smoking was highest among those who lived in the lowest income households (39% men; 35% women) and lowest among those living in the highest income households (17% men; 11% women). Smoking prevalence was also significantly higher among those living in Spearhead Primary Care Trusts (the most health deprived areas in England) than those who did not live in Spearhead PCTs.
- Cotinine is a derivative of nicotine and a level of 15 nanograms per millilitre (ng/ml) is indicative of personal tobacco use in the past 24 hours. Among self-reported non-smokers, detectable cotinine levels of less than 15ng/ml are indicative of exposure to other people's smoke.
- 26% of men and 21% of women had a cotinine level of 15ng/ml or above. This is slightly higher than self-reported cigarette smoking prevalence. Among men, most of the difference between the two estimates can be accounted for by cigar or pipe smoking. Among women aged 25 - 44, there appears to be a low but persistent level of under-reporting of cigarette smoking behaviour.
- Smokefree legislation was introduced in England on 1st July 2007. Comparison of HSE data 12 months pre policy implementation and 12 months post implementation shows that non-smokers were less exposed to the smoke of others than previously. Geometric mean cotinine levels among male non-smokers fell from 0.20ng/ml to 0.14ng/ml, pre and post 1st July 2007. Equivalent estimates for women were 0.19ng/ml and 0.13ng/ml.
- Self-reported mean hours of exposure to other people's smoke was also significantly lower post policy implementation, falling from 6.2 hours to 3.3 hours among men and 4.4 hours to 2.7 hours among women, pre and post 1st July 2007.
- Cigarette smoking prevalence did not vary significantly pre and post policy implementation. However, there is evidence that cigarette consumption has declined post 1st July 2007. Mean cotinine levels among male smokers fell from 316.4ng/ml to 275.6ng/ml and among female smokers fell from 276.9ng/ml to 249.6ng/ml, pre and post 1st July 2007.

- The impact of the smokefree legislation has varied among different sub-groups. For example, among male smokers in routine and manual occupations, mean cotinine levels did not significantly decrease post policy implementation. Likewise, geometric mean cotinine levels among female non-smokers from routine and manual households did not change significantly post policy implementation.

## 11.1 Introduction

Smoking is acknowledged as the greatest contributor to inequalities in health and mortality in this country.<sup>1</sup> The World Health Organisation (WHO) Tobacco Atlas estimates that in developed countries, smoking cigarettes kills between one third to one half of lifetime users.<sup>2</sup> In the United Kingdom, smoking is recognised to be the greatest single cause of preventable illness and premature death. Figures from the report *Statistics on Smoking: England 2009*<sup>3</sup> showed that in England in 2008 around 83,900 deaths among adults aged 35 and over were estimated to be caused by smoking, accounting for 23% of deaths in men and 14% of deaths in women aged 35 and over. These included around 37,700 deaths from cancer, 23,200 deaths from respiratory diseases, 21,600 deaths from circulatory diseases and 1,400 of deaths from diseases of the digestive system. This report also estimates that around 5% (440,900) of all hospital admissions among adults aged 35 and over in England were attributable to smoking.

In addition to causing harm to the smoker, exposure to other people's smoke causes conditions such as heart disease and lung cancer;<sup>4</sup> it exacerbates asthma;<sup>5</sup> and, among children, contributes to ear and respiratory problems<sup>5</sup> and cot deaths.<sup>4</sup> There is no threshold for exposure to secondhand smoke below which it is harmless.<sup>6</sup>

The government is committed to reducing the number of people smoking and has set the target that smoking rates among adults should be 21% or less by 2010, with a reduction in prevalence among routine and manual groups to 26% or less. This commitment is emphasised in the revised PSA targets published in 2007.<sup>7</sup> In 2007 the General Household Survey, which monitors progress towards the PSA targets, showed that smoking prevalence in 2007 had fallen to 21%. However, the authors of this report recognised that some respondents may mis-report their smoking behaviour and that the true estimate of smoking prevalence may be marginally higher than this.<sup>8</sup>

Furthermore, it is widely recognised that levels of smoking vary between different socio-economic groups; the white paper, *Smoking Kills*, stated that reductions in levels of smoking should occur equitably among manual and non-manual groups.<sup>9</sup> In 2004, the government set out its strategy to tackle smoking and the effects of smoking on other people in the white paper, *Choosing Health: Making healthy choices easier*.<sup>10</sup> Since then a number of proposed initiatives have been implemented, including the introduction of smokefree legislation in England from the 1st July 2007, the introduction of picture health warnings on cigarette packets from 1st October 2008 and from the 1st October 2007, raising the minimum age for sale of cigarettes from 16 to 18.

The Health Survey for England 2007 report provided a preliminary analysis of the impact of the smokefree legislation upon smoking behaviour, secondary exposure to other people's smoke, and attitudes to the smoking ban. Some promising results showed that there had been a reduction in exposure to secondhand smoke among non-smokers but that the impact differed among sub-groups, with some key target groups (young men, young men from routine and manual backgrounds) showing little difference in behaviours pre and post implementation of the smokefree legislation. This chapter builds upon those analyses and examines the impact of the legislation using data collected 12 months prior to 1st July 2007 and data collected 12 months after 1st July 2007. In addition, smoking behaviour in England in 2008 is also described.

In this chapter both self-reported data about smoking behaviour and objective cotinine data are presented. Cotinine data have also been used to assess levels of secondary exposure to tobacco smoke among adults, with a specific focus upon non-smokers. Where data permit, the chapter assesses whether there have been any inequalities in the impact of the smokefree legislation.

Trend data are available on smoking and other key variables in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre's website.<sup>11</sup>

## 11.2 Methods and definitions

### 11.2.1 Self-reported data

Questions about cigarette smoking have been asked of adults aged 16 and over as part of the HSE series since its inception in 1991. Participants aged 25 and over were asked about their smoking behaviour within the face to face interview. The interview collected information about the use of various tobacco products including cigarettes, cigars and among men, pipes. Those who reported smoking cigarettes were asked to estimate their daily consumption of cigarettes.

All participants aged 16 and over were asked to estimate the total number of hours that they were exposed to other people's smoke.

For those aged 16-17, information about smoking status was collected through a self-completion questionnaire to offer participants more privacy and to allow them to reply without disclosing their smoking behaviour to other household members. At the interviewer's discretion, those aged 18-24 could answer the smoking questions either through the face to face interview or through the self-completion questionnaire. In 2008, 18% of adults aged 18-24 answered the smoking behaviour questions through the self-completion questionnaire.

### 11.2.2 Cotinine

Cotinine is a metabolite of nicotine. It is generally considered to be the most useful of various biological markers that are indicators of personal tobacco use.<sup>12</sup> It can be measured in serum or saliva. For this survey, cotinine levels were measured using saliva. All participants who completed the stage one interviewer visit were asked if they would be willing to participate in the next stage of the survey, a visit by a qualified nurse. As part of the nurse visit, participating adults were asked if they would be willing to provide a small saliva sample which was analysed for cotinine. An additional weight has been applied to the cotinine data to account for differential non-response to the saliva sample (see Volume 2, Methods and documentation, Section 7).

Cotinine has a half-life in the body of around 16-20 hours, which means that it will detect regular tobacco use, but not occasional tobacco use if the last occasion was several days ago.<sup>13</sup> A level of 15 nanograms per millilitre (ng/ml) is regarded as indicative of smoking; it is unlikely to be due to anything other than personal use of tobacco.

Using a sensitive assay, cotinine levels less than 15ng/ml are indicative of either occasional smoking, particularly if the participants reported only occasionally smoking cigarettes, or indicative of exposure to environmental tobacco smoke, particularly if the participant reported that they did not currently smoke.<sup>14</sup> The latter provides a useful measure to monitor levels of secondary exposure to other people's smoke at both the population level and by sub-groups, as personal tobacco use, nicotine replacement therapy, and breathing other people's tobacco smoke, are the only sources of detectable cotinine levels.<sup>15</sup>

### 11.2.3 Pre and post 1st July 2007 analyses

In order to assess the impact of the smokefree legislation, data have been combined across Health Survey years. Data from participants interviewed between 1st July 2006 and 30th June 2007 have been combined from HSE 2006 and HSE 2007 to provide 12 months' data prior to the implementation of the smokefree legislation. Likewise, data from participants interviewed from 1st July 2007 to 30th June 2008 have been combined from HSE 2007 and HSE 2008 to give comparable data in the twelve months after the introduction of the smokefree legislation. These timeframes, 12 months before and 12 months after implementation, were chosen as they are of comparable duration and importantly contain the same seasonal periods.

All pre and post analyses presented in this chapter use these combined data. Interview and cotinine weights have been recalibrated accordingly to match the population distributions (see Volume 2, Methods and documentation, Section 7).



### 11.2.4 National Statistics Socio-economic Classification (NS-SEC)

NS-SEC is a social classification system that attempts to classify groups on the basis of employment relations, based on characteristics such as career prospects, autonomy, mode of payment and period of notice. It was introduced in 2001. It has similarities to Registrar General's Social Class. Participants are assigned to an NS-SEC category based on the current or former occupation of the household reference person.<sup>16</sup> Because base sizes are small for analyses using NS-SEC in this chapter, two groups are presented, with managerial and professional and intermediate categories grouped together as 'non routine/ non-manual', and other categories grouped as 'routine and manual'.<sup>17</sup>

## 11.3 Smoking behaviour in England

### 11.3.1 Introduction

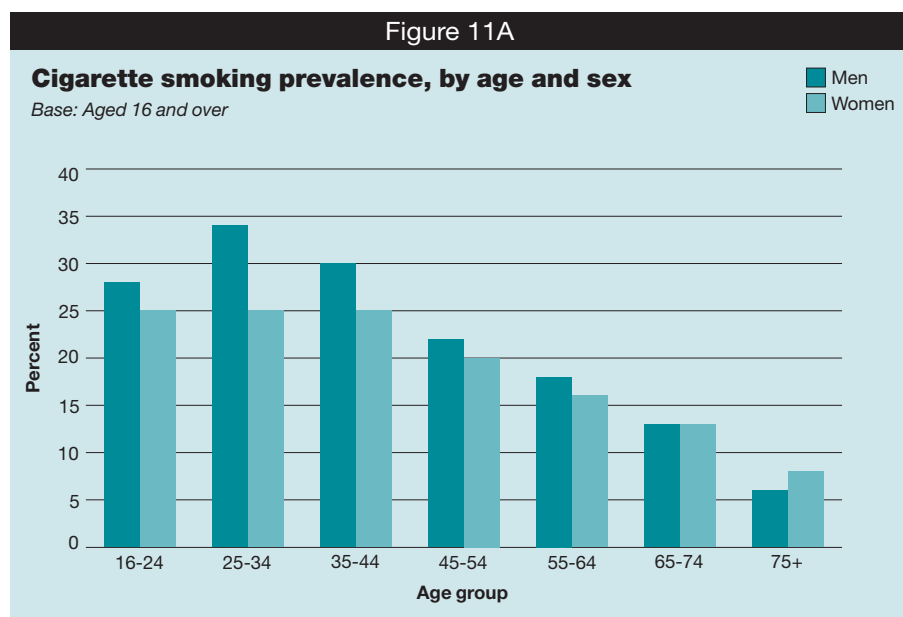
This section provides an overview of smoking behaviour in England in 2008. It provides accurate information about cigarette smoking prevalence, how many cigarettes smokers consume on an average day and gives an overview of geographical and socio-economic differences in smoking prevalence. In addition, cotinine data are presented, providing an objective measure of smoking prevalence.

### 11.3.2 Self-reported cigarette smoking prevalence and cigarette consumption

In 2008, 24% of men and 20% of women aged 16 and over reported that they were current cigarette smokers.

As in previous years, prevalence varied by age group. Among both men and women, smoking prevalence was highest among younger adults and lowest among older adults. From the age of 45 or more, smoking prevalence for men and women was similar. However, among those aged 16-44, men were more likely to report smoking cigarettes than women. Smoking prevalence was 9 percentage points higher among men aged 25-34 than women of the same age (34% and 25% respectively) and was 5 percentage points higher among men aged 35-44 than women in this age group (30% and 25% respectively).

Table 11.1, Fig 11A



Current smokers were asked to estimate their daily consumption of cigarettes on both weekdays and at weekends. 29% of male smokers and 21% of female smokers reported smoking 20 or more cigarettes per day.

As observed in previous years, male smokers reported smoking more cigarettes per day, on average, than female smokers (13.7 cigarettes and 12.2 cigarettes respectively). For both

men and women, mean cigarette consumption varied significantly by age, with mean cigarette consumption being lowest among the youngest and oldest age groups. Among men, those aged 55-64 reported smoking the most cigarettes, 17.4 on average, whereas cigarette consumption among women was highest among those aged 45-54 (14.0).

Table 11.2

11.3.3 Self-reported cigarette smoking prevalence by Strategic Health Authority

Table 11.3 shows cigarette smoking prevalence by Strategic Health Authority. Estimates have been age-standardised to account for the differing age profile within each region. Cigarette smoking prevalence varied significantly by Strategic Health Authority. Standardised estimates for men showed that those living in the West Midlands (21%), London (21%) and South West (20%) areas had the lowest rates of smoking prevalence whereas those living in the North West and East Midlands had the highest (28% for both). Among women, standardised estimates were lowest among those living in London and the South East Coast (16% for both areas) and highest among those in the North East (25%).

Table 11.3

11.3.4 Self-reported cigarette smoking prevalence by Spearhead status

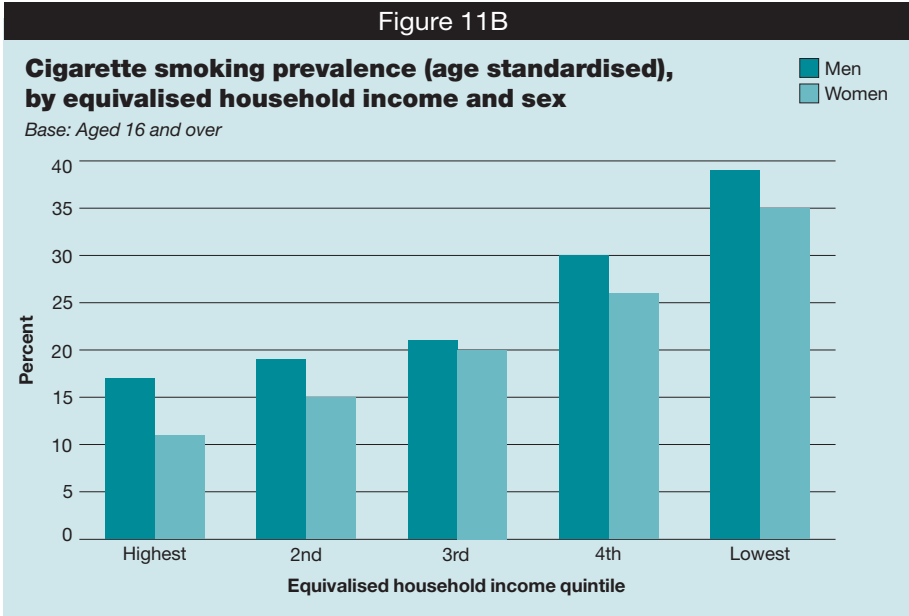
Spearhead Primary Care Trusts<sup>18</sup> are the most health deprived areas of England. Among both men and women, cigarette smoking prevalence was higher among those living in Spearhead PCT areas than those who did not. Cigarette smoking prevalence for men was 26% for those living in Spearhead PCTs and 22% for those living in non-Spearhead PCTs. Equivalent estimates for women were 21% and 19% respectively.

Table 11.5

11.3.5 Self-reported cigarette smoking prevalence by equivalised household income

There are inequalities in the prevalence of cigarette smoking among different population sub-groups, as illustrated by the difference between Spearhead and non-Spearhead PCTs (see section 11.3.4). However, as observed in previous years, differences in cigarette smoking prevalence by sub-groups were most marked when looking at the variation by equivalised household income. Equivalised household income is a measure of income that takes into account the total number of people living in the household. Estimates have been age-standardised. Among both men and women, cigarette smoking prevalence was lowest in the highest income households (17% for men; 11% for women) and highest among the lowest income households (39% for men and 35% for women). It is notable that around two in five men and one in three women who live in the lowest income households were current cigarette smokers.

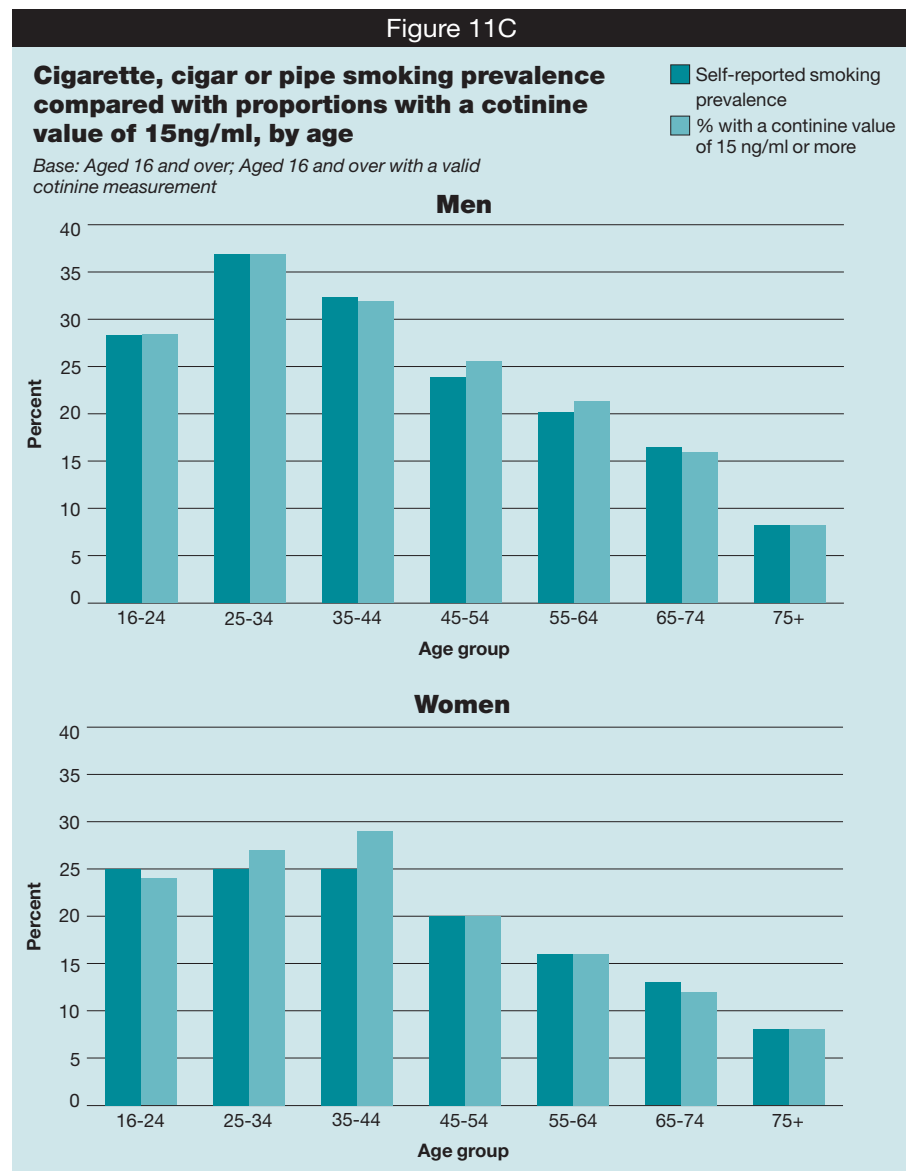
Table 11.4, Fig 11B



### 11.3.6 Cotinine levels

Cotinine is a derivative of nicotine and a high cotinine level is indicative of personal tobacco use.<sup>13</sup> A threshold of 15ng/ml has generally been used as an indicator of personal tobacco use in the past 24 hours.<sup>19</sup> Saliva cotinine levels provide an objective cross check of self-reported smoking behaviour, as well as providing information about levels of exposure to other people's smoke among non-smokers.<sup>12</sup>

Overall, 26% of men and 21% of women had a cotinine level consistent with having smoked in the past 24 hours. As observed in 2007, the overall proportions with a cotinine level of 15ng/ml were higher than self-reported estimates of cigarette smoking. Among men, most of the difference may be explained through pipe or cigar smoking. Figure 11C shows the difference between self-reported cigarette, cigar and pipe smoking and the proportion of participants with a cotinine value of 15ng/ml or more.



For most groups, the proportions reporting currently smoking cigarettes, pipes or cigars were similar to those with a cotinine value of 15ng/ml or more. However, there were some small, though important, exceptions. Among women, the proportion with a cotinine level of 15ng/ml or more was one percentage point higher than self-reported cigarette or cigar smoking prevalence. The difference between the two measures was most marked for women aged 35-44. 29% of women aged 35-44 had a cotinine level of 15ng/ml or more whereas 25% of women of the same age reported being either current cigarette or cigar smokers.

Such differences are a concern. Self-reported smoking status is a more inclusive measure as it incorporates both occasional and casual smokers, whereas cotinine is a measure of smoking in the last 24 hours, which captures regular, daily smoking and casual smokers whose last cigarette was in the 24 hours prior to interview. If there were no reporting biases, one would expect that self-reported smoking status would be higher than cotinine measurements. As this is not the case, it appears that for some groups, there is a small amount of under-reporting in relation to smoking status. These differences are important to understand and quantify, particularly when judging progress towards targets on this measure.

**Table 11.6, Fig 11C**

Mean cotinine levels among self-reported cigarette smokers are shown in Table 11.7. For both men and women, levels varied by age group, being lowest among the youngest age group (212.4ng/ml for men aged 16-34; 174.2ng/ml for women aged 16-24) and higher among older age groups (326.2ng/ml for men aged 55-64; 292.5ng/ml for women aged 45-54).

**Table 11.7**

Table 11.8 shows geometric mean cotinine values for self-reported and cotinine validated non-smokers. To be included within this category, participants had to have a cotinine value of less than 15ng/ml and be a self-reported non-smoker. Geometric means have been calculated for this group as they take into account any high or extreme values that might affect the average or mean for a sub-group.<sup>20</sup> For both male and female non-smokers, geometric mean cotinine varied by age, being higher among those aged 16-24 than all other age groups (0.20ng/ml for men aged 16-24 and 0.18ng/ml for women aged 16-24). This indicates that exposure to other people's smoke was highest among those participants. Geometric mean cotinine was also higher among men than women, 0.13ng/ml for men and 0.12ng/ml for women.

**Table 11.8**

## 11.4 The impact of the smokefree legislation

### 11.4.1 Introduction

On the 1st July 2007, smokefree legislation in England came into force. This section looks at any changes observed in smoking behaviour, cigarette consumption, saliva cotinine levels and exposure to other people's smoke pre and post 1st July, to assess the impact of this legislation. Combined data from HSE 2006, 2007 and 2008 have been used to compare the 12 month period prior to the 1st July 2007 with the 12 month period after the implementation of the legislation.<sup>21</sup>

### 11.4.2 Cigarette smoking prevalence, based on self-report and cotinine levels, pre and post 1st July 2007

Overall, there was no significant difference in cigarette smoking prevalence before and after the implementation of the smokefree legislation. 23% of men and 20% of women who were interviewed post 1st July 2007 reported that they were current smokers compared with 24% of men and 21% of women interviewed prior to 1st July 2007. There was also no significant difference in the proportion of men and women with a cotinine level of 15ng/ml or more pre and post 1st July 2007. 26% of men and 21% of women had a cotinine level consistent with smoking in the previous 24 hours prior to 1st July 2007. Equivalent estimates post legislation were 25% and 21%.

**Table 11.9, 11.11**

### 11.4.3 Cigarette consumption, based on self-report and mean cotinine among smokers, pre and post 1st July 2007

Self-reported data on the number of cigarettes smoked per day (both for weekdays and weekends), and the mean number of cigarettes smoked per smoker did not vary pre and post implementation of the smokefree legislation. Prior to the 1st July 2007, men reported smoking 13.6 cigarettes per day. After 1st July 2007, they reported smoking 13.7 cigarettes per day. Equivalent estimates for women were 12.4 cigarettes per day pre 1st July 2007 and

12.3 cigarettes per day post 1st July 2007. In HSE 2007, it was noted that although many participants felt the smokefree legislation would be likely to encourage them to cut back on the number of cigarettes they smoked, there was a disparity between intentions and actions.

Table 11.10

The lack of discernible impact upon cigarette smoking prevalence and self-reported cigarette consumption overall may mask some important changes. Table 11.12 shows mean cotinine levels among self-reported cigarette smokers. This is an objective measure of nicotine consumption.

For both male and female smokers, mean cotinine levels were significantly lower post 1st July 2007. Among male smokers, mean cotinine levels fell from 316.4ng/ml pre 1st July to 275.6ng/ml post 1st July 2007. Equivalent estimates for women were 276.9ng/ml pre and 249.6ng/ml post implementation. For both men and women, there were reductions in mean cotinine levels among all age groups, with the largest difference being observed among men aged 55 and over, whose mean cotinine levels fell from 400.8ng/ml pre to 310.0ng/ml post legislation.

Table 11.12, Fig 11D

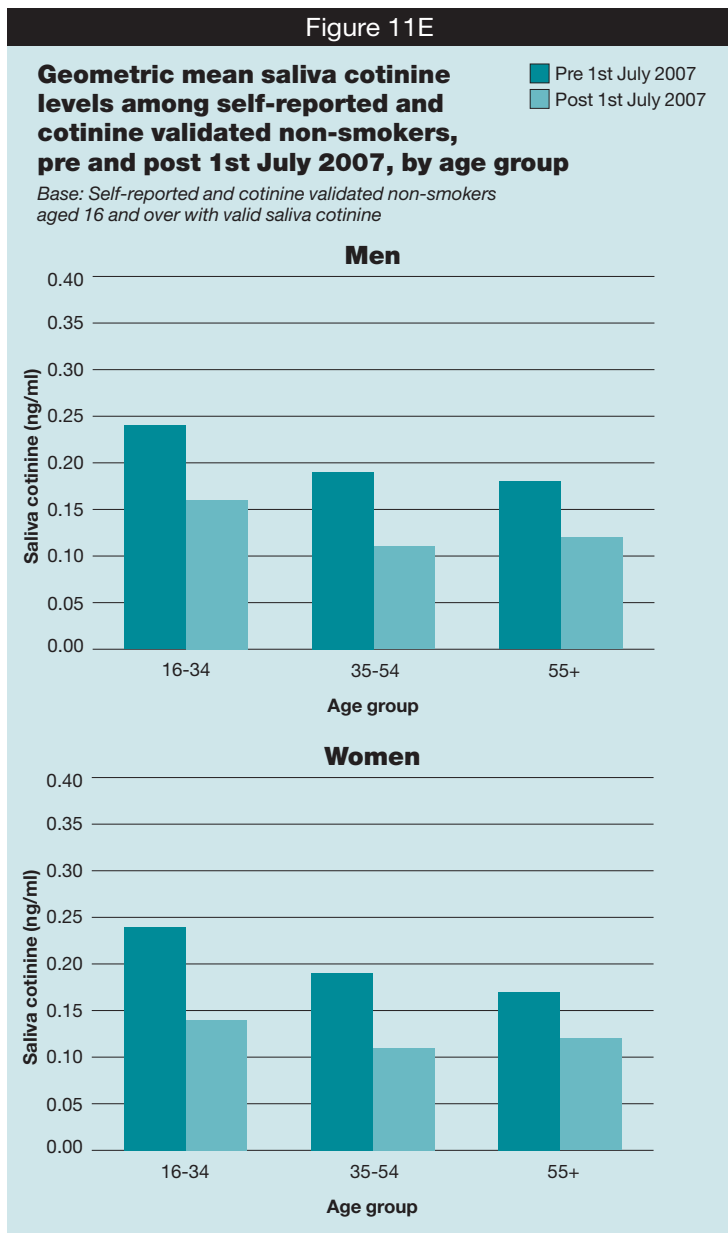


#### 11.4.4 Geometric mean cotinine levels among self-reported and cotinine validated non-smokers pre and post 1st July 2007

Geometric mean cotinine levels among self-reported and cotinine validated non-smokers are shown in table 11.13.<sup>22</sup> Among both male and female non-smokers, geometric mean cotinine levels were significantly lower after the implementation of the smokefree legislation

than before it. Among male non-smokers, geometric mean cotinine fell from 0.20ng/ml (pre 1st July 2007) to 0.14ng/ml (post 1st July 2007). Among female non-smokers, geometric mean cotinine fell from 0.19ng/ml to 0.13ng/ml pre and post legislation. With the exception of men aged 16-34,<sup>23</sup> there were significant falls in geometric mean cotinine for all age groups. The largest decline was observed among female non-smokers aged 16-34, where geometric mean cotinine fell from 0.24ng/ml (pre legislation) to 0.15ng/ml (post legislation).

Table 11.13, Fig 11E



### 11.4.5 Cotinine levels, pre and post 1st July 2007, by NS-SEC

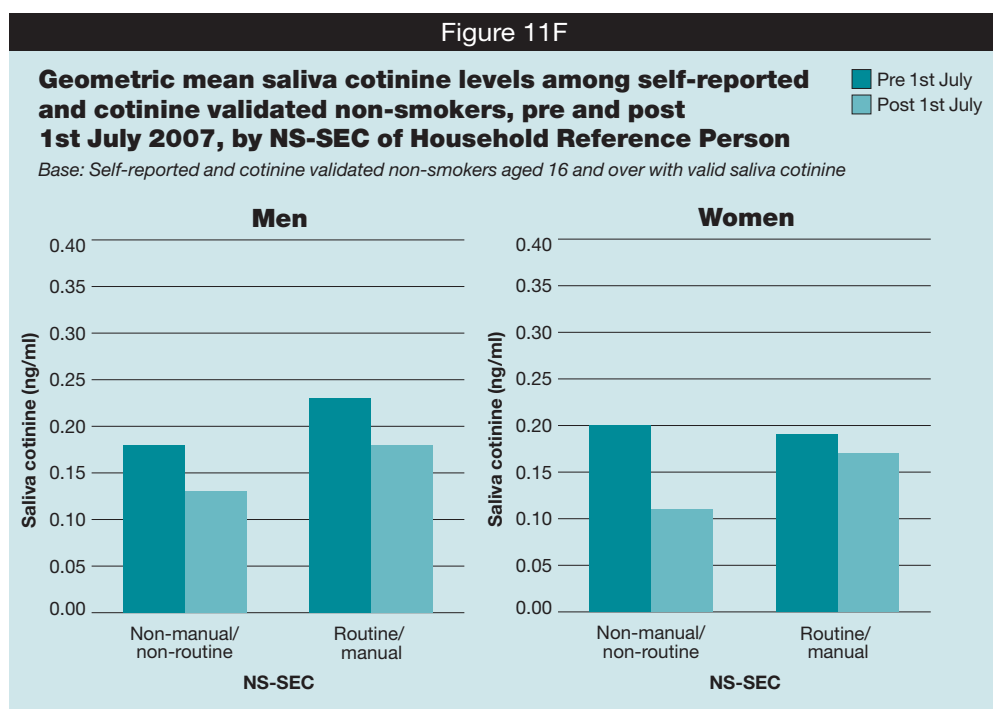
Sections 11.4.3 and 11.4.4 have shown that mean cotinine levels among self-reported smokers and geometric mean cotinine levels among non-smokers were lower after implementation of the smokefree legislation than before it. Tables 11.14 and 11.15 examine differences in mean cotinine levels by NS-SEC (National Statistics Socio-economic Classification) of the household reference person. NS-SEC is a classification of social position that was introduced in 2001. Due to small bases, two categories are presented in this chapter, non-routine/non-manual occupations and routine/manual occupations.<sup>17</sup>

Mean cotinine levels among self-reported current smokers varied significantly by NS-SEC of the household reference person pre and post policy implementation. Among men living in non-routine/non-manual households, mean cotinine levels fell sharply from 328.4ng/ml (pre 1st July) to 255.1ng/ml (post 1st July). However, mean cotinine levels among male smokers

from routine/manual households did not vary significantly after the introduction of the smokefree legislation. Among women, there were slight reductions in mean cotinine levels among those living in non-routine/non-manual households and sharper decreases among those living in routine/manual households, where mean cotinine fell from 309.0ng/ml (pre 1st July) to 271.9 ng/ml (post 1st July).

Table 11.15 also shows geometric mean cotinine levels among self-reported and cotinine validated non-smokers by NS-SEC, pre and post 1st July 2007. With the exception of women from routine and manual households, geometric mean cotinine levels were significantly lower among all groups post smokefree implementation. The greatest decrease was observed for women in non-routine/non-manual households, geometric mean cotinine falling from 0.20ng/ml before to 0.11ng/ml after policy implementation.

Table 11.14-15, Fig 11F



#### 11.4.6 Self-reported hours of exposure to other people's smoke, pre and post 1st July 2007

All participants aged 16 and over were asked to estimate their total hours of exposure to other people's tobacco smoke. For both men and women, the mean number of hours reported was significantly lower after the introduction of the smokefree legislation, falling from 6.2 hours (pre 1st July 2007) to 3.3 hours (post 1st July 2007) among men and from 4.4 hours (pre 1st July 2007) to 2.7 hours (post 1st July 2007) among women. The reduction among non-smokers was also marked, falling from 3.8 hours among men and 2.7 hours among women, pre 1st July, to 1.6 hours for men and 1.3 hours among women post 1st July 2007 (table not shown).

Table 11.16

## 11.5 Discussion

### 11.5.1 Overview

In the two years since smokefree legislation in England was implemented, a number of studies have been published assessing the impact of this legislation. For example, the Department of Health study *Smokefree England: One year on*<sup>24</sup> noted that preliminary findings from a study of bar workers showed that their cotinine levels had fallen by 76% following the implementation of the smokefree legislation, and concluded that bar workers had experienced marked improvement in the indoor air quality of their working



environment. The legislation itself was hailed as one of the most important steps in public health policy for many years.<sup>24</sup> As more varied sources of data become available, like HSE 2008, it is timely to consider the continuing impact of the smokefree legislation. The primary objective of the policy was to prevent occupational exposure to the multiple toxins in tobacco smoke and to protect the health and wellbeing of people working within the leisure and recreation industries by providing safe and healthy working environments in relation to secondhand smoke. A secondary objective was to protect the general public from exposure to tobacco smoke in public places. As observed in other countries, a by-product of these objectives was the potential encouragement that smokefree environments might give to current smokers to stop smoking altogether, or at least to smoke fewer cigarettes.

The main focus of this chapter has been to assess the impact of the smokefree legislation in relation to the secondary objective of the legislation, that is the protection of the general public from exposure to smoke in public places, and provide rudimentary assessment of whether displacement of smokers from public to private places has occurred. In addition to this, this chapter has also examined whether any 'by-product' objectives, such as reductions in smoking prevalence or consumption have been achieved.

### **11.5.2 Protection of non-smokers from exposure to secondhand smoke**

Examination of the impact of the legislation upon non-smokers has shown some promising results. Geometric mean cotinine levels were lower among both men and women and among most age groups in the 12 months post policy implementation compared with the 12 months prior to policy implementation. This indicates that the overall level of exposure to secondhand smoke experienced by non-smokers has fallen. Furthermore, self-reported hours of exposure to secondhand smoke has also reduced dramatically, with men and women typically reporting around two to three hours less exposure to other people's smoke per week and non-smokers reporting a reduction in exposure to secondhand smoke of at least half, post policy implementation.

However, the results from the combined HSE datasets also highlight some areas of concern. There is the indication that different socio-economic groups have experienced different outcomes from the implementation of the smokefree legislation. The fact that the fall in female non-smokers' geometric mean cotinine levels was accounted for almost entirely by reductions in exposure among those from non-manual/non-routine households highlights a persistent and enduring health inequality that the smokefree legislation has not yet been able to address. Furthermore, post legislation geometric mean cotinine levels among both male and female non-smokers were significantly higher among routine/manual than non-routine/non-manual groups, whereas this was not the case prior to the implementation of the policy. This appears to be due to the fact that the smokefree legislation has had the greatest impact upon those from non-manual/non routine households, and relatively little impact on routine/manual households. Further examination is needed of these differences, using alternative indices of socio-economic classification, to see if this pattern is replicated among low income groups or among those living within the most deprived areas. However, the evidence presented here could suggest that the smokefree legislation exacerbates health inequalities between those in non-manual/non-routine groups and those in routine/manual groups.

In HSE 2007, 37% of male smokers and 32% female smokers reported that the smokefree legislation had made them stay at home where they could smoke cigarettes. The potential displacement of smoking from public to private places has been noted as an unintentional by-product of the smokefree legislation. It is promising that although there has not been an increase in the number of smokefree homes post policy implementation, there also has not been an increase in the number of households with people smoking inside the home. After implementation, 20% of participants reported living in households where at least one person smoked, compared with 22% before implementation (table not shown). These differences are not statistically significant and it is encouraging that despite smokers saying they have stayed home where they can smoke, this effect has either reduced as people have become accustomed to the new legislation or, perhaps when at home, they are not



smoking inside the property. These findings are supported by the overall reduction in geometric mean cotinine levels showing that exposure to other people's smoke has fallen since 1st July 2007. They are further reinforced by the findings for children (see Chapter 15), which showed that there was no change in the proportion living in a household where at least one adult smoked regularly. Furthermore, while there had been no reduction in cotinine levels or the proportions with detectable cotinine among children, again there had been no increase.

However, further research is needed to assess whether family rules about smoking within the home or the number of people smoking within the home differ by socio-economic sub-groups. Such work may go some way to explain the differential impact of the smokefree legislation upon non-smokers from routine and manual households.

### **11.5.3 Impact on smoking behaviour**

The smokefree legislation in England has not seen the same overall reduction in smoking prevalence as some other countries. Countries such as Ireland and Scotland did see significant falls in smoking prevalence immediately after the implementation of smokefree legislation. To judge the impact of the smokefree legislation by this criterion alone would be unwise, as this was not a main objective of the policy. However, there are some promising results in relation to change in smokers' behaviour, namely reductions in mean cotinine levels among smokers.

A significant fall in the mean cotinine levels for both male and female smokers, as observed post policy implementation, is a step in the right direction as it is an indication of lower levels of cigarette and nicotine consumption. It is interesting that there was no corresponding fall in the self-reported number of cigarettes smoked by current cigarette smokers post policy implementation. This may be in part due to response biases when answering the daily cigarette consumption questions, with respondents continuing to report rounded figures of cigarette consumption (i.e. 10 per day) regardless of small changes in behaviour post implementation.<sup>25</sup> Data from the HSE 2007 report lends some support to this, with around 45% of smokers stating that the smokefree legislation had encouraged them to reduce the number of cigarettes they smoke, even though mean cigarette consumption among smokers did not change significantly pre and post policy implementation.<sup>21</sup>

As with non-smokers, when looking at the post 1st July 2007 data by sub-groups of smokers, it appears that the impact of the smokefree legislation may be affecting different sub-groups in different ways. Among men, the most notable decreases in mean cotinine levels post 1st July were observed among smokers living in non-manual/non-routine households. There was no evidence of change in mean cotinine levels pre and post 1st July in the groups that might be regarded as the main targets for reduction - those in routine and manual households. The latter group were identified as being of particular importance in the government's PSA target on smoking, originally set in 2004 and confirmed in 2007, with the aim of 'reducing adult smoking rates to 21% or less by 2010, with a reduction in prevalence among routine and manual groups to 26% or less'.<sup>7</sup> The combined HSE 2007/2008 findings point to the potentially limited impact of this policy upon a key target sub-group so far, and suggest that as yet little has been achieved in tackling the persistent inequalities in smoking behaviour among men. Among female smokers, there was a slightly more promising picture as the fall in mean cotinine levels was greatest among those from routine and manual households.

### **11.5.4. Overall cigarette smoking prevalence**

The 2007 General Household Survey showed that the government had reached its target of reducing cigarette smoking prevalence to 21% some three years early. However, the authors of this report also noted that a small proportion of participants may not report their true smoking behaviour.<sup>8</sup> By comparing cotinine reports with self-reported cigarette smoking status, HSE 2008 data has shown that there are some low levels of under-

reporting of cigarette smoking behaviour, largely by women aged 25-44. However, it is worth noting that in 2008, the proportion of women with a cotinine value of 15ng/ml was 21% and that self-reported smoking status was 20%, meaning that whichever criterion is used to judge government progress towards PSA targets, the target among women has been achieved. Among men, there is more progress to be made, as equivalent estimates were 26% and 24%.

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- 16 The Household Reference Person (HRP) is defined as the person in whose name the accommodation is held; if more than one, the person with the highest income; and if more than one, the oldest.
- 17 For a full explanation of NS-SEC and its derivation see the Glossary in Volume 2 of this report, *Methods and documentation*, and *The National Statistics Socio-economic Classification User Manual 2002*. ONS 2002.
- 18 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 19 Cotinine results can include nicotine through use of nicotine replacements as an adjunct to smoking cessation. Fewer than 1% of HSE participants in 2008 reported using nicotine replacement products in the last seven days and these participants have been excluded from the cotinine analysis.
- 20 Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the *n*th root, where *n* is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

- 21 Cotinine data was not collected from adults in HSE 2006. Therefore cotinine analyses in this section compare a 6 month period prior to the 1st July with a 12 month period after the 1st July.
- 22 To be included in this category, participants had to have a cotinine value of less than 15ng/ml and be a self-reported non-smoker.
- 23 Although the difference in geometric mean cotinine for men aged 16-34 looks large pre and post 1st July 2007, this is not significant as the base sizes for this group are small.
- 24 Department of Health, *Smokefree England: One year on*, DH 2008, pg 1.
- 25 Some researchers have noted that people tend to round their cigarette consumption down to the nearest half-pack of cigarettes rather than report actual number. See: Kozlowski, LT. *Pack size, reported smoking rates and public health*. American Journal of Public Health (1986) **76**: 1337-1338.

11.1	Cigarette smoking status, by age and sex	11.16	Self-reported mean hours of exposure to other people's smoke, pre and post 1st July 2007, by age and sex
11.2	Number of cigarettes smoked by current smokers, by age and sex		
11.3	Cigarette smoking status (observed and age-standardised), by Strategic Health Authority and sex		
11.4	Cigarette smoking status (age-standardised), by equivalised household income and sex		
11.5	Cigarette smoking status (age-standardised), by Spearhead status and sex		
11.6	Prevalence of saliva cotinine levels of 15ng/ml or more, by age and sex		
11.7	Saliva cotinine levels among self-reported current cigarette smokers, by age and sex		
11.8	Saliva cotinine levels among self-reported and cotinine validated non-smokers, by age and sex		
11.9	Cigarette smoking status, pre and post 1st July 2007, by age and sex		
11.10	Numbers of cigarettes smoked by current smokers, pre and post 1st July 2007, by age and sex		
11.11	Prevalence of saliva cotinine levels of 15ng/ml or more, pre and post 1st July 2007, by age and sex		
11.12	Saliva cotinine levels among self-reported current cigarette smokers, pre and post 1st July 2007, by age and sex		
11.13	Saliva cotinine levels among self-reported and cotinine validated non-smokers, pre and post 1st July 2007 by age and sex		
11.14	Saliva cotinine levels among self-reported current cigarette smokers pre and post 1st July 2007, by NS-SEC of household reference person		
11.15	Saliva cotinine levels among self-reported and cotinine validated non-smokers, pre and post 1st July 2007, by NS-SEC of household reference person		

Table 11.1

<b>Cigarette smoking status, by age and sex</b>								
<i>Aged 16 and over</i>								2008
<b>Cigarette smoking status</b>	<b>Age group</b>							<b>Total</b>
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Current cigarette smoker	28	34	30	22	18	13	6	24
Used to smoke cigarettes regularly	5	15	19	27	42	52	59	27
Never regularly smoked cigarettes	67	51	51	50	41	35	35	49
<b>Women</b>								
Current cigarette smoker	25	25	25	20	16	13	8	20
Used to smoke cigarettes regularly	8	17	19	22	31	32	32	22
Never regularly smoked cigarettes	67	58	56	58	53	55	60	58
<i>Bases (unweighted)</i>								
Men	738	952	1215	1097	1182	874	648	6706
Women	883	1217	1512	1374	1366	994	946	8292
<i>Bases (weighted)</i>								
Men	1084	1210	1407	1206	1085	725	539	7256
Women	1047	1212	1431	1233	1123	795	785	7626

Table 11.2

Number of cigarettes smoked by current smokers, by age and sex								
Current smokers aged 16 and over								2008
Cigarettes smoked per day	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
% under 10 cigarettes per day	41	42	24	24	16	21	[29]	30
% 10 to under 20 cigarettes per day	39	43	45	35	34	42	[43]	40
% 20 or more cigarettes per day	20	15	31	41	49	37	[28]	29
Median number of cigarettes smoked per day	10.3	10.0	15.0	15.0	18.7	12.0	[10.0]	12.9
Mean number of cigarettes smoked per day	11.7	10.9	14.3	16.0	17.4	15.9	[12.9]	13.7
Standard error of the mean	0.52	0.41	0.47	0.54	0.57	1.07	[1.24]	0.24
Women								
% under 10 cigarettes per day	46	41	33	32	28	27	47	36
% 10 to under 20 cigarettes per day	44	41	42	40	49	51	42	43
% 20 or more cigarettes per day	10	18	25	28	23	22	11	21
Median number of cigarettes smoked per day	10.0	10.0	12.0	12.9	12.0	12.0	10.0	10.6
Mean number of cigarettes smoked per day	10.3	11.3	12.7	14.0	13.1	12.8	9.7	12.2
Standard error of the mean	0.42	0.41	0.42	0.53	0.45	0.61	0.64	0.18
Bases (unweighted)								
Men	211	320	354	248	210	111	39	1493
Women	230	321	384	284	225	130	71	1645
Bases (weighted)								
Men	297	412	417	265	192	94	32	1709
Women	252	297	362	250	182	102	59	1504

Table 11.3

**Cigarette smoking status (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over

2008

Cigarette smoking status	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Current cigarette smoker	24	28	26	27	20	24	22	23	23	19
Used to smoke cigarettes regularly	25	26	27	28	28	28	21	30	29	34
Never regularly smoked cigarettes	51	45	48	45	52	48	57	47	48	47
<b>Standardised</b>										
Current cigarette smoker	24	28	25	28	21	25	21	24	22	20
Used to smoke cigarettes regularly	27	26	27	26	27	27	23	29	30	32
Never regularly smoked cigarettes	48	45	48	46	53	48	56	48	48	48
<b>Women</b>										
<b>Observed</b>										
Current cigarette smoker	25	21	22	21	18	21	16	16	18	22
Used to smoke cigarettes regularly	18	23	22	24	24	23	17	24	24	24
Never regularly smoked cigarettes	57	56	56	55	59	56	67	60	58	55
<b>Standardised</b>										
Current cigarette smoker	25	22	22	21	18	21	16	16	18	22
Used to smoke cigarettes regularly	19	23	22	23	23	23	18	23	24	23
Never regularly smoked cigarettes	56	56	56	56	59	56	66	61	58	55
<i>Bases (unweighted)</i>										
Men	426	956	712	636	677	817	750	526	526	680
Women	520	1190	902	796	876	936	920	669	622	861
<i>Bases (weighted)</i>										
Men	397	956	734	633	769	837	1035	576	585	734
Women	400	1033	795	677	841	834	1037	623	585	802

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 11.4

**Cigarette smoking status (age-standardised), by equivalised household income and sex**

Aged 16 and over

2008

Cigarette smoking status	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Current cigarette smoker	17	19	21	30	39
Used to smoke cigarettes regularly	27	30	28	28	23
Never regularly smoked cigarettes	56	51	51	42	38
<b>Women</b>					
Current cigarette smoker	11	15	20	26	35
Used to smoke cigarettes regularly	21	24	25	22	19
Never regularly smoked cigarettes	68	61	55	52	46
<i>Bases (unweighted)</i>					
Men	1320	1177	1039	1040	851
Women	1315	1277	1309	1395	1265
<i>Bases (weighted)</i>					
Men	1428	1303	1097	1081	902
Women	1240	1201	1190	1242	1138

Table 11.5

**Cigarette smoking status (age-standardised), by Spearhead status<sup>a</sup> and sex**

Aged 16 and over

2008

Cigarette smoking status	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Current cigarette smoker	22	26
Used to smoke cigarettes regularly	28	26
Never regularly smoked cigarettes	50	48
<b>Women</b>		
Current cigarette smoker	19	21
Used to smoke cigarettes regularly	23	22
Never regularly smoked cigarettes	59	57
<i>Bases (unweighted)</i>		
Men	4210	2471
Women	5174	3085
<i>Bases (weighted)</i>		
Men	4619	2612
Women	4844	2752

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

Table 11.6

### Prevalence of saliva cotinine levels of 15ng/ml or more, by age and sex

Aged 16 and over with valid cotinine assay

2008

Saliva cotinine (ng/ml)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Cotinine 15ng/ml or more	28	37	32	26	21	16	8	26
<b>Women</b>								
Cotinine 15ng/ml or more	24	27	29	20	16	12	8	21
<i>Bases (unweighted)</i>								
Men	468	553	779	730	822	573	437	4362
Women	514	734	963	918	955	623	532	5239
<i>Bases (weighted)</i>								
Men	713	755	888	763	685	458	342	4604
Women	689	770	901	774	712	502	492	4840

Table 11.7

### Saliva cotinine levels among self-reported current cigarette smokers, by age and sex

Self-reported cigarette smokers aged 16 and over with valid cotinine assay

2008

Saliva cotinine (ng/ml)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
50th percentile <sup>a</sup>	203	201	271	309	322	280	b	247
75th percentile	278	293	348	418	405	383	b	358
90th percentile	425	402	463	532	569	535	b	459
Mean saliva cotinine	212.4	212.4	263.3	307.5	326.2	302.1	b	258.6
Standard error of the mean	13.4	10.8	8.7	11.5	11.7	20.0	b	5.2
Women								
50th percentile	163	219	233	278	290	243	[203]	228
75th percentile	254	349	364	410	375	408	[281]	350
90th percentile	330	445	484	518	487	510	[426]	462
Mean saliva cotinine	174.2	237.7	255.9	292.5	285.9	268.6	[228.9]	248.5
Standard error of the mean	9.4	10.4	8.6	11.5	10.2	18.0	[22.5]	4.4
Bases (unweighted)								
Men	120	177	216	162	146	70	27	918
Women	120	193	247	175	145	65	35	980
Bases (weighted)								
Men	177	260	263	169	125	59	21	1074
Women	145	200	238	150	109	54	33	929

<sup>a</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, the group of those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>b</sup> Data not shown because the base is too small.



Table 11.8

**Saliva cotinine levels among self-reported and cotinine validated non-smokers,<sup>a</sup> by age and sex***Self-reported non-smokers aged 16 and over with valid cotinine assay*

2008

Saliva cotinine (ng/ml)	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
50th percentile <sup>b</sup>	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.1
75th percentile	0.5	0.3	0.2	0.2	0.2	0.3	0.2	0.3
90th percentile	1.9	0.6	0.6	0.7	0.6	0.7	0.6	0.8
Geometric mean saliva cotinine <sup>c</sup>	0.20	0.14	0.12	0.13	0.12	0.13	0.12	0.13
Confidence interval	(0.17,0.24)	(0.12,0.15)	(0.10,0.13)	(0.11,0.14)	(0.11,0.13)	(0.12,0.14)	(0.10,0.13)	(0.13,0.13)
Women								
50th percentile	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
75th percentile	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2
90th percentile	1.4	0.6	0.6	0.6	0.6	0.6	0.4	0.7
Geometric mean saliva cotinine	0.18	0.13	0.11	0.11	0.12	0.11	0.10	0.12
Confidence interval	(0.15,0.21)	(0.12,0.14)	(0.10,0.12)	(0.10,0.12)	(0.11,0.13)	(0.10,0.12)	(0.10,0.11)	(0.12,0.12)
Bases (unweighted)								
Men	309	349	533	534	647	481	400	3253
Women	358	527	683	723	802	546	492	4131
Bases (weighted)								
Men	475	459	590	558	534	382	313	3312
Women	496	555	632	607	597	438	454	3780

<sup>a</sup> To be included within this category, participants had to be both self-reported non-smokers and have a saliva cotinine level lower than 15ng/ml.

<sup>b</sup> Percentiles have been presented in this table for reference only. The percentiles presented in this table assume a normal distribution of cotinine data. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, the group of those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>c</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean (as in table 11.7) is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the  $n$ th root, where  $n$  is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

Table 11.9

**Cigarette smoking status, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Aged 16 and over

2008

Cigarette smoking	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>Pre 1st July 2007</b>								
Current cigarette smoker	26	35	28	24	18	12	9	24
Used to smoke cigarettes regularly	5	16	18	25	41	52	55	27
Never regularly smoked cigarettes	69	50	54	51	41	36	36	50
<b>Post 1st July 2007</b>								
Current cigarette smoker	27	34	27	20	19	13	8	23
Used to smoke cigarettes regularly	4	16	22	28	42	56	58	28
Never regularly smoked cigarettes	69	50	52	52	38	31	34	49
<b>Women</b>								
<b>Pre 1st July 2007</b>								
Current cigarette smoker	27	26	25	24	19	12	7	21
Used to smoke cigarettes regularly	6	19	18	20	30	27	33	21
Never regularly smoked cigarettes	67	55	58	55	51	61	60	58
<b>Post 1st July 2007</b>								
Current cigarette smoker	26	26	25	19	17	13	9	20
Used to smoke cigarettes regularly	7	15	18	26	29	30	31	22
Never regularly smoked cigarettes	67	59	56	55	54	57	60	58
<b>Bases (unweighted)</b>								
<b>Pre 1st July 2007</b>								
Men	504	677	932	819	855	682	484	4953
Women	601	895	1203	1036	951	743	712	6141
<b>Post 1st July 2007</b>								
Men	490	643	779	688	788	612	435	4435
Women	553	787	949	907	965	694	624	5479
<b>Bases (weighted)</b>								
<b>Pre 1st July 2007</b>								
Men	799	897	1044	883	797	538	418	5376
Women	767	895	1052	902	828	593	647	5684
<b>Post 1st July 2007</b>								
Men	727	805	926	790	711	481	373	4812
Women	684	797	941	808	737	528	582	5078

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 11.10

**Number of cigarettes smoked by current smokers, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Current smokers aged 16 and over

2006-2008

Number of cigarettes smoked	Pre 1st July 2007			Total	Post 1st July 2007			Total
	16-34	35-54	55+		16-34	35-54	55+	
Men								
% under 10 cigarettes per day	40	30	23	33	40	24	26	31
% 10 to under 20 cigarettes per day	42	31	36	37	42	42	36	40
% 20 or more cigarettes per day	17	39	41	31	18	34	39	28
Mean number of cigarettes smoked per day	11.3	15.0	15.6	13.6	11.8	15.0	15.3	13.7
Standard error of the mean	0.41	0.46	0.57	0.28	0.36	0.35	0.46	0.34
Women								
% under 10 cigarettes per day	43	30	28	34	43	31	33	36
% 10 to under 20 cigarettes per day	42	46	42	44	42	42	45	43
% 20 or more cigarettes per day	14	24	30	22	15	27	22	21
Mean number of cigarettes smoked per day	10.9	13.0	13.9	12.4	10.7	13.7	12.5	12.3
Standard error of the mean	0.51	0.53	0.61	0.23	0.36	0.43	0.43	0.25
Bases (unweighted)								
Men	366	462	282	1110	352	347	268	967
Women	419	556	324	1299	364	422	310	1096
Bases (weighted)								
Men	513	508	245	1267	465	406	229	1100
Women	434	479	277	1191	375	394	245	1014

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE June to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 11.11

**Prevalence of a saliva cotinine levels of 15ng/ml or more, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Aged 16 and over with valid cotinine assay

2007-2008

Saliva cotinine (ng/ml)	Pre 1st July 2007			Total	Post 1st July 2007			Total
	16-34	35-54	55+		16-34	35-54	55+	
Men								
Cotinine 15ng/ml or more	30	28	18	26	30	27	17	25
Women								
Cotinine 15ng/ml or more	27	26	13	21	26	25	13	21
Bases (unweighted)								
Men	233	346	380	959	685	979	1242	2906
Women	273	421	402	1096	835	1252	1435	3522
Bases (weighted)								
Men	326	355	323	1004	1011	1108	1007	3127
Women	313	357	383	1053	979	1130	1192	3301

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE January to June 2007 (saliva samples were not collected for adults for 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 11.12

**Saliva cotinine levels among self-reported current cigarette smokers, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Self reported smokers aged 16 and over with valid cotinine assay

2007-2008

Saliva cotinine (ng/ml)	Pre 1st July 2007			Total	Post 1st July 2007			Total
	16-34	35-54	55+		16-34	35-54	55+	
Men								
Mean saliva cotinine among self-reported cigarette smokers	258.5	331.7	400.8	316.4	227.9	305.1	310.0	275.6
Standard error of the mean	29.72	22.88	27.29	16.80	11.85	12.10	14.62	7.59
Women								
Mean saliva cotinine among self-reported cigarette smokers	229.4	311.0	[292.0]	276.9	200.4	278.3	280.3	249.6
Standard error of the mean	19.72	15.38	[27.17]	11.31	10.82	9.96	13.85	6.98
Bases (unweighted)								
Men	62	81	53	196	177	230	162	569
Women	70	96	45	211	209	272	174	655
Bases (weighted)								
Men	93	89	48	230	268	273	138	680
Women	76	87	43	207	240	257	143	640

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE January to June 2007 (saliva samples were not collected for adults for 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 11.13

**Saliva cotinine levels among self-reported and cotinine validated non-smokers,<sup>a</sup> pre and post 1st July 2007,<sup>b</sup> by age and sex**

Self reported non-smokers aged 16 and over with valid cotinine assay

2007-2008

Saliva cotinine (ng/ml)	Pre 1st July 2007			Total	Post 1st July 2007			Total
	16-34	35-54	55+		16-34	35-54	55+	
Men								
Geometric mean <sup>c</sup> saliva cotinine among self-reported and cotinine validated non-smokers	0.24	0.19	0.18	0.20	0.18	0.13	0.13	0.14
Confidence interval	(0.19,0.31)	(0.16,0.22)	(0.15,0.21)	(0.18,0.22)	(0.16,0.21)	(0.11,0.14)	(0.12,0.14)	(0.13,0.15)
Women								
Geometric mean saliva cotinine among self-reported and cotinine validated non-smokers	0.24	0.19	0.17	0.19	0.15	0.12	0.13	0.13
Confidence interval	(0.2,0.28)	(0.16,0.22)	(0.15,0.2)	(0.18,0.21)	(0.14,0.17)	(0.11,0.13)	(0.12,0.14)	(0.12,0.14)
Bases (unweighted)								
Men	154	249	312	715	462	715	1031	2208
Women	188	315	348	851	594	938	1238	2770
Bases (weighted)								
Men	208	251	263	722	672	798	830	2300
Women	221	263	331	815	701	835	1030	2566

<sup>a</sup> To be included within this category, participants had to be both self-reported non-smokers and have a saliva cotinine level lower than 15ng/ml.

<sup>b</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE January to June 2007 (saliva samples were not collected for adults for 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>c</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean (as in table 11.7) is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the  $n$ th root, where  $n$  is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

Table 11.14

**Saliva cotinine levels among self-reported current cigarette smokers, pre and post 1st July 2007,<sup>a</sup> by NS-SEC of household reference person**

*Aged 16 and over with valid cotinine assay*

*2007-2008*

Saliva cotinine (ng/ml)	Pre 1st July 2007		Post 1st July 2007	
	Non-routine/ non-manual	Routine and manual	Non-routine/ non-manual	Routine and manual
<b>Men</b>				
Mean saliva cotinine among self-reported cigarette smokers	328.4	296.6	255.1	299.2
Standard error of the mean	19.76	30.50	10.79	10.70
<b>Women</b>				
Mean saliva cotinine among self-reported cigarette smokers	232.7	309.0	222.0	271.9
Standard error of the mean	20.54	14.31	10.55	9.28
<i>Bases (unweighted)</i>				
<i>Men</i>	<i>100</i>	<i>88</i>	<i>285</i>	<i>263</i>
<i>Women</i>	<i>82</i>	<i>120</i>	<i>284</i>	<i>345</i>
<i>Bases (weighted)</i>				
<i>Men</i>	<i>113</i>	<i>107</i>	<i>349</i>	<i>301</i>
<i>Women</i>	<i>78</i>	<i>119</i>	<i>277</i>	<i>334</i>

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE January to June 2007 (saliva samples were not collected for adults for 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 11.15

**Saliva cotinine levels among self-reported and cotinine validated non-smokers,<sup>a</sup> pre and post 1st July 2007,<sup>b</sup> by NS-SEC of household reference person**

Self reported non-smokers aged 16 and over with valid cotinine assay

2007-2008

Saliva cotinine (ng/ml)	Pre 1st July 2007		Post 1st July 2007	
	Non-routine/ non-manual	Routine and manual	Non-routine/ non-manual	Routine and manual
<b>Men</b>				
Geometric mean <sup>c</sup> saliva cotinine among self-reported and cotinine validated non-smokers	0.18	0.23	0.13	0.18
Confidence interval	(0.16,0.20)	(0.19,0.27)	(0.12,0.14)	(0.16,0.2)
<b>Women</b>				
Geometric mean saliva cotinine among self-reported and cotinine validated non-smokers	0.20	0.19	0.11	0.17
Confidence interval	(0.17,0.23)	(0.16,0.22)	(0.11,0.12)	(0.16,0.19)
<b>Bases (unweighted)</b>				
Men	468	236	1506	681
Women	556	267	1867	847
<b>Bases (weighted)</b>				
Men	451	255	1540	728
Women	505	277	1674	829

<sup>a</sup> To be included within this category, participants had to be both self-reported non-smokers and have a saliva cotinine level lower than 15ng/ml.

<sup>b</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE January to June 2007 (saliva samples were not collected for adults for 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>c</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean (as in table 11.7) is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the  $n$ th root, where  $n$  is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

Table 11.16

**Self-reported mean hours of exposure to other people's smoke, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Aged 16 and over

2006-2008

Hours exposure to others' smoke	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
<b>Pre 1st July 2007</b>								
Mean number of hours exposed to other people's smoke	9.7	8.0	5.9	6.2	4.8	3.4	1.9	6.2
Standard error of the mean	0.76	0.64	0.45	0.49	0.46	0.42	0.35	0.25
<b>Post 1st July 2007</b>								
Mean number of hours exposed to other people's smoke	6.5	3.7	3.3	2.4	2.5	2.0	1.4	3.3
Standard error of the mean	0.64	0.43	0.44	0.35	0.34	0.38	0.45	0.19
<b>Women</b>								
<b>Pre 1st July 2007</b>								
Mean number of hours exposed to other people's smoke	9.6	4.6	4.2	5.0	3.0	2.1	1.2	4.4
Standard error of the mean	0.65	0.32	0.32	0.40	0.35	0.34	0.23	0.17
<b>Post 1st July 2007</b>								
Mean number of hours exposed to other people's smoke	6.2	3.0	2.5	2.5	1.5	1.7	1.0	2.7
Standard error of the mean	0.65	0.38	0.31	0.31	0.21	0.32	0.31	0.16
<b>Bases (unweighted)</b>								
<b>Pre 1st July 2007</b>								
Men	520	675	928	812	851	680	482	4948
Women	610	889	1194	1029	948	742	710	6122
<b>Post 1st July 2007</b>								
Men	708	802	921	788	709	478	372	4779
Women	675	796	937	806	736	527	580	5057
<b>Bases (weighted)</b>								
<b>Pre 1st July 2007</b>								
Men	827	894	1040	876	794	536	416	5383
Women	780	889	1044	896	825	592	645	5671
<b>Post 1st July 2007</b>								
Men	478	641	776	686	786	609	433	4409
Women	546	786	945	905	963	693	621	5459

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

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# Adult alcohol consumption

# 12

Elizabeth Fuller

## Summary

- This chapter covers alcohol consumption by men and women aged 16 and over. It measures drinking in the last week, including the number of drinking days and the maximum amount drunk on a single day.
- 89% of men and 84% of women said they drank alcohol at least occasionally.
- The majority of adults had drunk alcohol in the last week; 71% of men, 58% of women. This includes 21% of men and 13% of women who had drunk alcohol on five or more days in the last week. Drinking at this frequency increased with age, from 8% of men and 4% of women aged 16-24 to 32% of men aged 75 and over and 19% of women aged between 55 and 64.
- The proportion of men and women who drank on five or more days in the last week was at a similar level across Strategic Health Authority (SHA) regions except for London, where it was significantly lower (17% of men, 10% of women). Prevalence of drinking on five or more days in the last week increased strongly in line with equivalised household income, from 15% of men and 8% of women in the lowest quintile to 30% of men and 22% of women in the highest quintile.
- The current recommendations for daily alcohol intake are that it should not regularly exceed three to four units for men and two to three units for women. In the last week, 41% of men and 32% of women had drunk more than the recommended maximum on at least one day. This includes 25% of men and 15% of women who had drunk more than twice the recommended maximum.
- Among those adults who drank in the last week, the majority exceeded recommendations on at least one day; 58% of men and 55% of women had done so. 35% of men and 27% of women had drunk more than twice the recommended levels on at least one day in the last week. The proportions drinking at potentially harmful levels declined with age, from 52% of men and 50% of women aged 16-24 to just 4% of men and 3% of women aged 75 and over.
- Maximum daily consumption in the last week varied according to SHA. Among men, there was a contrast between the north and the south, with the proportion drinking at twice recommended levels at its highest in the North East and also relatively high in the North West, Yorkshire and the Humber and the East Midlands. Drinking at this level was lowest in London, South West, South Central and South East Coast. Among women there was a similar but less pronounced pattern.
- There was also significant variation by quintile of equivalised income among women who drank in the last week. The proportion who drank more than twice the recommended level at least once was highest among those in the lowest income quintile (32%) and decreased as income increased to 24% of women in the highest income quintile. There was no such pattern for men.
- On average among those who drank in the last week, men consumed 8.1 units on the day they drank most in the last week, and women consumed 5.3 units. Average consumption was highest among young adults and declined with age.

## 12.1 Introduction

Most adults in Britain drink alcohol, at least occasionally. However, in recent years, concern has increased among policy makers and the general public about the damage caused by excessive drinking to individuals, communities and society as a whole. Following a wide-ranging review of the current extent and nature of alcohol-related harms, the government published its *Alcohol Harm Reduction Strategy for England* in 2004, with a further report, *Safe. Sensible. Social. The next steps in the national alcohol strategy* in 2007.<sup>1,2,3</sup>

Alcohol has been identified as a causal factor in more than 60 medical conditions, including mouth, throat, stomach, liver and breast cancers; hypertensive disease (high blood pressure), cirrhosis and depression.<sup>4,5</sup> Additionally, alcohol is implicated in many road traffic accidents and violent assaults.<sup>6,7</sup> Both hospital admissions for conditions specifically related to alcohol and deaths attributed to alcohol increased substantially between 1991 and 2007.<sup>8</sup> The annual cost to the NHS of alcohol misuse has been estimated as £2.7 billion.<sup>8</sup>

Per capita alcohol consumption in the UK rose over the second half of the twentieth century.<sup>9</sup> In recent years, as households' disposable income has risen, alcohol has become more affordable; taking 1980 as a baseline, in 2008, the affordability of alcohol had increased by 75%.<sup>8</sup> While the average amount drunk each year increased over this period from 9.4 litres of pure alcohol per head to 10.8 litres in 2008, the proportion of household expenditure spent on alcohol fell from 9.6% to 4.8%.<sup>10</sup> What people drink has also changed. Since the 1960s, there has been a fall in the proportion of alcohol drunk in the form of beer and a corresponding rise in the proportion drunk in other forms, particularly wine. Between 1980 and 2006, the proportion of alcohol drunk as beer changed from 60% to 43% of total consumption. In the same period, the proportion of wine increased from 14% to 30% of total consumption.<sup>10</sup>

In the 1980s, the concept of 'sensible drinking' was developed by government and health educators.<sup>11</sup> In 1987, this was linked in official guidance to the amount of alcohol consumed; specifically 'units' of alcohol, previously a term used in clinical practice, was introduced as a means of monitoring the alcohol content of specific drinks. The recommended limits, 21 units per week for men, 14 units per week for women, were endorsed by three of the Royal Colleges: General Practitioners, Psychiatrists and Physicians.<sup>12</sup> This guidance was revised in 1995 and linked to daily rather than weekly consumption. The Department of Health now advises that men should not regularly drink more than three to four units of alcohol per day, and women should not regularly drink more than two to three units of alcohol per day. Pregnant women are advised to avoid alcohol altogether.<sup>13</sup> Men who regularly drink more than eight units a day (or 50 units a week) and women who regularly drink more than six units a day (or 35 units a week) are considered to be at particular risk of harm.<sup>14</sup>

In the 1980s and 1990s, the sensible drinking message was coupled with the advice that one unit was equivalent to a half pint of ordinary beer or lager, a small (125ml) glass of wine or a single measure of spirits.<sup>4</sup> However, the 2004 *Alcohol Harm Reduction Strategy* acknowledged that these equivalents were no longer valid. Two changes were identified as being particularly significant. Over time, the alcoholic strength of beers and wines had increased; for example, the average strength of wine was around 12.5% alcohol by volume (ABV), rather than the 9% assumed earlier. In addition, a standard glass of wine sold in a pub or bar was likely to be 175ml or even 250 ml. As a consequence, advice on the alcoholic content of drinks has become more specific; for example, the NHS 'Know your units' website defines the content in units of drinks not just by type, but also by volume and ABV.<sup>15</sup>

'Making the sensible drinking message easier to understand and apply' was one of the actions identified in the 2004 *Alcohol Harm Reduction Strategy* under the heading 'Better education and communication'.<sup>2</sup> Other actions included targeting messages at those most at risk, providing better information for consumers, and improving alcohol education in schools.

The 2007 strategy update claimed some success for the actions identified in 2004, but acknowledged that more needed to be done. Among new initiatives proposed were the development of informal sources of support for people who wanted to drink less, the provision of authoritative guidance about what is safe for young people to drink, local alcohol strategies and a public consultation on alcohol pricing and promotion.<sup>16,17</sup>

Alcohol pricing, specifically the setting of a minimum price per unit, became the focus of public debate after the Chief Medical Officer highlighted the impact of what he called 'passive drinking' – how one person's drinking affects others – in his 2009 annual report.<sup>18</sup> He recommended a minimum price of 50 pence per unit of alcohol; a strategy which University of Sheffield researchers had predicted would have relatively little effect on moderate drinkers but would significantly reduce social harms caused by heavy drinking.<sup>17,18</sup> Though not yet on the policy agenda in England, minimum unit pricing seems likely to be adopted in Scotland in the near future.<sup>19</sup>

This chapter describes alcohol consumption by men and women aged 16 and over, including the number of drinking days in the last week and the maximum amount of alcohol consumed on any day in the last week. It includes results for 2008. Trend data for adult alcohol consumption and other key variables are available in *Health Survey for England 2008 Latest Trends* on The Information Centre's website.<sup>20</sup> The 2006 HSE report included multivariate logistic regression to explore the risk factors associated with drinking above government guidelines, both drinking above recommended daily limits, and drinking more than twice the recommended daily limits.<sup>21</sup>

## 12.2 Methods and definitions

### 12.2.1 Methods

The Health Survey for England has asked about drinking alcohol since its inception in 1991. Information on drinking alcohol is generally collected from adults as part of the main survey interview. In 2008, as in previous years, there were two exceptions to this, designed to provide greater privacy for younger participants. Teenagers aged 16 and 17, below the legal age for buying alcohol, were asked to fill in a self-completion questionnaire covering smoking and drinking; young adults aged between 18 and 24 were offered this questionnaire as an alternative to the interview.<sup>22</sup>

The questionnaire was revised between 1998 and 2003 to reflect changes in government guidelines, specifically the move from recommended limits for weekly consumption to those based on daily consumption.<sup>23</sup> In 2008, the HSE questionnaire covered the following areas:

- Frequency of drinking in the last 12 months (including those who never drink)
- Number of drinking days in the last week
- For those who drank in the last week, the amounts of different types of alcohol drunk on the day they drank most.

### 12.2.2 Measuring alcohol intake

Alcohol consumption is reported in terms of units of alcohol; one unit of alcohol is 10ml by volume of pure alcohol. Maximum daily consumption is calculated by recording the amounts drunk using the day in the past week when the participant drank most. Those who drank bottled or canned beer, lager, stout or cider were asked in detail about what they drank, and this information was used to estimate the amount in pints.<sup>24</sup>

The method used by the HSE to convert drinks to units remained essentially unchanged from 1991 until 2005. The assumptions were similar to those which have been used by other major surveys since they were introduced by the General Household Survey (GHS) in 1990.<sup>25</sup> However, in the same way that the original health promotion advice about the alcoholic drinks had become out of date as the drinking environment changed (see Section 12.1), it became clear that the assumptions about the strength of drinks and standard glass

sizes were no longer valid. In response, from 2006 changes were made to the way HSE and other surveys estimated alcohol consumption.<sup>21,26,27</sup>

In 2007, the questions about the quantities of wine drunk were revised from the previous format which measured consumption by the number of glasses drunk, with no definition of glass size. The new format asked separately about large (250ml), medium (175ml) and small (125ml) glasses, and also included the option of specifying the quantity of wine drunk in bottles or fractions of a bottle; a bottle was treated as the equivalent of six small (125ml) glasses.

Table 12A below shows the conversion factors used in this report; drinks other than wine are the same as the revised unit measures used since 2006.<sup>26</sup> In 2006 the unit conversion for a glass of wine (size unspecified) was two units (revised from one unit in previous years).

Type of drink	Measure	Revised equivalent units of alcohol
Normal strength beer, lager, stout, cider, shandy (less than 6% ABV)	Pint	2
	Can or bottle	Amount in pints multiplied by 2.5
	Small cans (size unknown)	1.5
	Large cans or bottles (size unknown)	2
Strong beer, lager, stout, cider (6% ABV or more)	Pint	4
	Can or bottle	Amount in pints multiplied by 4
	Small cans (size unknown)	2
	Large cans or bottles (size unknown)	3
Spirits and liqueurs	Glass (single measure)	1
Sherry, martini and other fortified wines	Glass	1
Wine	Small glass (125ml)	1.5
	Medium glass (175ml)	2.0
	Large glass (250ml)	3.0
	Bottle	9.0
Alcopops	Small can or bottle	1.5

### 12.2.3 Measuring alcohol consumption in surveys

Survey measures of alcohol consumption are generally acknowledged to underestimate consumption. There are several reasons why this is so; the most significant are believed to be the under-representation of heavy drinkers in survey samples and the difficulty of accurately recalling amounts drunk, particularly where drinking is in informal settings. Comparisons of survey measures with HM Revenue and Customs data on alcohol taxed for sale suggest that survey estimates of consumption represent between 55% and 60% of the true figure.<sup>28</sup> However, survey data provide a reliable means of comparing drinking between different groups and of measuring trends in drinking over time.

## 12.3 Prevalence of drinking alcohol

Most adults drink alcohol, at least occasionally. In 2008, 89% of men and 84% of women said they drank at least once or twice a year.

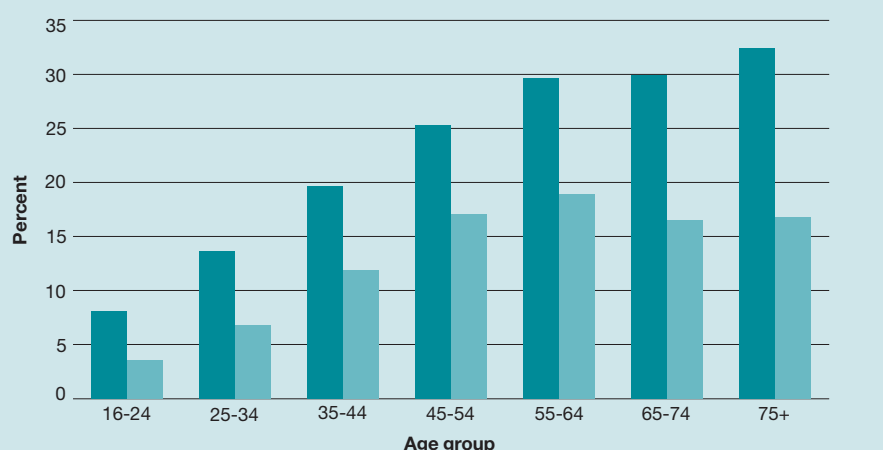
In the last week, 71% of men and 58% of women had drunk alcohol. This included 21% of men and 13% of women who had drunk alcohol on five or more days in the week. The proportion of men who drank this frequently increased with age from 8% of those aged 16-24 to 32% of the group aged 75 and over. Among women there was a similar increase from 4% of those aged 16-24 to 19% of those aged between 55 and 64.

Tables 12.1, 12.2, Figure 12A

Figure 12A

**Drank on five days or more in the last week, by age and sex**

Base: Aged 16 and over



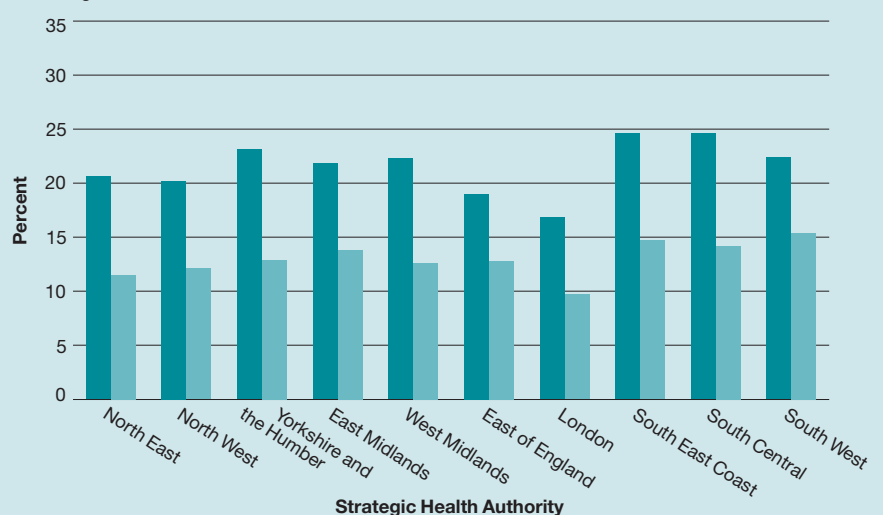
Analysis by Strategic Health Authority (SHA) showed that London was significantly different from other regions. A higher proportion of men and women in London had not drunk any alcohol in the last week (43% of men and 54% of women, compared with 29% and 42% nationally). The proportion of men and women who drank on five or more days in the last week was at a similar level across SHAs except for London, where it was significantly lower (17% of men, 10% of women).

Table 12.3, Figure 12B

Figure 12B

**Drank on five days or more in the last week, by Strategic Health Authority and sex**

Base: Aged 16 and over



Prevalence of drinking on five or more days in the last week increased strongly in line with equivalised household income, from 15% of men and 8% of women in the lowest quintile to 30% of men and 22% of women in the highest quintile. Men and women in non-Spearhead PCTs<sup>29</sup> were more likely to have drunk this frequently (22% and 13% respectively) than those in Spearhead PCTs (20% and 12%).

Tables 12.4, 12.5

12.4 Maximum daily consumption in the last week

12.4.1 Maximum daily consumption in the last week, by sex and age

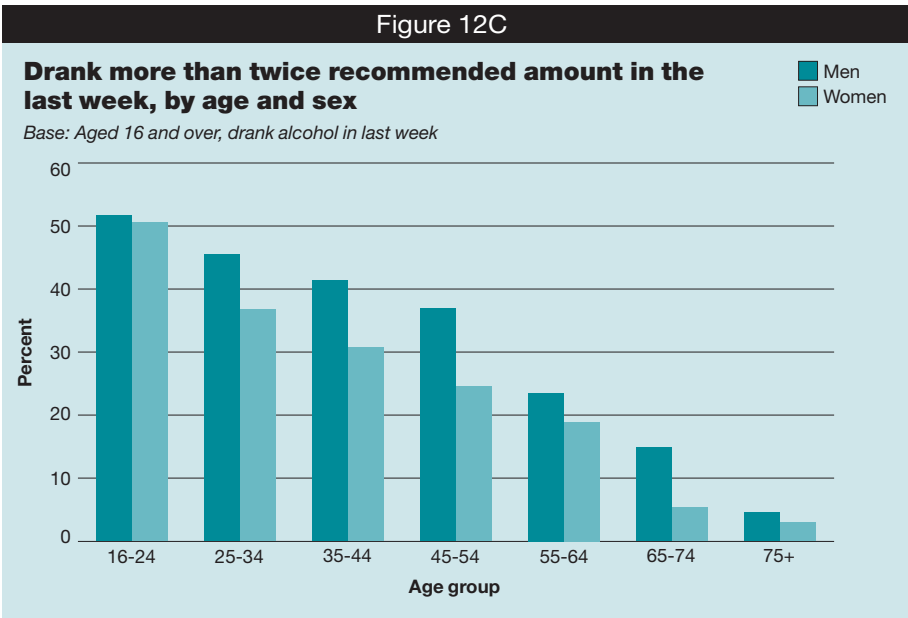
The current recommendations for sensible drinking are that men should normally drink no more than three to four units a day and that women should normally drink no more than two to three units. Regular drinking at more than twice these amounts is considered potentially harmful (see Section 12.1).<sup>3</sup> In the last week, 59% of men and 68% of women had either drunk no alcohol or had drunk within the recommended levels on every day they did drink. Adults aged 16-24, or 65 and over, were the most likely not to have drunk alcohol in the last week, and adults aged 55 and over were the most likely to have drunk within recommendations.

The HSE measures the amount drunk by adults on the day they drank most in the last week, but is not able to identify the combinations of quantity and frequency that are most likely to cause harm. Among men, 41% drank above the recommended levels on at least one day, including 25% who drank twice the recommended amount at least once. The corresponding proportions among women were 32% and 15%.

Table 12.6

The rest of this chapter is based on the 71% of men and 58% of women who drank some alcohol in the last week. More than half of these adults had drunk above the daily recommended levels on at least one day (58% of men and 55% of women). This included 35% of men and 27% of women who drank more than twice the recommended levels on at least one day. The proportions drinking at potentially harmful levels declined with age. 52% of men and 50% of women aged 16-24 who had drunk alcohol in the last week had drunk more than twice the recommended amounts on at least one day, while this decreased to just 4% of men and 3% of women aged 75 and over.

As Figure 12C illustrates, there was a slightly different pattern by age for men and women. While there were similar proportions of each sex aged 16-24 and 55-64 drinking more than twice recommended amounts, between 25 and 54 significantly more men than women did so.

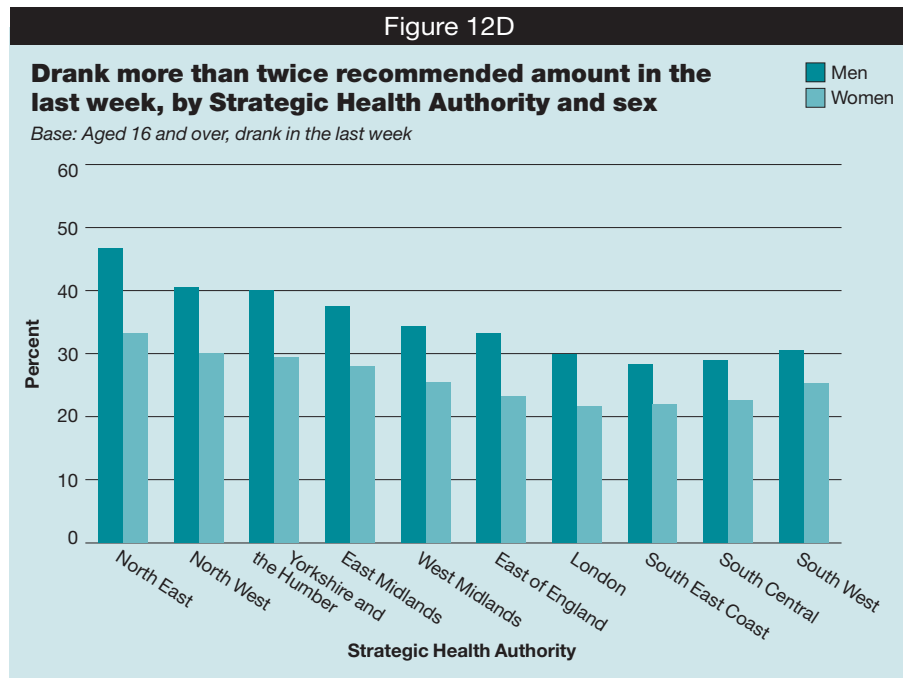


There was a similar pattern in the average (mean) amount drunk by men and women on the day in the last week they drank most. Overall the mean was 8.1 units for men and 5.3 units for women. The mean declined from 12.3 units drunk by men aged 16-24 to 3.2 units drunk by men aged 75 or over, and from 8.3 units drunk by women aged 16-24 to 2.3 units drunk by women aged 75 or more.

Table 12.7, Figure 12C

### 12.4.2 Maximum daily consumption in the last week, by Strategic Health Authority and sex

Maximum daily consumption in the last week varied according to SHA. Among men, there was a contrast between the north and the south, with the proportion drinking more than twice the recommended daily levels at its highest in the North East (47%) and also relatively high in the North West (41%), Yorkshire and the Humber (40%) and the East Midlands (38%). Drinking at this level was lowest in London, South West (both 30%), South Central (29%) and South East Coast (28%). Among women there was a similar but less pronounced pattern, from 33% of women in the North East to 22% of women in London and the South East Coast.



Mean numbers of units drunk on the heaviest drinking day in the last week followed the same broad regional pattern, being highest in the North East and North West (10.8 and 9.3 respectively for men, 6.1 in each for women) and lower in the southern SHAs (8.0 or below for men, 5.0 or below for women).

Table 12.8, Figure 12D

### 12.4.3 Maximum daily consumption in the last week, by equivalised household income and sex

Among women who drank in the last week, there was significant variation by equivalised household income in the proportion who drank more than twice the recommended level on the heaviest drinking day, although the mean number of units drunk did not vary significantly. The proportion who drank more than twice the recommended level at least once was highest among those in the lowest income quintile (32%) and decreased as income increased to 24% of women in the highest income quintile. There was no such pattern for men.

Table 12.9

### 12.4.4 Maximum daily consumption in the last week, by Spearhead status and sex

There was significant variation in patterns of maximum consumption in the last week by Spearhead status. Both men and women were more likely to have drunk more than twice the recommended levels if they lived in a Spearhead PCT (39% and 29% respectively) than if they lived in a non-Spearhead PCT (32% and 25%). Similarly, the mean number of units drunk on the heaviest drinking day was higher in Spearhead (8.9 for men, 5.5 for women) than non-Spearhead PCTs (7.9 for men, 5.1 for women).

Table 12.10



## 12.5 Discussion

The HSE measures frequency of drinking and also collects data on the maximum amount of alcohol drunk on any day in the previous week. This makes it possible to identify the prevalence of potentially harmful drinking occasions, where this is defined by the amount drunk in a single day, but not the identification of harmful drinking patterns, where individuals drink more than recommended levels on a regular basis.

There may be cause for concern about groups who combine a high prevalence of frequent drinking with a high prevalence of excessive drinking on at least one occasion a week. Compared with women, men were more likely to have drunk alcohol on five or more days in the last week and also to have drunk more than twice the recommended amount on at least one day. Otherwise, the groups that were most likely to have drunk at potentially harmful levels on a single day were not those who were most likely to drink on most days of the week. The reverse was broadly true in respect of age; drinking large quantities on a single day was most common among younger age groups, while drinking on several days in the week was most common among men and women aged 45 or more. Similarly, women (but not men) in higher income groups were more likely to drink on five or more days in the week, but less likely to have drunk more than twice the recommended levels on any day in the last week.

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- 12 For the Royal College of Psychiatrists, a significant revision from their previous recommendation that sensible drinking indicated an intake of up to 56 units per week for men and women; see Department of Health (1995), cited above.
- 13 [http://www.dh.gov.uk/en/PublicHealth/Healthimprovement/Alcoholmisuse/DH\\_085385](http://www.dh.gov.uk/en/PublicHealth/Healthimprovement/Alcoholmisuse/DH_085385)
- 14 Department of Health et al (2007), cited above. Drinking at this level has been described in surveys, including the HSE, as 'binge drinking'. 'Binge drinking' is also used to define a pattern of drinking a large quantity of alcohol in a short period of time with the aim of getting drunk. In practice, this may involve considerably more than twice the recommended daily limits. To avoid confusion, the term 'binge drinking' is not used in this report.



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- 23 See Department of Health (1995), cited above. Questions about average daily consumption, which enabled the estimation of weekly consumption, were last asked by the Health Survey for England in 2002.
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- 29 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

- 12.1 Usual frequency of drinking alcohol in the last year, by age and sex
- 12.2 Number of days on which drank alcohol in the last week, by age and sex
- 12.3 Number of days on which drank alcohol in the last week (observed and age-standardised), by Strategic Health Authority and sex
- 12.4 Number of days on which drank alcohol in the last week (age-standardised), by equivalised household income and sex
- 12.5 Number of days on which drank alcohol in the last week (age-standardised), by Spearhead status and sex
- 12.6 Summary of maximum alcohol consumption on any day in the last week, by age and sex (among all adults)
- 12.7 Maximum alcohol consumption on any day in the last week, by age and sex (among adults who drank in the last week)
- 12.8 Maximum alcohol consumption on any day in the last week (observed and age-standardised), by Strategic Health Authority and sex
- 12.9 Maximum alcohol consumption on any day in the last week (age-standardised), by equivalised household income and sex
- 12.10 Maximum alcohol consumption on any day in the last week (age-standardised), by Spearhead status and sex

Table 12.1

**Usual frequency of drinking alcohol in the last year, by age and sex***Aged 16 and over* *2008*

Usual frequency of drinking	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Almost every day	3	6	13	16	22	24	29	14
Five or six days a week	3	5	6	8	8	6	4	6
Three or four days a week	14	21	21	21	15	14	10	18
Once or twice a week	36	36	30	29	26	22	22	30
Once or twice a month	17	11	13	10	9	9	8	11
Once every couple of months	6	4	4	4	5	5	5	5
Once or twice a year	7	4	4	5	6	8	8	6
Not at all in the last 12 months/Non-drinker	14	11	10	8	9	12	13	11
<i>Drank alcohol in the last year</i>	<i>86</i>	<i>89</i>	<i>90</i>	<i>92</i>	<i>91</i>	<i>88</i>	<i>87</i>	<i>89</i>
<b>Women</b>								
Almost every day	2	4	7	10	14	13	15	9
Five or six days a week	1	2	4	6	4	3	2	3
Three or four days a week	8	14	15	16	15	8	6	12
Once or twice a week	33	30	28	26	23	19	16	26
Once or twice a month	24	18	15	12	11	11	12	15
Once every couple of months	11	7	10	8	10	8	8	9
Once or twice a year	5	8	7	8	11	18	17	10
Not at all in the last 12 months/Non-drinker	16	18	13	12	12	20	24	16
<i>Drank alcohol in the last year</i>	<i>84</i>	<i>82</i>	<i>87</i>	<i>88</i>	<i>88</i>	<i>80</i>	<i>76</i>	<i>84</i>
<i>Bases (unweighted)</i>								
<i>Men</i>	<i>737</i>	<i>953</i>	<i>1214</i>	<i>1095</i>	<i>1182</i>	<i>873</i>	<i>647</i>	<i>6701</i>
<i>Women</i>	<i>884</i>	<i>1217</i>	<i>1513</i>	<i>1373</i>	<i>1366</i>	<i>993</i>	<i>946</i>	<i>8292</i>
<i>Bases (weighted)</i>								
<i>Men</i>	<i>1082</i>	<i>1210</i>	<i>1406</i>	<i>1204</i>	<i>1085</i>	<i>724</i>	<i>538</i>	<i>7250</i>
<i>Women</i>	<i>1047</i>	<i>1212</i>	<i>1432</i>	<i>1232</i>	<i>1123</i>	<i>794</i>	<i>785</i>	<i>7625</i>

Table 12.2

### Number of days on which drank alcohol in the last week, by age and sex

Aged 16 and over

2008

Number of days	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
	%	%	%	%	%	%	%	%
<b>Men</b>								
Did not drink in last week	37	27	27	24	24	31	35	29
One	22	19	17	16	16	12	14	17
Two	18	17	17	15	14	12	9	15
Three	10	14	11	11	10	8	7	11
Four	5	9	8	9	7	7	4	7
Five	3	5	6	7	6	6	4	5
Six	1	3	4	5	5	3	2	4
Seven	4	5	10	13	18	21	26	12
<i>Drank in the last week</i>	63	73	73	76	76	69	65	71
<i>Drank on five or more days in last week</i>	8	14	20	25	30	30	32	21
Mean number of days	1.6	2.1	2.4	2.7	2.9	2.8	2.8	2.4
Standard error of the mean	0.10	0.07	0.07	0.07	0.07	0.09	0.12	0.03
<b>Women</b>								
Did not drink in last week	46	43	37	34	36	52	57	42
One	24	22	22	18	17	14	15	19
Two	17	13	14	14	13	8	5	13
Three	7	9	10	11	10	6	4	9
Four	3	5	6	6	5	4	2	5
Five	1	3	4	6	5	3	2	4
Six	1	1	2	3	3	1	2	2
Seven	1	3	5	9	11	12	14	7
<i>Drank in the last week</i>	54	57	63	66	64	48	43	58
<i>Drank on five or more days in last week</i>	4	7	12	17	19	17	17	13
Mean number of days	1.1	1.4	1.7	2.1	2.1	1.7	1.6	1.7
Standard error of the mean	0.05	0.05	0.06	0.06	0.06	0.08	0.09	0.03
<i>Bases (unweighted)</i>								
Men	740	953	1214	1095	1182	874	646	6704
Women	890	1217	1513	1373	1366	994	946	8299
<i>Bases (weighted)</i>								
Men	1087	1210	1406	1204	1085	725	538	7255
Women	1054	1212	1432	1232	1123	795	785	7634

Table 12.3

**Number of days on which drank alcohol in the last week (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over

2008

Number of days	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
Did not drink in last week	23	28	26	29	26	29	42	21	28	24
One	17	17	17	17	19	17	16	16	15	19
Two	21	15	15	16	14	16	12	17	16	15
Three	12	11	12	9	9	11	9	12	12	11
Four	6	8	7	6	9	8	6	8	5	8
Five	4	6	6	7	5	5	4	6	6	6
Six	4	3	3	3	4	3	3	5	5	3
Seven	13	11	14	13	14	11	8	14	14	15
<i>Drank in the last week</i>	<i>77</i>	<i>72</i>	<i>74</i>	<i>71</i>	<i>74</i>	<i>71</i>	<i>58</i>	<i>79</i>	<i>72</i>	<i>76</i>
<i>Drank on five or more days in last week</i>	<i>20</i>	<i>20</i>	<i>23</i>	<i>23</i>	<i>23</i>	<i>19</i>	<i>16</i>	<i>25</i>	<i>24</i>	<i>24</i>
<i>Mean number of days</i>	<i>2.5</i>	<i>2.4</i>	<i>2.6</i>	<i>2.4</i>	<i>2.6</i>	<i>2.4</i>	<i>1.9</i>	<i>2.8</i>	<i>2.6</i>	<i>2.6</i>
<i>Standard error of the mean</i>	<i>1.26</i>	<i>1.50</i>	<i>1.40</i>	<i>1.41</i>	<i>1.27</i>	<i>1.19</i>	<i>1.80</i>	<i>1.15</i>	<i>1.19</i>	<i>1.34</i>
<b>Standardised</b>										
Did not drink in last week	24	28	26	29	27	29	43	21	28	23
One	18	17	17	17	19	17	15	17	15	19
Two	20	15	15	17	14	16	11	17	16	15
Three	11	11	12	9	9	11	8	12	12	11
Four	7	8	7	7	9	8	6	8	5	8
Five	4	6	6	7	5	5	4	6	6	6
Six	4	3	3	3	4	3	4	5	5	3
Seven	13	12	14	12	14	11	9	13	14	13
<i>Drank in the last week</i>	<i>76</i>	<i>72</i>	<i>74</i>	<i>71</i>	<i>73</i>	<i>71</i>	<i>57</i>	<i>79</i>	<i>72</i>	<i>77</i>
<i>Drank on five or more days in last week</i>	<i>21</i>	<i>20</i>	<i>23</i>	<i>22</i>	<i>22</i>	<i>19</i>	<i>17</i>	<i>25</i>	<i>25</i>	<i>22</i>
<i>Mean number of days</i>	<i>2.5</i>	<i>2.4</i>	<i>2.6</i>	<i>2.4</i>	<i>2.5</i>	<i>2.3</i>	<i>1.9</i>	<i>2.8</i>	<i>2.6</i>	<i>2.6</i>
<i>Standard error of the mean</i>	<i>0.92</i>	<i>1.52</i>	<i>1.42</i>	<i>1.41</i>	<i>1.26</i>	<i>1.24</i>	<i>1.67</i>	<i>1.24</i>	<i>1.23</i>	<i>1.33</i>

Continued

Table 12.3 continued

Aged 16 and over

2008

Number of days	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Women</b>										
<b>Observed</b>										
Did not drink in last week	39	39	39	43	41	43	54	40	40	39
One	23	20	18	19	21	17	17	17	22	21
Two	13	14	15	13	13	14	9	12	12	10
Three	9	11	9	8	7	8	6	10	7	9
Four	4	5	4	4	4	5	4	5	4	6
Five	2	3	4	4	3	4	2	5	4	4
Six	3	2	2	1	2	2	1	2	3	2
Seven	6	7	7	9	8	7	5	8	7	9
<i>Drank in the last week</i>	<i>61</i>	<i>61</i>	<i>61</i>	<i>57</i>	<i>59</i>	<i>57</i>	<i>46</i>	<i>60</i>	<i>60</i>	<i>61</i>
<i>Drank on five or more days in last week</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>	<i>13</i>	<i>13</i>	<i>9</i>	<i>15</i>	<i>14</i>	<i>16</i>
Mean number of days	1.7	1.8	1.8	1.7	1.7	1.7	1.3	1.9	1.7	1.9
Standard error of the mean	0.69	1.18	1.06	1.60	0.98	1.02	1.53	1.18	1.22	0.95
<b>Standardised</b>										
Did not drink in last week	40	39	40	43	41	43	54	40	41	39
One	23	20	18	19	22	17	17	17	22	21
Two	13	14	15	13	13	14	9	12	12	10
Three	8	11	9	8	7	8	6	11	7	9
Four	4	5	4	4	4	5	4	5	4	6
Five	2	3	4	4	3	4	2	5	4	4
Six	3	2	2	1	2	2	1	2	3	2
Seven	6	7	7	9	7	7	6	8	7	9
<i>Drank in the last week</i>	<i>60</i>	<i>61</i>	<i>60</i>	<i>57</i>	<i>59</i>	<i>57</i>	<i>46</i>	<i>60</i>	<i>59</i>	<i>61</i>
<i>Drank on five or more days in last week</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>	<i>13</i>	<i>13</i>	<i>10</i>	<i>15</i>	<i>14</i>	<i>15</i>
Mean number of days	1.6	1.8	1.8	1.7	1.7	1.7	1.3	1.8	1.7	1.9
Standard error of the mean	0.68	1.19	1.06	1.62	1.00	1.01	1.69	1.21	1.22	0.96
<b>Bases (unweighted)</b>										
<i>Men</i>	<i>427</i>	<i>958</i>	<i>710</i>	<i>635</i>	<i>676</i>	<i>817</i>	<i>751</i>	<i>526</i>	<i>525</i>	<i>679</i>
<i>Women</i>	<i>520</i>	<i>1193</i>	<i>903</i>	<i>798</i>	<i>877</i>	<i>934</i>	<i>920</i>	<i>670</i>	<i>622</i>	<i>862</i>
<b>Bases (weighted)</b>										
<i>Men</i>	<i>398</i>	<i>959</i>	<i>732</i>	<i>632</i>	<i>768</i>	<i>836</i>	<i>1037</i>	<i>577</i>	<i>584</i>	<i>733</i>
<i>Women</i>	<i>399</i>	<i>1037</i>	<i>796</i>	<i>679</i>	<i>842</i>	<i>832</i>	<i>1037</i>	<i>624</i>	<i>585</i>	<i>803</i>

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 12.4

### Number of days on which drank alcohol in the last week (age-standardised), by equivalised household income and sex

Aged 16 and over 2008

Number of days	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
Did not drink in last week	16	20	29	36	43
One	14	15	19	21	18
Two	16	19	14	14	13
Three	14	12	11	8	7
Four	10	9	7	5	4
Five	8	7	4	4	3
Six	7	4	3	2	1
Seven	15	13	12	10	11
<i>Drank in the last week</i>	84	80	71	64	57
<i>Drank on five or more days in last week</i>	30	24	20	16	15
Mean number of days	3.1	2.8	2.4	2.0	1.8
Standard error of the mean	0.08	0.08	0.08	0.08	0.08
<b>Women</b>					
Did not drink in last week	25	29	44	48	57
One	20	21	19	20	18
Two	14	16	12	12	9
Three	11	11	9	7	5
Four	7	6	4	3	2
Five	7	5	2	3	2
Six	4	2	2	1	1
Seven	12	10	8	6	6
<i>Drank in the last week</i>	75	71	56	52	43
<i>Drank on five or more days in last week</i>	22	18	12	10	8
Mean number of days	2.5	2.2	1.6	1.4	1.1
Standard error of the mean	0.08	0.07	0.06	0.06	0.06
<i>Bases (unweighted)</i>					
Men	1320	1176	1039	1040	852
Women	1315	1279	1310	1397	1266
<i>Bases (weighted)</i>					
Men	1428	1303	1096	1082	903
Women	1241	1204	1192	1244	1139

Table 12.5

### Number of days on which drank alcohol in the last week (age-standardised), by Spearhead status<sup>a</sup> and sex

Aged 16 and over 2008

Variable Description	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
Did not drink in last week	28	30
One	17	18
Two	15	15
Three	11	10
Four	7	7
Five	6	5
Six	4	3
Seven	12	12
<i>Drank in the last week</i>	72	70
<i>Drank on five or more days in last week</i>	22	20
Mean number of days	2.5	2.4
Standard error of the mean	0.04	0.05
<b>Women</b>		
Did not drink in last week	42	43
One	19	20
Two	13	12
Three	8	9
Four	5	4
Five	4	3
Six	2	2
Seven	7	7
<i>Drank in the last week</i>	58	57
<i>Drank on five or more days in last week</i>	13	12
Mean number of days	1.7	1.6
Standard error of the mean	0.03	0.05
<i>Bases (unweighted)</i>		
Men	4207	2472
Women	5176	3090
<i>Bases (weighted)</i>		
Men	4617	2613
Women	4847	2757

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

Table 12.6

**Summary of maximum alcohol consumption on any day in the last week, by age and sex**

Aged 16 and over

2008

Maximum daily consumption	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
Did not drink in last week	39	27	27	24	24	31	35	29
Up to and including 4 units	18	25	26	30	37	39	51	30
More than 4, up to and including 8 units	11	15	17	18	21	19	11	16
More than 8 units	32	33	30	28	18	10	3	25
Women								
Did not drink in last week	48	43	37	34	36	52	57	42
Up to and including 3 units	15	21	24	26	31	34	35	26
More than 3, up to and including 6 units	11	15	19	24	21	11	6	16
More than 6 units	27	21	19	16	12	3	1	15
Bases (unweighted)								
Men	712	953	1215	1095	1180	871	647	6673
Women	864	1214	1512	1373	1365	994	944	8266
Bases (weighted)								
Men	1048	1210	1407	1204	1083	723	538	7213
Women	1027	1210	1431	1232	1122	795	783	7600



Table 12.7

**Maximum alcohol consumption on any day in the last week, by age and sex***Aged 16 and over, drank alcohol in last week*

2008

Maximum daily consumption	Age group							Total
	16-24	25-34	35-44	45-54	55-64	65-74	75+	
Men								
2 units or less	17	20	19	21	26	32	54	24
More than 2, up to and including 3 units	6	5	7	7	9	11	12	7
More than 3, up to and including 4 units	7	10	10	11	15	13	13	11
More than 4, up to and including 5 units	4	4	6	4	6	6	6	5
More than 5, up to and including 6 units	7	9	8	12	12	12	8	10
More than 6, up to and including 8 units	7	7	8	8	10	10	4	8
More than 8 units	52	46	41	37	24	15	4	35
More than 4 units	70	66	65	61	51	43	21	58
More than 8 units	52	46	41	37	24	15	4	35
Mean number of units	12.3	10.1	8.8	8.0	6.1	5.2	3.2	8.1
Standard error of mean	0.60	0.36	0.27	0.24	0.16	0.20	0.12	0.15
Women								
2 units or less	21	28	29	30	38	57	71	35
More than 2, up to and including 3 units	8	9	10	10	11	15	12	10
More than 3, up to and including 4 units	7	9	15	13	15	14	7	12
More than 4, up to and including 5 units	5	6	5	7	6	5	2	6
More than 5, up to and including 6 units	8	12	10	16	11	5	5	10
More than 6, up to and including 8 units	9	8	9	9	7	3	2	7
More than 8 units	41	28	22	15	12	3	2	19
More than 3 units	71	64	61	60	51	29	17	55
More than 6 units	50	37	31	24	19	5	3	27
Mean number of units	8.3	6.5	5.7	5.2	4.4	2.9	2.3	5.3
Standard error of mean	0.33	0.21	0.16	0.13	0.13	0.09	0.09	0.08
Bases (unweighted)								
Men	445	694	900	841	907	605	422	4814
Women	459	690	965	920	879	477	404	4794
Bases (weighted)								
Men	649	880	1030	915	825	498	352	5149
Women	540	687	904	818	717	380	333	4379

Table 12.8

**Maximum alcohol consumption on any day in the last week (observed and age-standardised), by Strategic Health Authority<sup>a</sup> and sex**

Aged 16 and over, drank alcohol in last week

2008

Maximum daily consumption	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Men</b>										
<b>Observed</b>										
2 units or less	14	19	19	24	22	26	27	31	28	27
More than 2, up to and including 3 units	6	6	6	7	8	8	10	8	7	7
More than 3, up to and including 4 units	8	10	10	11	11	11	9	11	14	13
More than 4, up to and including 5 units	3	5	5	6	5	6	5	6	5	6
More than 5, up to and including 6 units	9	11	10	10	9	10	10	8	9	10
More than 6, up to and including 8 units	9	8	9	7	10	6	7	8	8	9
More than 8 units	49	41	40	35	34	33	32	28	30	29
More than 4 units	71	65	64	58	58	54	54	50	52	53
More than 8 units	49	41	40	35	34	33	32	28	30	29
Mean number of units	11.2	9.3	8.4	7.8	7.9	7.5	7.9	6.9	7.4	7.8
Standard error of mean	0.89	0.44	0.33	0.41	0.40	0.38	0.47	0.54	0.37	0.39
<b>Standardised</b>										
2 units or less	15	19	19	23	22	26	29	31	29	26
More than 2, up to and including 3 units	7	6	7	7	8	8	10	8	7	7
More than 3, up to and including 4 units	8	10	10	10	11	11	9	11	13	13
More than 4, up to and including 5 units	3	5	5	6	5	6	5	5	5	5
More than 5, up to and including 6 units	9	11	11	10	8	10	10	8	9	9
More than 6, up to and including 8 units	10	8	8	7	10	6	7	9	8	9
More than 8 units	47	41	40	38	34	33	30	28	29	30
More than 4 units	69	64	64	60	58	55	52	50	51	54
More than 8 units	47	41	40	38	34	33	30	28	29	30
Mean number of units	10.8	9.3	8.5	8.4	8.0	7.7	7.7	7.3	7.3	8.0
Standard error of mean	0.69	0.46	0.35	0.48	0.43	0.41	0.47	0.77	0.37	0.42
<b>Bases (unweighted)</b>										
Men	318	687	529	450	497	586	447	408	379	513
<b>Bases (weighted)</b>										
Men	313	719	541	455	514	526	429	403	371	523

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Continued

Table 12.8

Table 12.8 continued

Aged 16 and over, drank alcohol in last week

2008

Maximum daily consumption	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Women</b>										
<b>Observed</b>										
2 units or less	27	30	34	35	38	34	37	36	39	39
More than 2, up to and including 3 units	10	8	8	12	12	11	12	12	9	9
More than 3, up to and including 4 units	11	14	11	11	11	15	12	13	9	12
More than 4, up to and including 5 units	7	4	7	6	6	5	6	7	6	5
More than 5, up to and including 6 units	9	12	9	9	8	11	11	12	13	9
More than 6, up to and including 8 units	12	6	8	8	8	7	7	6	7	7
More than 8 units	24	25	23	20	18	18	15	14	16	19
<i>More than 3 units</i>	64	62	58	53	51	55	51	52	52	51
<i>More than 6 units</i>	36	31	31	28	26	24	22	20	24	25
Mean number of units	6.4	6.2	5.7	5.2	5.0	5.1	4.9	4.8	5.0	5.0
Standard error of mean	0.47	0.21	0.27	0.17	0.27	0.23	0.22	0.25	0.29	0.21
<b>Standardised</b>										
2 units or less	30	32	37	36	39	37	39	35	41	41
More than 2, up to and including 3 units	10	8	8	11	12	11	13	12	10	10
More than 3, up to and including 4 units	12	13	10	10	10	14	12	12	9	11
More than 4, up to and including 5 units	6	4	6	6	6	5	5	6	6	4
More than 5, up to and including 6 units	9	12	9	9	8	10	10	12	13	9
More than 6, up to and including 8 units	12	6	7	8	7	7	8	6	7	7
More than 8 units	21	24	22	20	18	17	14	16	16	19
<i>More than 3 units</i>	60	59	55	53	49	53	49	53	50	49
<i>More than 6 units</i>	33	30	29	28	26	23	22	22	23	25
Mean number of units	6.1	6.1	5.5	5.2	5.0	5.0	4.8	5.0	4.8	4.9
Standard error of mean	0.49	0.21	0.27	0.18	0.29	0.23	0.23	0.31	0.33	0.24
<b>Bases (unweighted)</b>										
<i>Women</i>	313	719	541	455	514	526	429	403	371	523
<b>Bases (weighted)</b>										
<i>Women</i>	242	629	479	385	489	469	472	375	349	489

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 12.9

**Maximum alcohol consumption on any day in the last week  
(age-standardised), by equivalised household income and sex**

Aged 16 and over, drank alcohol in last week

2008

Maximum daily consumption	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Men</b>					
2 units or less	19	22	26	26	26
More than 2, up to and including 3 units	8	6	7	7	9
More than 3, up to and including 4 units	12	9	12	12	11
More than 4, up to and including 5 units	5	6	6	6	3
More than 5, up to and including 6 units	9	10	9	8	10
More than 6, up to and including 8 units	10	8	8	8	7
More than 8 units	36	38	33	33	34
<i>More than 4 units</i>	<i>60</i>	<i>62</i>	<i>55</i>	<i>55</i>	<i>53</i>
<i>More than 8 units</i>	<i>36</i>	<i>38</i>	<i>33</i>	<i>33</i>	<i>34</i>
Mean number of units	8.5	8.7	8.1	7.6	8.6
Standard error of the mean	0.30	0.35	0.41	0.33	0.50
<b>Women</b>					
2 units or less	31	34	38	35	37
More than 2, up to and including 3 units	16	11	9	10	7
More than 3, up to and including 4 units	12	12	12	11	11
More than 4, up to and including 5 units	5	5	5	6	6
More than 5, up to and including 6 units	13	11	10	9	8
More than 6, up to and including 8 units	7	8	7	7	9
More than 8 units	17	17	18	22	23
<i>More than 3 units</i>	<i>53</i>	<i>54</i>	<i>53</i>	<i>55</i>	<i>56</i>
<i>More than 6 units</i>	<i>24</i>	<i>25</i>	<i>25</i>	<i>29</i>	<i>32</i>
Mean number of units	5.1	5.1	5.4	5.6	5.7
Standard error of the mean	0.17	0.16	0.25	0.21	0.27
<i>Bases (unweighted)</i>					
<i>Men</i>	<i>1125</i>	<i>943</i>	<i>747</i>	<i>657</i>	<i>490</i>
<i>Women</i>	<i>1006</i>	<i>908</i>	<i>749</i>	<i>715</i>	<i>530</i>
<i>Bases (weighted)</i>					
<i>Men</i>	<i>1213</i>	<i>1028</i>	<i>777</i>	<i>671</i>	<i>519</i>
<i>Women</i>	<i>948</i>	<i>840</i>	<i>672</i>	<i>630</i>	<i>475</i>

Table 12.10

**Maximum alcohol consumption on any day in the last week (age-standardised), by Spearhead status<sup>a</sup> and sex**

*Aged 16 and over, drank alcohol in last week* *2008*

Maximum daily consumption	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Men</b>		
2 units or less	26	20
More than 2, up to and including 3 units	7	7
More than 3, up to and including 4 units	11	10
More than 4, up to and including 5 units	5	5
More than 5, up to and including 6 units	9	10
More than 6, up to and including 8 units	8	8
More than 8 units	32	39
<i>More than 4 units</i>	55	62
<i>More than 8 units</i>	32	39
Mean number of units	7.9	8.9
Standard error of the mean	0.18	0.30
<b>Women</b>		
2 units or less	38	35
More than 2, up to and including 3 units	10	10
More than 3, up to and including 4 units	11	10
More than 4, up to and including 5 units	5	5
More than 5, up to and including 6 units	10	9
More than 6, up to and including 8 units	7	7
More than 8 units	18	21
<i>More than 3 units</i>	52	55
<i>More than 6 units</i>	25	29
Mean number of units	5.1	5.5
Standard error of the mean	0.11	0.14
<i>Bases (unweighted)</i>		
<i>Men</i>	3058	1736
<i>Women</i>	3017	1757
<i>Bases (weighted)</i>		
<i>Men</i>	3312	1816
<i>Women</i>	2804	1557

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

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# Children's BMI, overweight and obesity

# 13

Tosin Ogunbadejo

## Summary

- There is a growing body of evidence that links childhood overweight and obesity with a number of long-term and immediate physiological and psychological health risks. This chapter examines the patterns of overweight and obesity among children aged 2-15, and their relationship with a number of demographic variables. Comparisons are also made between the Health Survey for England (HSE) 2007 and 2008 data and National Child Measurement Programme (NCMP) data on the prevalence of overweight/obesity in primary school children aged 4-5 (Reception Year) and 10-11 (Year 6) in 2007/08 and 2008/09.
- Mean Body Mass Index (BMI) was higher overall among girls than boys aged 2-15 (a difference of  $0.3\text{kg/m}^2$ ). Mean BMI was similar among younger boys and girls, but from the age of 9 a gap between the sexes was apparent.
- 17% of boys and 15% of girls were classed as obese, and around three in ten boys and girls were classed as either overweight or obese (31% and 29% respectively). Children aged 11-15 were more likely than those aged 2-10 to be obese (21% of boys and 18% of girls aged 11-15, compared with 14% and 13% respectively aged 2-10).
- There was significant variation in mean BMI by Strategic Health Authority (SHA), with lower means in South East Coast, South Central and the South West than in most other regions.
- There was significant variation both in mean BMI and in the proportion of children who were obese according to equivalised household income. Mean BMI was lowest among children living in households in the highest income quintile ( $18.0\text{kg/m}^2$  for both boys and girls), and generally increased as equivalised income decreased ( $18.7\text{kg/m}^2$  for boys,  $19.0\text{kg/m}^2$  for girls in the lowest quintile). Those in the highest income quintile were the least likely to be obese (12% of both boys and girls).
- There was a higher prevalence of obesity in Spearhead PCTs (20% of boys and 17% of girls aged 2-15) compared with non-Spearhead PCTs (15% and 14% respectively).
- Between 1995 and 2008, the prevalence of obesity among boys aged 2-15 increased from 11% to 17%, and the equivalent increase for girls was from 12% to 15%. However, the pattern has not been one of uniform increase over the period. The prevalence of obesity increased steadily in most years up to around 2004 and 2005, and since then the pattern has been slightly different for boys and girls. Among boys, the proportion who were obese has remained between 17% and 19% since 2002. Among girls, there was a significant decrease in obesity between 2005 and 2006, and levels have been similar from 2006 to 2008.
- These results suggest that the trend in obesity now appears to be flattening out, and future HSE data will be important in confirming whether this is a continuing pattern, or whether the longer term trend is still gradually increasing.
- Comparisons were made between HSE 2007 and 2008 and data from the National Child Measurement Programme (NCMP) 2007/08 and 2008/09 on national obesity prevalence among children in the Reception Year (aged 4-5) and Year 6 (aged 10-11).

In 2007, among Reception Year children (aged 4-5) the estimates for the proportion of girls who were obese appear higher from the HSE than those from the NCMP. There was no significant difference for boys, or for the proportions of either sex who were overweight. Among Year 6 children (aged 10-11) the estimates from the HSE and the NCMP were very close for both overweight and obesity.

- There were no significant differences in the estimates from the 2008/09 NCMP and the HSE 2008 for the proportions of children overweight or obese in Reception or Year 6.



## 13.1 Introduction

In 2004, the government published its health white paper, *Choosing Health: making healthier choices easier*, which set out its commitments for action on obesity, including stemming the rise in obesity among children under 11 years of age.<sup>1</sup> This is reflected in the current Public Service Agreement (PSA) shared by the Department of Health, Department for Children, Schools and Families and Department of Culture, Media and Sport to 'Reduce the proportion of overweight and obese children to 2000 levels by 2020 in the context of tackling obesity across the population'.<sup>2</sup> This PSA has been echoed in later strategies, including the cross-government paper *Healthy Weight, Healthy Lives*<sup>3</sup> and the current *Change4Life*<sup>4</sup> campaign. Change4Life, currently promoted society-wide, aims to prevent people from becoming overweight through promoting healthier eating and more active lifestyles.

Overweight and obesity are terms that refer to an excess of body fat and they usually relate to increased weight-for-height. The two terms denote different degrees of excess adiposity, and overweight can be thought of as a stage where an individual is at risk of developing obesity.<sup>5</sup> The adverse health consequences associated with obesity are mostly related to an increased adiposity rather than increased weight per se<sup>6</sup> and it is therefore important that any indicator of obesity reflects this increased adiposity. Body Mass Index (BMI), calculated as weight (kg) divided by height squared (m<sup>2</sup>), has been shown to correlate strongly with adiposity in adults<sup>7,8</sup> and children.<sup>6,9,10</sup> It is the key measure of overweight and obesity in this chapter. The decision to use BMI is supported by recommendations made by the International Obesity Task Force, which concluded that BMI is a reasonable measure of body adiposity in children.<sup>11</sup>

In this chapter overweight and obesity prevalence and trends have been produced using the 85th and 95th BMI percentiles of the UK reference curves as cut-offs respectively for overweight and obesity.<sup>12</sup> The UK National BMI percentiles classification has been used in the past to describe childhood overweight and obesity prevalence trends in the UK<sup>13</sup> and was used to produce obesity trend estimates in the Chief Medical Officer's (CMO) 2002 Annual Report.<sup>14</sup>

The increasing body of evidence that links obesity with numerous long term and immediate physiological health risk demonstrates the importance of studying early overweight and obesity. Childhood and adolescent obesity can persist into adulthood, where the direct health risks of obesity are severe and well established. It has been estimated that up to 50% of obese adolescents remain obese in adulthood.<sup>15</sup> Other studies have linked childhood and adolescent overweight/obesity directly to middle-age mortality and morbidity.<sup>16,17,18,19,20</sup> In addition to the increased risk for health problems in later life, children face immediate health consequences of obesity including increased risks for an abnormal lipids profile and elevated blood pressure.<sup>21</sup> Associations between childhood obesity and increased asthma prevalence<sup>22</sup> or the incidence of type 2 diabetes mellitus<sup>23</sup> have also been reported.

Overweight and obesity can also have psychological effects. Studies have found that obese children are more likely to experience psychological or psychiatric problems than non-obese children, with girls at a greater risk, and psychological morbidity increasing with age.<sup>24</sup> Various studies of pre-adolescents and adolescents have also shown that a significant proportion are dissatisfied with their body size and shape and want to be thinner. This concern increases with body mass, and again, is more prevalent in females than in males.<sup>25,26,27</sup> Low self esteem, behavioural problems and other negative psychological consequences have also been associated with obesity or increases in body mass among children.<sup>24,28,29,30</sup>

Obesity in adolescence/ young adulthood has also been found to have adverse effects on social and economic outcomes in young adulthood (for example, income and educational attainment).<sup>24</sup>

This chapter examines patterns of overweight and obesity among children aged 2-15, and their relationship with a number of demographic variables. It also compares the 2007 and

2008 HSE data on overweight/obesity prevalence in primary school children with data from the 2007/8 and 2008/09 National Child Measurement Programme (NCMP). Trend data on key HSE measures, including child obesity, are available in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre website.<sup>31</sup>

## 13.2 Methods and definitions

### 13.2.1 Methods

For children aged 2-15, height and weight were measured and BMI was calculated from these. BMI and overweight/obesity prevalence are presented by individual years of age. For the overweight and obesity prevalence estimates the *exact* age was used (extracted from the date of interview minus the date of birth). Presentation of the results is based, however, on the *age at last birthday*, which is the HSE standard. Also in line with the HSE standard for children, the results for different regions and income groups have not been aged-standardised.

BMI, overweight and obesity prevalence trends for children aged 2-15 were calculated for HSE years 1995 to 2008. Since 1995 when children were first included in the HSE, weighting was necessary to compensate for limiting the number of children interviewed in a household to two, and the weighting is used to adjust the data to ensure that the age/sex distribution matched that of all children in co-operating households. Non-response weighting was also introduced in 2003. The child selection weighted estimates are shown for 1995-2002 and the non-response weighted estimates (including adjustment for child selection) for 2003-2008. In light of the PSA target for children under 11, national trend data are presented separately for three age groups: 2-10, 11-15 and 2-15.

### 13.2.2 Definitions

Overweight and obesity prevalence for children aged 2-15 was estimated using the age and sex-specific UK National BMI percentiles classification.<sup>32,33</sup> Different growth patterns among boys and girls at each age mean that a universal categorisation cannot be used to define childhood overweight/obesity. The UK National BMI percentiles classification gives the BMI threshold for each age above which a child is considered overweight or obese. The classification estimates were produced by calculating the percentage of boys and girls who were at or above the 85th (overweight) or 95th (obese) BMI percentiles of the 1990 reference population.

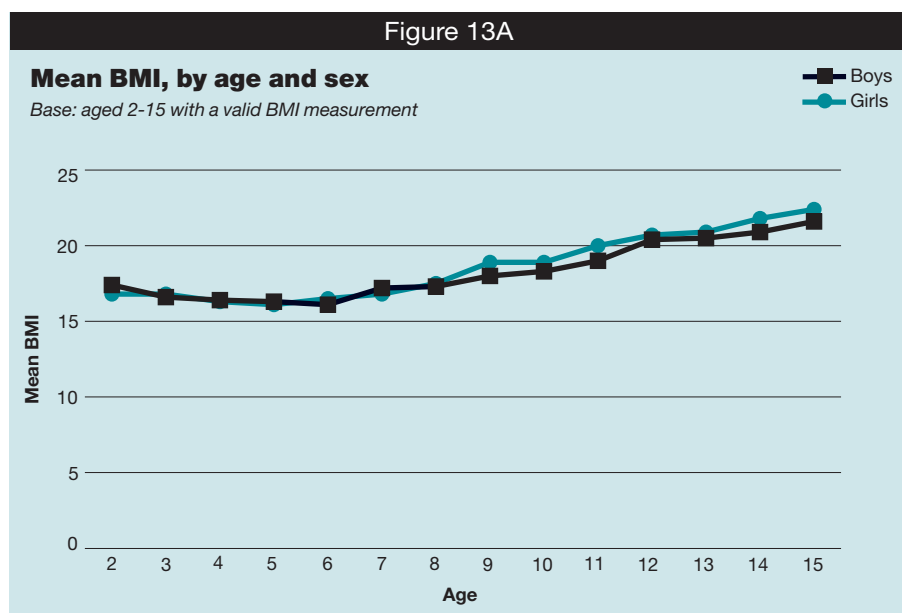
In 2008, the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. The revised percentages of those overweight or obese in each year differ by less than 0.1 – 1.1 percentage points from those originally published, and 0.3% - 1.2% of children in each year were misclassified. In no cases were results significantly different from those presented previously. Some percentages appear to have increased because of rounding. Table 13.6 -13.8 use the new definitions for each year, and trend tables published separately by The NHS Information Centre have also been updated to use the new definitions.<sup>31</sup>

## 13.3 BMI and prevalence of overweight and obesity

### 13.3.1 BMI, overweight and obesity, by age and sex

Mean BMI was higher overall among girls than boys aged 2-15 (a difference of 0.3kg/m<sup>2</sup>). Mean BMI was similar among younger children of both sexes, but from the age of 9 a gap between girls and boys was apparent, ranging from 0.3kg/m<sup>2</sup> to 1.0kg/m<sup>2</sup>.

Table 13.1, Figure 13A



17% of boys and 15% of girls were classed as obese, and around three in ten boys and girls were classed as either overweight or obese (31% and 29% respectively). Table 13A below summarises the proportions within two broad age groups. Children aged 11-15 were more likely than those aged 2-10 to be obese (21% of boys and 18% of girls aged 11-15, compared with 14% and 13% respectively aged 2-10). They were also more likely to be overweight including obese (36% of boys and 34% of girls aged 11-15, 28% of both boys and girls aged 2-10).

Table 13A			
Overweight and obesity prevalence, by age and sex			
	Age group		
	2-10	11-15	2-15
	%	%	%
<b>Boys</b>			
Overweight	14	16	15
Obese	14	21	17
Overweight including obese	28	36	31
<b>Girls</b>			
Overweight	13	16	14
Obese	13	18	15
Overweight including obese	28	34	29

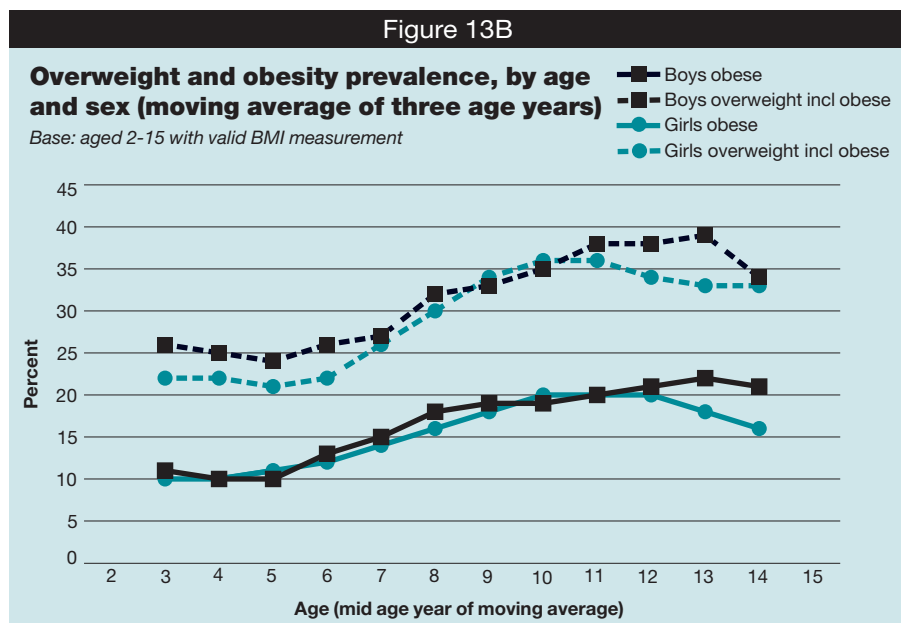
Figure 13B shows the proportions of children who were obese, and overweight including obese, by age with moving averages of three age year groups. The proportion of children who were obese rose gradually from around the age of 6 or 7, and levelled out among the oldest children. There was generally less variation by age in the proportion who were overweight.

Table 13.2, Table 13A, Figure 13B

### 13.3.2 BMI, overweight and obesity by Strategic Health Authority

There was significant variation in mean BMI by Strategic Health Authority (SHA), with lower means in South East Coast, South Central and the South West than in most other regions. However, there was no significant variation in the proportion who were obese across the regions.

Table 13.3



### 13.3.3 BMI, overweight and obesity by equivalised household income

Among children aged 2-15, there was significant variation both in mean BMI and in the proportion of children who were obese according to equivalised household income. Mean BMI was lowest among children living in households in the highest income quintile (18.0kg/m<sup>2</sup> for both boys and girls), and generally increased as equivalised income decreased (18.7kg/m<sup>2</sup> for boys, 19.0kg/m<sup>2</sup> for girls in the lowest quintile).

Figure 13C shows the proportion of children who were overweight or obese in each income quintile. Reflecting the pattern with mean BMI, those in the highest income quintile were the least likely to be obese (12% of both boys and girls).

Table 13.4, Figure 13C

### 13.3.4 BMI, overweight and obesity prevalence, by Spearhead status and sex

Boys and girls aged 2 - 15 who lived in a Spearhead PCT<sup>34</sup> had a higher mean BMI (18.7kg/m<sup>2</sup> for boys, 18.9kg/m<sup>2</sup> for girls) than those who lived in non-Spearhead PCTs (18.2kg/m<sup>2</sup> and 18.6kg/m<sup>2</sup> respectively). Correspondingly, there was a higher prevalence of obesity in Spearhead PCTs (20% of boys and 17% of girls) compared with non-Spearhead PCTs (15% and 14% respectively).

Table 13.5

## 13.4 Trends in BMI, overweight and obesity

Tables 13.6 to 13.8 show trends in mean BMI and prevalence of overweight and obesity between 1995 and 2008. The tables present results for children aged 2-15, and then for the age groups 2-10 and 11-15 separately.

Among children aged 2-15, mean BMI increased by 0.7kg/m<sup>2</sup> for boys and by 0.6kg/m<sup>2</sup> for girls between 1995 and 2008. With fluctuations from year to year, overall increases in mean BMI were evident for both sexes during this period.

Between 2000 (the 'baseline' year for the PSA target) and 2008 mean BMI among boys aged 2-15 increased overall by 0.4 kg/m<sup>2</sup> (from 18.0kg/m<sup>2</sup> to 18.4kg/m<sup>2</sup>), while there was no significant change for girls in the same period (18.5kg/m<sup>2</sup> in 2000, 18.7kg/m<sup>2</sup> in 2008). However, among both boys and girls the mean peaked between 2003 and 2005, and has dropped back slightly in the last three years.

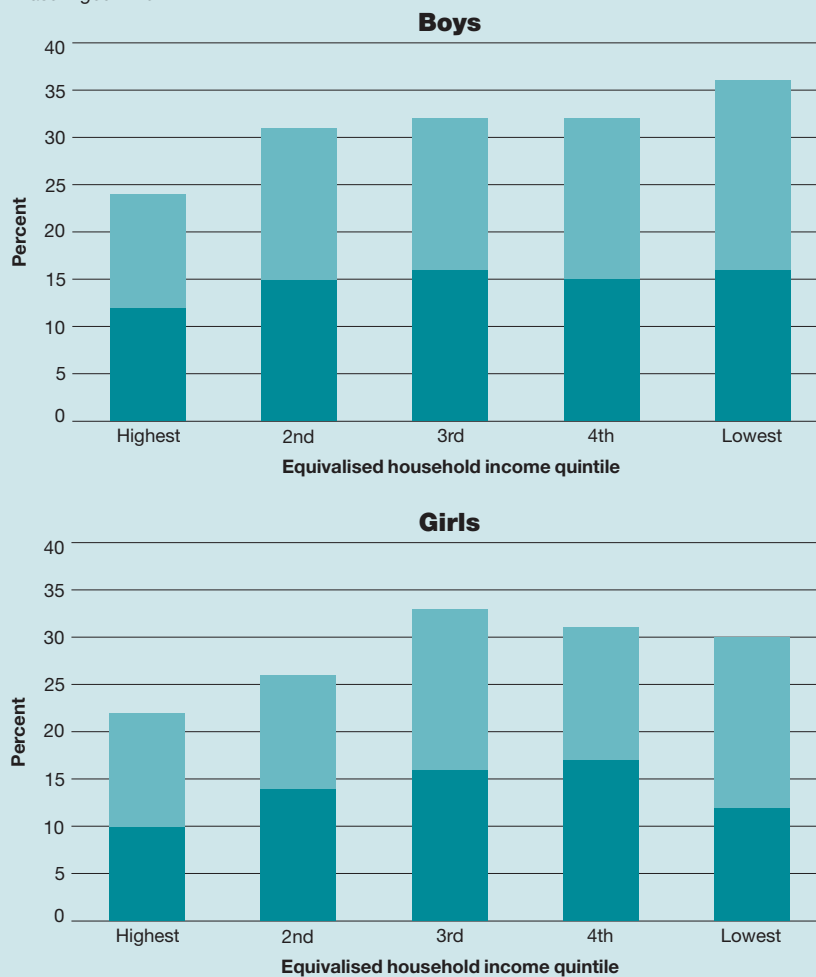
Figure 13D shows three-year moving averages from 1995 to 2008 for obesity, and overweight including obesity among children aged 2-15. It has been well documented that childhood obesity in the UK has increased significantly since 1995. While the trends show yearly fluctuations between 1995 and 2008, the prevalence of obesity among boys aged 2-

Figure 13C

**Prevalence of overweight and obesity, by equivalised household income and sex**

Base: Aged 2-15

Obese  
Overweight



15 increased by six percentage points (from 11% to 17%), and the equivalent increase for girls was three percentage points (from 12% to 15%). However, the pattern has not been one of uniform increase over the entire period. The prevalence of obesity increased steadily in most years up to around 2004 and 2005, and since then the pattern has been slightly different for boys and girls. Among boys, the proportion who were obese has remained between 17% and 19% since 2002. Among girls, there was a significant decrease in obesity between 2005 and 2006, and levels have been similar from 2006 to 2008.

The proportion of children who were overweight varied less over the period than the proportion who were obese. While there has been a gradual slight increase overall, there have been fluctuations from year to year. Thus changes in the proportion who were either overweight or obese have closely followed the pattern of changes in the proportion who were obese.

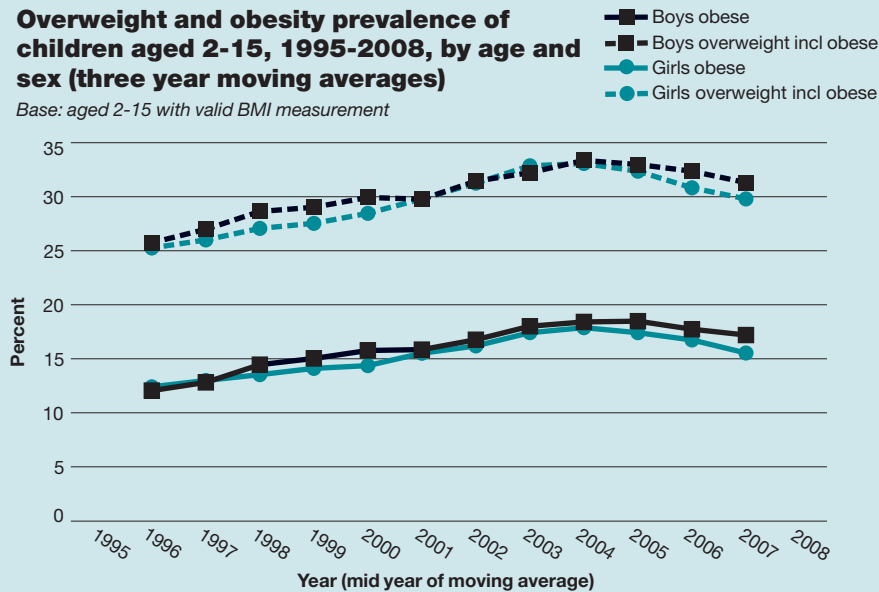
The moving averages shown in Figure 13D suggest that the trend in obesity now appears to be flattening out, and future HSE data will be important in confirming whether this is a continuing pattern, or whether this is a plateau within the longer term trend which is still gradually increasing.

As well as differences between boys and girls, there were differences in trends according to age. Figure 13E shows, for the period from 1995 to 2008, the proportion of children aged 2-10 and 11-15 who were obese. Among boys, there was a broadly similar pattern of increase for both age groups up to 2005; since then the proportion who were obese has changed little. There was an apparently anomalous result among boys aged 11-15 in 2004.<sup>35</sup> However, among boys in the older age group, the proportion who were obese in 2008 was

Figure 13D

### Overweight and obesity prevalence of children aged 2-15, 1995-2008, by age and sex (three year moving averages)

Base: aged 2-15 with valid BMI measurement



Note: data for 1995-2007 have been corrected to include a small number of children previously omitted from the overweight and obese categories

21%, one of the highest levels recorded; while this was not a significant increase from 2007, it remains to be seen whether the upward trend is starting again or whether this is a temporary fluctuation.

Among girls aged 11-15, the overall pattern was similar to that among older boys. The prevalence of obesity increased between 1995 and 2003 (16% to 22%); since then, apart from an apparently anomalous result in 2004,<sup>35</sup> there has been no significant year on year change. However, the proportion of girls in this age group who were obese in 2008 (18%) was not significantly higher than in 1995 (16%), and it would seem that the trend has been flattening over the most recent few years. Younger girls, aged 2-10, were also not significantly more likely to be obese in 2008 than in 1995 (13% and 11% respectively), and apart from some year on year fluctuation there has been little change in this age group.

Tables 13.6-13.8, Figures 13D, 13E

## 13.5 Comparisons between Health Survey for England and National Child Measurement Programme data

### 13.5.1 Introduction

The National Child Measurement Programme (NCMP) is part of the Healthy Weight, Healthy Lives strategy. Annually, children in Reception Year and Year 6 are weighed and measured during the school year as part of the programme. Comparing HSE and NCMP data on overweight and obesity prevalence in England provides a useful indication of childhood overweight/obesity prevalence within the UK, and this section compares the HSE 2007 with the NCMP 2007/8 data,<sup>36</sup> and the HSE 2008 with the NCMP 2008/09 data.<sup>37</sup>

It is important to note that there are a number of differences in the data collected for the HSE and the NCMP:

- HSE figures are based on a sample of children, whereas the NCMP is a census of all eligible children (albeit with an 88% participation rate in 2007/08 and 90% in 2008/09 for the NCMP);
- In the HSE 2007 a total of 7,504 children (aged 0-15 years) were interviewed. Of these, valid height and weight measurements were taken for 953 children aged 4-5 and 841 children aged 10-11. In 2008, a total of 7,521 children (aged 0-15 years) were interviewed. Of these, valid height and weight measurements were taken for 829 children aged 4-5 and 974 children aged 10-11;

Figure 13E

**Prevalence of obesity from 1995 to 2008**

Base: Aged 2-15

Age 2-10  
Age 11-15



Note: data for 1995-2007 have been corrected to include a small number of children previously omitted from the overweight and obese categories

- NCMP 2007/08 measured 973,073 children in total: 477,652 were in the Reception Year (aged 4 or 5 years) and 495,421 were in Year 6 (aged 10 or 11 years). In 2008/09, 1,003,849 children were measured in total: 506,169 were in the Reception Year and 497,680 were in Year 6.
- The HSE uses a multi-stage stratified probability sampling design which is designed to ensure the sample is representative of the population of England. Therefore, the HSE provides a reference standard with which the NCMP figures can be compared.

Figure 13F compares the NCMP 2007/08 estimates of national obesity prevalence for children in Reception and Year 6 with those obtained from the HSE 2007 for children aged 4-5 and 10-11 years. Figure 13G makes the same comparison between the NCMP 2008/09 estimates and the HSE 2008. 95% confidence intervals are shown for the HSE data; the confidence intervals for the NCMP data are less than 0.2% and are too small to be shown on this scale. Where the HSE confidence intervals overlap with the top of the NCMP bar for a given group, the difference between the two estimates is not statistically significant.

### 13.5.2 HSE 2007 and NCMP 2007/08

In 2007, among Reception Year children (aged 4-5) the estimates for the proportion of girls who were obese appear higher from the HSE than those from the NCMP. There was no significant difference for boys, or for the proportions of either sex who were overweight. Among Year 6 children (aged 10-11) the estimates from the HSE and the NCMP were very close for both overweight and obesity.



13.5.3 HSE 2008 and NCMP 2008/09

In 2008, there were no significant differences in the estimates from the 2008/09 NCMP and the HSE 2008 for the proportions of children overweight or obese in the Reception Year or Year 6.



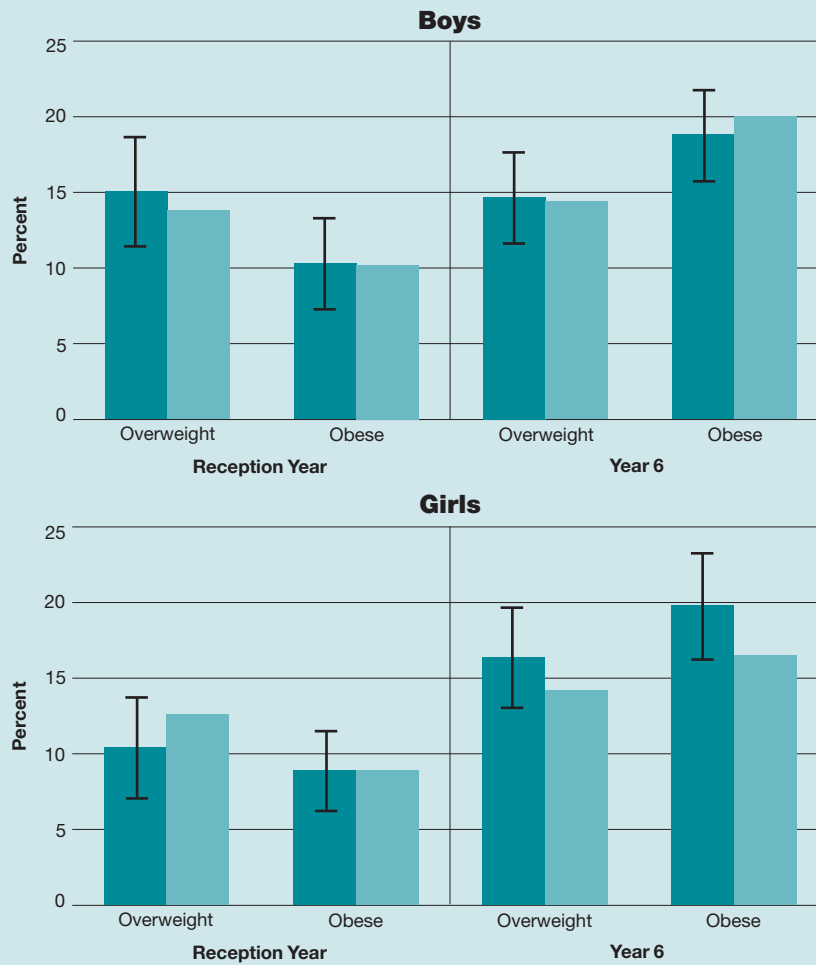


Figure 13G

### Comparison of overweight and obesity prevalence: HSE 2008 and the NCMP 2008/09

Base: aged 4 or 5/ Reception Year and aged 10 or 11/Year 6

■ HSE 2008  
■ NCMP 2008/09



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- 31 [www.ic.nhs.uk/pubs/hse08trends](http://www.ic.nhs.uk/pubs/hse08trends)
- 32 There is no generally agreed definition of childhood obesity, but there are two widely used indicators: the International Classification, based on reference points derived from an international survey; and the National Body Mass Index percentile classification, based on the UK 1990 reference curves (as used in this report). Although the figures produced by the two different definitions differ considerably (obesity estimates derived using the National Body Mass Index percentile classification are much higher than those derived by the international classification), the overall trends are not affected by the definition used.
- 33 Stamatakis E. *Anthropometric measures, overweight, and obesity* (Chapter 9) in Sproston K, Primatesta P (Eds) *Health Survey for England, 2002*. The Stationery Office, London, 2003.
- 34 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.
- 35 The estimate for obesity for girls aged 11-15 in 2004, based on a small sample, was higher than other

years. The long term trends suggest that 2004's estimate may have been an outlier in the series (due to random variation), and otherwise the trend appears to be flattening out for this and other age groups over the most recent years.

- 36 *National child measurement programme: results from the school year 2007/08*. The NHS Information Centre for health and social care, available at: <http://www.ic.nhs.uk/ncmp>
- 37 *National child measurement programme: results from the school year 2008/09*. The NHS Information Centre for health and social care, available at: <http://www.ic.nhs.uk/ncmp>

- 13.1 BMI, by age and sex
- 13.2 Overweight and obesity prevalence, by age and sex
- 13.3 BMI, overweight and obesity prevalence, by Strategic Health Authority and sex
- 13.4 BMI, overweight and obesity prevalence, by equivalised household income and sex
- 13.5 BMI, overweight and obesity prevalence, by Spearhead status and sex
- 13.6 Trends in BMI, overweight and obesity prevalence among children aged 2-15, 1995-2008, by sex
- 13.7 Trends in BMI, overweight and obesity prevalence among children aged 2-10, 1995-2008, by sex
- 13.8 Trends in BMI, overweight and obesity prevalence among children aged 11-15, 1995-2008, by sex

Table 13.1

**BMI, by age and sex***Aged 2-15 with a valid BMI measurement*

2008

BMI (kg/m²)	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Boys															
Mean	17.4	16.6	16.4	16.3	16.1	17.2	17.3	18.0	18.3	19.0	20.4	20.5	20.9	21.6	18.4
Standard error of the mean	0.27	0.12	0.13	0.12	0.12	0.35	0.19	0.22	0.21	0.30	0.26	0.25	0.25	0.28	0.08
5th percentile	15.0	14.7	13.9	14.3	13.5	13.9	13.9	14.4	14.6	14.6	16.0	15.8	16.2	17.1	14.5
10th percentile	15.5	15.1	14.6	14.7	14.2	14.5	14.7	15.0	15.0	15.3	16.3	16.5	17.0	17.4	15.1
15th percentile	15.7	15.3	15.0	14.9	14.5	14.9	15.0	15.3	15.5	15.8	16.8	16.9	17.6	18.1	15.4
Median	16.9	16.6	16.3	16.1	15.9	16.2	16.6	17.2	17.6	18.1	19.8	19.6	20.0	20.5	17.4
85th percentile	19.0	17.8	17.6	17.7	17.5	18.8	20.4	20.7	21.1	22.1	24.2	24.4	24.8	26.1	21.6
90th percentile	19.4	18.1	17.8	18.1	18.1	20.0	21.4	22.6	22.6	24.4	25.9	25.7	26.6	27.2	23.2
95th percentile	20.7	19.1	18.9	18.8	19.2	22.8	23.0	24.2	25.4	26.8	28.0	27.9	28.4	29.7	25.9
Girls															
Mean	16.8	16.8	16.3	16.1	16.5	16.8	17.5	18.9	18.9	20.0	20.7	20.9	21.8	22.4	18.7
Standard error of the mean	0.23	0.21	0.13	0.14	0.18	0.18	0.19	0.27	0.21	0.24	0.27	0.24	0.24	0.29	0.08
5th percentile	14.2	13.9	14.0	13.8	13.8	13.7	14.3	15.0	14.7	15.3	15.4	16.1	17.0	17.1	14.3
10th percentile	14.8	14.8	14.4	14.3	14.1	14.2	14.6	15.5	15.6	16.1	16.6	16.8	17.8	18.2	14.9
15th percentile	15.1	15.0	14.8	14.5	14.4	14.6	15.1	15.8	16.0	16.6	17.2	17.3	18.4	18.7	15.3
Median	16.7	16.4	16.1	15.7	15.9	16.4	17.0	17.8	18.3	18.9	19.7	20.3	20.8	21.7	17.7
85th percentile	18.0	18.3	17.9	17.4	18.7	19.2	20.2	22.5	22.3	24.2	24.8	24.7	25.3	26.0	22.5
90th percentile	18.5	18.7	18.1	18.2	19.5	20.0	21.3	24.3	23.4	25.4	26.5	26.0	26.7	27.9	24.0
95th percentile	20.2	21.0	19.2	20.5	21.1	21.9	23.3	25.6	25.6	27.6	28.7	28.3	28.5	31.5	26.1
Bases (unweighted)															
Boys	170	174	220	212	226	208	204	225	224	233	227	256	245	206	3030
Girls	168	212	195	202	209	229	202	229	263	254	202	227	256	220	3068
Bases (weighted)															
Boys	172	163	200	199	205	190	203	215	216	213	204	230	252	217	2880
Girls	155	185	186	190	178	203	189	205	209	196	190	214	236	204	2740

Table 13.2

**Overweight and obesity prevalence, by age and sex**

Aged 2-15 with a valid BMI measurement

2008

BMI status <sup>a</sup>	Age														Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Boys															
Overweight <sup>b,c</sup>	12	16	16	14	12	13	11	17	14	15	23	13	16	11	15
Obese <sup>b,c</sup>	17	8	9	12	9	17	19	20	19	19	23	22	20	19	17
Overweight including obese	29	24	25	26	21	29	30	37	33	34	46	35	36	30	31
Girls															
Overweight <sup>b,c</sup>	10	16	13	8	10	12	14	15	18	14	15	15	16	18	14
Obese <sup>b,c</sup>	9	11	9	9	14	13	15	21	17	22	21	16	17	16	15
Overweight including obese	18	27	21	17	24	25	28	36	36	36	35	31	33	35	29
Bases (unweighted)															
Boys	170	174	220	212	226	208	204	225	224	233	227	256	245	206	3030
Girls	168	212	195	202	209	229	202	229	263	254	202	227	256	220	3068
Bases (weighted)															
Boys	172	163	200	199	205	190	203	215	216	213	204	230	252	217	2880
Girls	155	185	186	190	178	203	189	205	209	196	190	214	236	204	2740

<sup>a</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously.

<sup>b</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>c</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

Table 13.3

**BMI, overweight and obesity prevalence, by Strategic Health Authority<sup>a</sup> and sex**

Aged 2-15 with a valid BMI measurement

2008

BMI (kg/m <sup>2</sup> ) and BMI status <sup>b</sup>	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>										
Mean BMI	18.3	18.6	18.7	18.3	18.2	18.5	18.7	18.2	18.0	18.2
Standard error of the mean	0.26	0.18	0.25	0.22	0.21	0.23	0.29	0.24	0.22	0.20
Median BMI	17.5	17.7	17.9	17.3	17.2	17.3	17.3	17.5	17.0	17.3
% overweight <sup>c,d</sup>	16	18	13	16	14	13	13	14	13	16
% obese <sup>c,d</sup>	18	19	19	17	16	16	18	14	14	16
% overweight including obese	33	37	32	32	30	29	31	28	27	32
<b>Girls</b>										
Mean BMI	18.9	18.8	19.1	18.5	19.0	18.8	18.7	18.2	18.3	18.5
Standard error of the mean	0.36	0.20	0.26	0.28	0.23	0.21	0.24	0.19	0.27	0.23
Median BMI	17.8	18.0	18.1	17.6	18.2	17.9	17.3	17.2	17.4	17.5
% overweight <sup>c,d</sup>	17	15	16	12	14	14	12	12	13	15
% obese <sup>c,d</sup>	14	16	15	13	18	15	20	12	12	11
% overweight including obese	31	31	32	26	32	29	32	25	25	26
<i>Bases (unweighted)</i>										
Boys	134	456	300	264	302	349	392	282	226	325
Girls	150	469	340	262	302	336	393	249	257	310
<i>Bases (weighted)</i>										
Boys	120	374	279	258	320	320	431	256	212	310
Girls	132	383	296	235	295	290	398	211	221	279

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously.

<sup>c</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>d</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

Table 13.4

**BMI, overweight and obesity prevalence, by equivalised household income and sex**

Aged 2-15 with a valid BMI measurement

2008

BMI (kg/m <sup>2</sup> ) and BMI status <sup>a</sup>	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Boys</b>					
Mean BMI	18.0	18.1	18.4	18.6	18.7
Standard error of the mean	0.24	0.15	0.16	0.19	0.19
Median BMI	17.1	17.3	17.5	17.4	17.5
% overweight <sup>b,c</sup>	12	15	16	15	16
% obese <sup>b,c</sup>	12	16	16	17	20
% overweight including obese	23	31	32	31	36
<b>Girls</b>					
Mean BMI	18.0	18.3	19.2	18.6	19.0
Standard error of the mean	0.20	0.15	0.20	0.16	0.19
Median BMI	16.9	17.5	18.2	17.6	18.0
% overweight <sup>b,c</sup>	10	14	16	17	12
% obese <sup>b,c</sup>	12	12	17	14	18
% overweight including obese	22	26	32	32	31
<b>Bases (unweighted)</b>					
Boys	369	502	609	561	543
Girls	390	534	527	588	568
<b>Bases (weighted)</b>					
Boys	337	467	575	541	529
Girls	333	455	473	532	528

<sup>a</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously.

<sup>b</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>c</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

Table 13.5

**BMI, overweight and obesity prevalence, by Spearhead status<sup>a</sup> and sex**

Aged 2-15 with a valid BMI measurement

2008

BMI (kg/m <sup>2</sup> ) and BMI status <sup>b</sup>	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Boys</b>		
Mean BMI	18.2	18.7
Standard error of the mean	0.10	0.13
Median BMI	17.3	17.6
% overweight <sup>c,d</sup>	14	16
% obese <sup>c,d</sup>	15	20
% overweight including obese	29	35
<b>Girls</b>		
Mean BMI	18.6	18.9
Standard error of the mean	0.09	0.14
Median BMI	17.6	17.9
% overweight <sup>c,d</sup>	14	14
% obese <sup>c,d</sup>	14	17
% overweight including obese	28	31
<b>Bases (unweighted)</b>		
Boys	1912	1102
Girls	1884	1169
<b>Bases (weighted)</b>		
Boys	1831	1034
Girls	1671	1057
Girls	1912	1102

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously.

<sup>c</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>d</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.



Table 13.6

**Trends in BMI, overweight and obesity prevalence among children aged 2-15, 1995-2008, by sex**

Aged 2-15 with a valid BMI measurement

1995-2008

BMI (kg/m <sup>2</sup> ) and BMI status <sup>a</sup>	Survey year													
	1995	1996	1997	1998	1999	2000	2001	2002	2003 <sup>b</sup>	2004	2005	2006	2007	2008
<b>Boys</b>														
Mean	17.7	17.7	17.8	17.9	18.2	18.0	18.2	18.3	18.5	18.6	18.6	18.4	18.4	18.4
Standard error of the mean	0.08	0.07	0.06	0.08	0.15	0.14	0.08	0.07	0.12	0.15	0.13	0.07	0.06	0.08
Median	17.0	17.1	17.0	17.1	17.3	17.0	17.4	17.4	17.5	17.5	17.7	17.5	17.5	17.4
% Overweight <sup>c,d</sup>	13	15	13	15	15	13	15	14	15	14	16	13	14	15
% Obese <sup>c,d</sup>	11	12	13	13	17	15	16	17	17	19	18	18	17	17
% Overweight including obese	24	27	26	28	32	27	31	31	32	33	35	31	31	31
<b>Girls</b>														
Mean	18.1	18.1	18.1	18.4	18.2	18.5	18.6	18.8	18.8	19.3	18.9	18.7	18.7	18.7
Standard error of the mean	0.09	0.10	0.07	0.10	0.15	0.14	0.10	0.07	0.12	0.20	0.14	0.08	0.08	0.08
Median	17.3	17.2	17.3	17.4	17.3	17.4	17.6	17.8	17.8	18.1	17.8	17.6	17.7	17.7
% Overweight <sup>c,d</sup>	13	12	13	14	14	13	16	14	15	17	13	14	14	14
% Obese <sup>c,d</sup>	12	12	13	14	14	14	15	17	16	18	19	15	16	15
% Overweight including obese	26	24	26	28	28	27	31	32	32	35	32	29	31	29
<b>Bases (unweighted)</b>														
Boys	1697	1874	3275	1754	857	864	1490	3250	1417	635	1166	3029	3255	3030
Girls	1672	1758	3288	1657	789	846	1532	3140	1416	578	1191	2950	3090	3068
<b>Bases (weighted)</b>														
Boys	1918	2130	3061	1980	977	875	1652	3744	1452	623	1102	2821	2885	2880
Girls	1901	2012	3068	1872	950	841	1698	3634	1392	581	1091	2668	2792	2740

<sup>a</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously. This table uses the new definitions for each year.

<sup>b</sup> Data for all years have been weighted to correct for the probability of selection. For 2003-2008, data have also been weighted for non-response (shaded columns).

<sup>c</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>d</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

Table 13.7

**Trends in BMI, overweight and obesity prevalence among children aged 2-10, 1995-2008, by sex***Aged 2-10 with a valid BMI measurement**1995-2008*

<b>BMI (kg/m<sup>2</sup>) and BMI status<sup>a</sup></b>	<b>Survey year</b>													
	1995	1996	1997	1998	1999	2000	2001	2002	2003 <sup>b</sup>	2004	2005	2006	2007	2008
<b>Boys</b>														
Mean	16.7	16.7	16.7	16.9	17.2	16.9	17	17.1	17.2	17.2	17.3	17.1	17.2	17.1
Standard error of the mean	0.06	0.06	0.05	0.08	0.15	0.1	0.08	0.06	0.12	0.13	0.12	0.07	0.06	0.07
Median	16.4	16.4	16.4	16.5	16.6	16.4	16.6	16.6	16.5	16.6	16.7	16.6	16.7	16.5
% Overweight <sup>c,d</sup>	13	14	13	15	14	14	16	14	15	15	16	12	13	14
% Obese <sup>c,d</sup>	10	11	11	12	17	12	14	16	15	16	17	17	16	14
% Overweight including obese	23	25	25	27	31	26	30	29	31	31	34	30	30	28
<b>Girls</b>														
Mean	16.9	16.8	16.9	17	17	17	17.1	17.3	17.2	17.3	17.4	17.1	17.2	17.2
Standard error of the mean	0.08	0.08	0.05	0.07	0.13	0.12	0.09	0.07	0.11	0.14	0.13	0.07	0.07	0.07
Median	16.4	16.4	16.5	16.5	16.6	16.4	16.6	16.7	16.6	16.8	16.7	16.5	16.7	16.6
% Overweight <sup>c,d</sup>	13	11	12	13	14	12	15	14	14	15	13	13	14	13
% Obese <sup>c,d</sup>	11	11	11	12	13	12	13	16	13	13	17	14	15	13
% Overweight including obese	23	22	23	25	27	24	27	30	27	28	30	27	29	26
<b>Bases (unweighted)</b>														
Boys	1113	1234	2159	1185	563	582	913	2036	864	404	707	1875	2006	1863
Girls	1114	1178	2222	1082	535	537	980	1948	869	338	731	1845	1921	1909
<b>Bases (weighted)</b>														
Boys	1261	1418	2005	1336	633	570	1035	2364	878	379	664	1737	1766	1762
Girls	1266	1365	2081	1215	628	523	1094	2290	857	346	674	1635	1746	1701

<sup>a</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously. This table uses the new definitions for each year.

<sup>b</sup> Data for all years have been weighted to correct for the probability of selection. For 2003-2008, data have also been weighted for non-response (shaded columns).

<sup>c</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>d</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

Table 13.8

**Trends in BMI, overweight and obesity prevalence among children aged 11-15, 1995-2008, by sex**

Aged 11-15 with a valid BMI measurement

1995-2008

BMI (kg/m <sup>2</sup> ) and BMI status <sup>a</sup>	Survey year													
	1995	1996	1997	1998	1999	2000	2001	2002	2003 <sup>b</sup>	2004	2005	2006	2007	2008
<b>Boys</b>														
Mean	19.7	19.7	19.7	19.9	20.1	19.9	20.1	20.3	20.5	20.8	20.5	20.3	20.2	20.5
Standard error of the mean	0.15	0.16	0.11	0.15	0.24	0.24	0.16	0.12	0.19	0.27	0.23	0.12	0.11	0.12
Median	19.1	19.2	19.1	19.1	19.2	19.2	19.4	19.7	19.7	20.2	19.4	19.7	19.6	19.6
% Overweight <sup>c,d</sup>	14	15	13	15	15	10	14	15	14	13	15	15	16	16
% Obese <sup>c,d</sup>	14	14	16	17	18	19	19	20	20	24	21	18	18	21
% Overweight including obese	28	29	29	31	33	29	33	35	35	37	36	33	34	36
<b>Girls</b>														
Mean	20.6	20.8	20.7	21.0	20.5	21.0	21.2	21.2	21.5	22.2	21.4	21.1	21.1	21.2
Standard error of the mean	0.16	0.18	0.13	0.17	0.28	0.24	0.19	0.13	0.2	0.33	0.21	0.13	0.13	0.11
Median	19.9	20.2	20.1	20.4	20.1	20.6	20.6	20.6	20.8	21.3	20.8	20.5	20.4	20.3
% Overweight <sup>c,d</sup>	14	14	16	16	14	15	18	15	17	20	14	17	15	16
% Obese <sup>c,d</sup>	16	16	16	18	16	19	18	20	22	27	21	17	19	18
% Overweight including obese	30	30	32	34	29	33	36	35	39	46	36	34	34	34
<b>Bases (unweighted)</b>														
Boys	584	640	1116	569	294	282	577	1214	553	231	459	1154	1249	1167
Girls	558	580	1066	575	254	309	552	1192	547	240	460	1105	1169	1159
<b>Bases (weighted)</b>														
Boys	658	713	1056	644	343	305	617	1380	573	244	438	1084	1120	1117
Girls	635	648	987	657	322	318	604	1343	535	235	417	1033	1046	1039

<sup>a</sup> In 2008 the definitions for children who were overweight or obese were revised from those used in previous years to correct an error which meant that small numbers of children that should have been classified as either 'overweight' or 'obese' were omitted from these categories because of rounding of age and BMI thresholds. In no cases were results significantly different from those presented previously. This table uses the new definitions for each year.

<sup>b</sup> Data for all years have been weighted to correct for the probability of selection. For 2003-2008, data have also been weighted for non-response (shaded columns).

<sup>c</sup> Categories are mutually exclusive, i.e. overweight does not include those who are obese.

<sup>d</sup> Overweight was defined as at or above the 85th but below the 95th UK National BMI percentile; obese was defined as at or above the 95th UK National BMI percentile.

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# Children's fruit and vegetable consumption

## 14

*Dhriti Jotangia*

### Summary

- This chapter presents analyses on the consumption of fruit and vegetables among children aged 5-15. The proportion of boys and girls meeting the government's recommended target of consuming at least five portions of fruit and vegetables per day is examined. In addition, this chapter explores the different types of food items consumed by children.
- Among children aged 5-15, around one in five boys and girls met the government's recommended guidelines for daily consumption (19% of boys and 20% of girls). Overall, the mean number of portions consumed was 3.1 portions for boys and 3.3 portions for girls.
- Fresh fruit was the most commonly eaten item. More girls than boys reported eating fresh fruit the previous day (72% of girls and 68% of boys). The consumption of fresh fruit was related to age, with younger children consuming more fresh fruit than older children.
- Fruit and vegetable consumption varied by Strategic Health Authority (SHA) regions. A higher proportion of boys and girls living in the South Central region consumed five or more portions of fruit and vegetables per day than children in other regions.
- There were significant differences in the intake of fruit and vegetables by equivalised household income. Boys and girls in the highest income quintile were the most likely to meet the '5 A DAY' recommendations (27% of boys and 30% of girls). There was little variation among those in the lower quintiles (from 16% to 19% of boys and 17% to 20% of girls).
- More boys and girls in non-Spearhead Primary Care Trusts achieved the '5 A DAY' target (20% of boys and 22% of girls) than those in Spearhead Primary Care Trusts (17% of boys and 18% of girls).

## 14.1 Introduction

The protective health benefits of a diet rich in fruit and vegetables have been long recognised for both adults and children. Diet plays a key role in shaping children's health both now and later in life. A childhood diet abundant in fruit and vegetables can ensure an adequate intake of many essential nutrients and can help displace foods high in saturated fats, sugar and salt.<sup>1</sup> Evidence also suggests that a diet plentiful in fruit and vegetables has the potential to reduce the risk of heart disease<sup>2</sup> in later life and can help improve childhood respiratory problems.<sup>3</sup> Conversely, a diet lacking in fruit and vegetables may contribute to the onset of chronic diseases such as diabetes, and to certain cancers developed later in life.<sup>1</sup>

Evidence suggests that health related behaviour patterns and attitudes towards healthier eating can be acquired during childhood. The strongest determinants of fruit and vegetable consumption in adults were whether they had been in the habit of consuming plenty of fruit and vegetables in childhood.<sup>4</sup>

Many government papers have raised concerns about children's diet and a number of initiatives have been launched to educate children about healthier food options. For example, The National Healthy Schools Standard (NHSS), part of the National Healthy Schools Programme, was implemented in 1998 and was designed to encourage schools to consider diet and nutrition in a variety of aspects of school life.<sup>5</sup> By August 2009, more than 99% of schools were involved in the programme and more than 76% had achieved 'Healthy School Status', based on accreditation criteria set by the government.

The (then) Department for Education and Skills' 2004 paper *Starting early: food and nutrition education of young children* states that for positive attitudes to develop, messages about healthy lifestyles, including diet, need to be clear and concise and delivered in such a way that children get involved.<sup>6</sup> Similarly, the 2003 Food Standards Agency paper *Getting to Grips with Grub* outlines key nutritional competencies children should meet prior to leaving school, such as an understanding of fruit and vegetable consumption and portion size.<sup>7</sup>

Following the 1997 white paper *Excellence in Schools*,<sup>8</sup> and 2003 green paper *Every Child Matters*,<sup>9</sup> in which the government pledged to help all schools to become healthy, there has been a focus on implementing initiatives in schools which aim to educate and provide children with healthy food options, in particular wider access to fruit and vegetables. These include Wired for Health, the National School Fruit Scheme, breakfast clubs and fruit tuck shops. The School Fruit and Vegetable Scheme was introduced in 2004 to reinforce messages about improving children's diets and to minimise the health inequalities experienced by some groups of the population. As part of this scheme children aged between four and six are entitled to a free piece of fruit each school day.<sup>10</sup> In 2007 the (then) Department for Education and Skills and the Department of Health launched the Food in Schools programme to assist schools across England in implementing a 'whole-school' approach to healthier eating and drinking.<sup>11</sup>

In an attempt to remove the inequalities that exist in accessing a healthy nutritious diet, the government's 2005 *Food and Health Action Plan*<sup>12</sup> set out a strategy to promote a healthy balanced diet. This framework focused on improving access to, and increasing the average consumption of a variety of fruit and vegetables to at least five portions per day. The '5 A DAY' programme, introduced in 2000, is a national priority aimed at encouraging the population to increase their consumption of fruit and vegetables. The programme was designed to raise awareness of the health benefits of and improve access to fruit and vegetables through targeted action.<sup>13</sup> The government continues to promote the message of the '5 A DAY' initiative, that people should eat at least five portions (400g) of a variety of fruit and vegetables each day.

The Change4Life<sup>14</sup> campaign launched in January 2009 is a three-year initiative aimed at preventing people becoming overweight by encouraging them to eat healthily and do physical activity. One of the 'healthy behaviours' that the initiative would like young families

to adopt is ensuring that children eat a variety of fruit and vegetables a day; this is promoted to parents through the '5 A DAY' message.<sup>15</sup>

This chapter presents results from 2008. Trend data for key measures, including adult and child fruit and vegetable consumption, can be found in *Health Survey for England 2008 Latest Trends* on The NHS Information Centre's website.<sup>16</sup> The 2007 report examined children's knowledge about the '5 A DAY' recommendations, what constitutes a portion of fruit or vegetables, and attitudes to healthy eating. In 2003 analyses examined fruit and vegetable consumption according to whether children were normal weight, overweight or obese, whether either parent was obese, and by the children's perception of their own weight, though none of these factors were found to have a significant association.

## 14.2 Methods and definitions

### 14.2.1 Fruit and vegetable consumption

Questions about fruit and vegetable consumption have been asked of children aged 5-15 as part of the HSE survey series since 2001. Data about patterns of fruit and vegetable consumption were collected within the face-to-face interview. Parents answered on behalf of children aged 12 and under, and participants aged 13-15 answered the questions themselves with their parents present. Any seasonal or weekly variation in eating habits is minimised in the aggregate data, as interviewing is carried out throughout the year and on every day of the week.

Questions were designed to examine a range of food items to determine the overall amount of fruit and vegetables, including pulses, salad and fruit juice that children had consumed in a single day (defined as the 24 hours ending the previous midnight). Participants were asked whether they had consumed each food type and, if so, the quantity that had been consumed. Separate questions were asked for vegetables (fresh, frozen and tinned), vegetables in composites (for example vegetable curry), salads, pulses, fresh fruit, frozen and tinned fruit, dried fruit, fruit in composites (such as apple pie), as well as fruit juice.

Summary measures were created to examine total consumption of fruit and vegetables (including portions and part portions) and consumption of different groups of food. The summary measures included were total fruit and vegetables, total vegetables (including fresh, raw, frozen and tinned vegetables, vegetables in composites and salads, but excluding pulses) and total fruit consumption (including fresh, frozen, tinned and dried fruit and fruit in composites). Measurement of the amount of different food items differed according to the type of food (see section 14.2.2).

### 14.2.2 Measuring portion size

Fruit and vegetable consumption is measured using the guidelines specified in the '5 A DAY' programme. The World Health Organisation (WHO) recommended that people should eat at least five portions defined as 400g of fruit and vegetables per day (an average portion of 80g).<sup>1</sup> To make it easier for participants to report their consumption of different types of fruit and vegetables, portion size was converted into everyday household measures. For example, participants were asked about tablespoons of vegetables, cereal bowlfuls of salad, pieces of medium sized fruit (such as apples) or handfuls of very small fruit (such as raspberries). Table 14A below illustrates the portion sizes defined for each of the different food items included in the analysis.

**Table 14A**

Table 14A	
Food item	Portion size
Vegetables (fresh, raw, tinned and frozen)	3 tablespoons
Pulses	3 tablespoons
Salad	1 cereal bowl
Vegetables in composites e.g. vegetable curry	3 tablespoons
Very large fruit e.g. melon	1 average slice
Large fruit e.g. grapefruit	Half a fruit
Medium fruit e.g. apples	1 fruit
Small fruit e.g. plums	2 fruits
Very small fruit and berries	1 average handful
Dried fruit	1 tablespoon
Frozen/tinned fruit	3 tablespoons
Fruit in composites e.g. stewed fruit	3 tablespoons
Fruit juice	1 small glass (150ml)

The '5 A DAY' policy clearly advises which food items contribute towards the recommendation, and these guidelines were incorporated into the Health Survey questions. For example, participants were told not to count potatoes, pasta or rice as vegetables and to exclude squash and other fruit drinks that were not pure fruit juice. Interviewers were able to record full and half units, such as half a tablespoon; no amounts smaller than this could be recorded. Additionally, the consumption of fruit juice, pulses, and dried fruit were counted as a maximum of one portion each, even if more than this was consumed in the previous 24 hours. These restrictions are in line with the '5 A DAY' message, which emphasises that a variety of fruit and vegetables should be consumed to ensure a healthy balanced diet. In the absence of defined portion sizes for children, fruit and vegetable consumption was measured using the same definition of portion sizes as those of adults.

### 14.2.3 Interpretation of the data

Data on fruit and vegetable consumption are based on self-reported information for a 24-hour recall period, given by either the child's parent up to the age of 12 or the child him/herself if aged 13-15. Every attempt has been made to ensure that participants report their consumption accurately. However there may be some variations in the way that participants interpreted the definitions, for instance in assessing the amount of fruit contained in an apple pie. The data may be subject to recall error, and evidence suggests that participants may intentionally over-report consumption to indicate socially desirable behaviour.<sup>17</sup> Nevertheless, survey estimates can still provide useful comparisons of consumption patterns of the population.

Within specific groups, mean consumption may also be increased by a small number of participants eating unusually large amounts of fruit and vegetables. Median consumption is also shown, where appropriate, to indicate the mid-range value as an alternative measure that is not influenced by extreme values.

## 14.3 Fruit and vegetable consumption

### 14.3.1 Daily fruit and vegetable consumption, by age and sex

In 2008, around one in five of both boys and girls aged 5-15 met the government's recommended guidelines of consuming five portions or more of fruit and vegetables per day (19% of boys and 20% of girls). However, the mean daily consumption was slightly lower among boys (3.1 portions) than among girls (3.3 portions), and slightly more boys than girls reported eating no fruit or vegetables (7% and 4% respectively). Age was not significantly associated with the total number of portions consumed.

Table 14.1

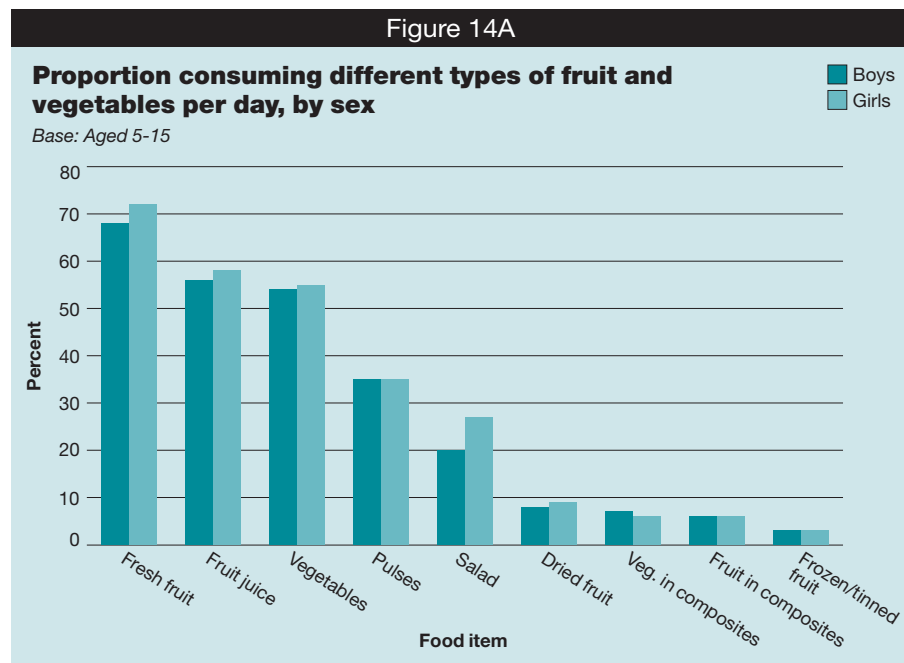


### 14.3.2 Types of fruit and vegetables consumed daily

As in previous years children were asked about their consumption of individual food items in the previous 24 hours, and summary measures were created to look at total consumption of fruit and vegetables (including portions or part portions) and consumption of different groups of food.

Table 14.2 shows the proportion of children aged 5-15 consuming the different food items and Table 14.3 shows the mean number of portions of each food type consumed. Table 14B below summarises the proportion of boys and girls who had eaten each food type and the mean number of portions consumed for each, and Figure 14A shows the proportion eating different types of fruit and vegetables.

	Boys		Girls	
	% consuming food item	Mean no. of portions consumed	% consuming food item	Mean no. of portions consumed
Any fruit and vegetables	93	3.1	96	3.3
Any fruit (excludes fruit juice)	71	1.5	76	1.6
Fresh fruit	68	1.3	72	1.4
Dried fruit	8	0.1	9	0.1
Fruit in composites	6	0.1	6	0.1
Frozen/tinned fruit	3	0.0	3	0.0
Fruit juice	56	0.6	58	0.6
Any vegetables and salads (excludes pulses)	64	0.8	69	0.9
Vegetables	54	0.5	55	0.5
Pulses	35	0.3	35	0.3
Salad	20	0.2	27	0.3
Vegetables in composites	7	0.1	6	0.1



The majority of boys and girls consumed some fruit and vegetables in the previous 24 hours (93% of boys and 96% of girls). Younger children were generally more likely than older children to have eaten some fruit and vegetables.

As with previous years, more girls than boys reported eating any fruit excluding fruit juice (76% of girls and 71% of boys). Fresh fruit was the main source of fruit and vegetables consumed by all children. More girls than boys had eaten fresh fruit in the previous 24 hours

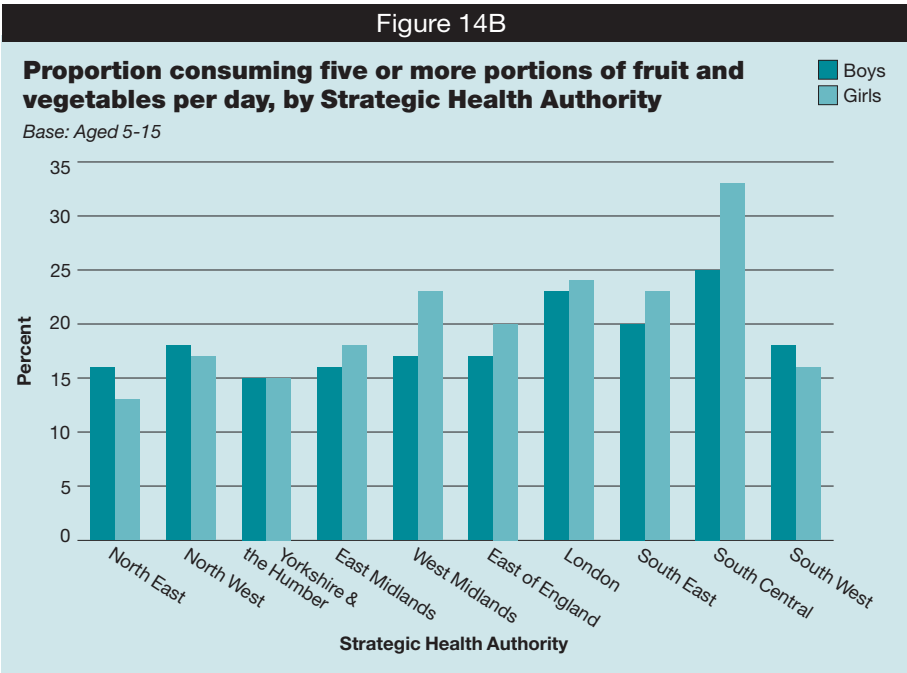
(72% of girls and 68% of boys). Younger children were more likely than older children to have consumed fresh fruit at all, and to have eaten more portions of fresh fruit.

Tables 14.2, 14.3, Figures 14A, 14B

14.3.3 Daily fruit and vegetable consumption by Strategic Health Authority

Fruit and vegetable consumption varied by Strategic Health Authority (SHA) regions, with the pattern similar for boys and girls. Children living in the South Central region were more likely to consume five or more portions of fruit and vegetables per day (25% and 33% respectively) than children in other regions. The mean daily consumption of fruit and vegetables followed a similar pattern.

Table 14.4, Figure 14B



14.3.4 Daily fruit and vegetable consumption by equivalised household income

As in previous years, differences in fruit and vegetable consumption were strongly associated with equivalised household income. Boys and girls in the highest income quintile (27% of boys and 30% of girls) were the most likely to eat at least five portions of fruit and vegetables per day. There was little variation among those in the lower quintiles (from 16% to 19% of boys and 17% to 20% of girls).

The mean number of portions of fruit and vegetables decreased from the highest income quintile to the lowest. Fewer boys and girls in the highest income quintile had not eaten any fruit or vegetables in the previous 24 hours (2% of both boys and girls) than those in the lowest income quintile (12% of boys and 7% of girls).

Table 14.5, Figure 14C

14.3.5 Daily fruit and vegetable consumption by Spearhead status

Comparison between Spearhead and non-Spearhead Primary Care Trusts (PCTs)<sup>18</sup> showed that boys and girls in non-Spearhead PCTs were more likely to achieve the government's '5 A DAY' target than those in Spearhead PCTs. Among boys, the proportions were 20% in non-Spearhead PCTs compared with 17% in Spearhead PCTs. The equivalent proportions for girls were 22% and 18% respectively.

Table 14.6

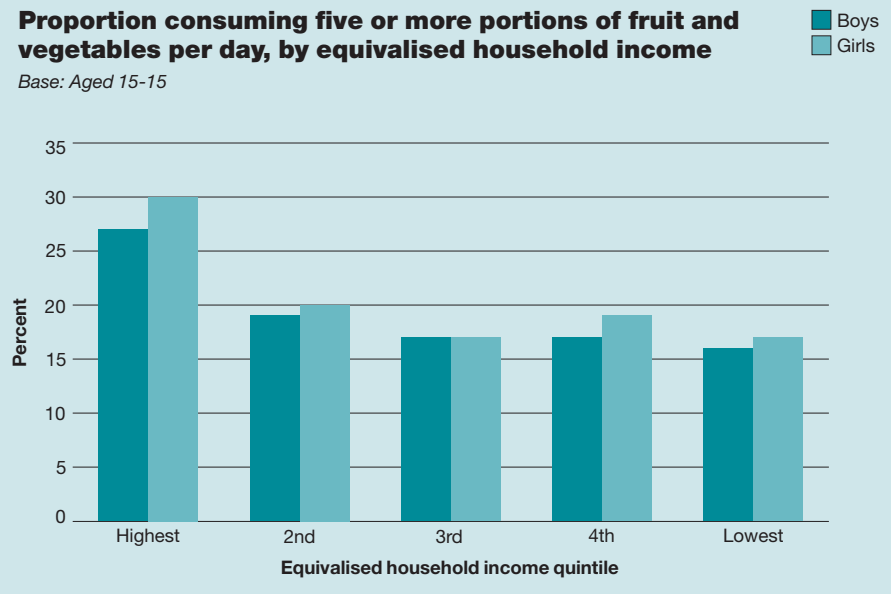
14.4 Discussion

The findings from the Health Survey for England 2008 show that around one in five children aged 5-15 met the recommended target of 400g of fruit and vegetables per day. There were no major differences between boys and girls and few variations based on age. The majority

Figure 14C

### Proportion consuming five or more portions of fruit and vegetables per day, by equivalised household income

Base: Aged 15-15



of children consumed some fruit and vegetables, with fresh fruit being the main source of fruit and vegetables eaten. While the proportion of children meeting the target increased significantly between 2004 and 2006, there has been no further increase in the last two to three years.

There is still further need to reinforce the government's initiatives to improve access to a healthier affordable diet, particularly for those in low income families. Findings presented in this chapter suggest that inequalities exist between income groups, with children in the lowest income groups consuming the fewest portions of fruit and vegetables on average. The analyses also showed a significant association with Spearhead status, with boys and girls in non-Spearhead PCTs more likely to achieve the '5 A DAY' target than those in Spearhead areas.

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- 11 See [http://www.dh.gov.uk/en/PublicHealth/Healthimprovement/Foodinschoolsprogramme/DH\\_139](http://www.dh.gov.uk/en/PublicHealth/Healthimprovement/Foodinschoolsprogramme/DH_139)

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[http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_4002960](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4002960) .
- 14 See [http://www.dh.gov.uk/en/News/Currentcampaigns/Change4Life/DH\\_091128](http://www.dh.gov.uk/en/News/Currentcampaigns/Change4Life/DH_091128).
- 15 See <http://www.nhs.uk/change4life>.
- 16 See [www.ic.nhs.uk/pubs/hse08trends](http://www.ic.nhs.uk/pubs/hse08trends)
- 17 Herbert JR, Clemow I, Pbert L et al. *Social desirability bias in dietary self report may compromise the validity of dietary intake measures*. Int J Epidemiol. 1995; **24**: 389-398.
- 18 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

- 14.1 Daily fruit and vegetable consumption, by age and sex
- 14.2 Types of fruit and vegetables consumed daily, by age and sex
- 14.3 Daily mean fruit and vegetable consumption, by food item, age and sex
- 14.4 Daily fruit and vegetable consumption, by Strategic Health Authority and sex
- 14.5 Daily fruit and vegetable consumption, by equivalised household income and sex
- 14.6 Daily fruit and vegetable consumption, by Spearhead status and sex

Table 14.1

**Daily fruit and vegetable consumption, by age and sex**

Aged 5-15

2008

Portions per day	Age											Total
	5	6	7	8	9	10	11	12	13	14	15	%
	%	%	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>												
None	5	6	5	4	8	5	5	9	5	12	11	7
Less than 1 portion	4	3	4	3	4	4	3	3	4	5	5	4
1 portion or more but less than 2	13	16	18	19	16	17	21	18	16	18	20	17
2 portions or more but less than 3	21	25	21	23	19	23	22	22	25	17	21	22
3 portions or more but less than 4	26	20	19	20	19	18	12	23	16	19	12	18
4 portions or more but less than 5	13	12	15	13	16	16	15	8	15	9	15	13
5 portions or more	18	20	18	19	18	18	22	17	19	21	15	19
Mean	3.2	3.3	3.2	3.3	3.1	3.2	3.2	2.9	3.2	3.0	2.9	3.1
Standard error of the mean	0.12	0.16	0.14	0.14	0.14	0.13	0.15	0.13	0.13	0.15	0.16	0.04
Median	3.2	3.0	3.0	3.0	3.0	3.0	2.7	2.7	2.8	2.7	2.3	3.0
<b>Girls</b>												
None	3	3	3	2	1	3	7	4	7	7	7	4
Less than 1 portion	2	2	3	2	1	2	3	1	4	3	3	2
1 portion or more but less than 2	16	19	15	14	15	16	16	20	18	20	20	17
2 portions or more but less than 3	27	25	23	20	24	22	25	19	19	18	21	22
3 portions or more but less than 4	22	22	20	19	21	18	19	19	15	18	17	19
4 portions or more but less than 5	16	15	17	20	12	16	13	14	12	14	12	15
5 portions or more	14	12	19	23	25	22	16	24	25	21	21	20
Mean	3.3	3.1	3.4	3.6	3.6	3.4	3.0	3.4	3.3	3.2	3.3	3.3
Standard error of the mean	0.15	0.14	0.13	0.14	0.14	0.13	0.13	0.15	0.15	0.13	0.16	0.04
Median	3.0	2.9	3.3	3.3	3.0	3.0	2.8	3.0	3.0	3.0	2.8	3.0
<b>Bases (unweighted)</b>												
Boys	241	253	235	236	244	256	256	260	286	267	231	2765
Girls	226	237	256	234	251	298	291	241	259	281	246	2820
<b>Bases (weighted)</b>												
Boys	224	233	215	235	235	248	239	237	258	275	242	2640
Girls	212	203	227	223	227	239	226	224	245	260	228	2514
Girls	241	253	235	236	244	256	256	260	286	267	231	2765

Table 14.2

Types of fruit and vegetables consumed daily, by age and sex												
Aged 5-15												2008
Types of fruit and vegetables consumed	Age											Total
	5	6	7	8	9	10	11	12	13	14	15	%
	%	%	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>												
Any fruit and vegetables	95	94	95	96	92	95	95	91	95	88	89	93
Any vegetables and salads (excludes pulses)	66	66	66	70	63	65	62	63	65	55	62	64
Any fruit (excludes fruit juice)	81	81	78	81	79	73	74	62	69	59	52	71
Vegetables (fresh, raw, tinned and frozen)	58	56	60	60	55	55	52	51	54	44	49	54
Pulses	39	34	33	35	33	36	33	35	36	32	41	35
Salad	18	19	17	17	24	21	22	19	20	17	23	20
Vegetables in composites	5	5	6	9	7	6	4	8	8	7	8	7
Fresh fruit	81	78	73	77	74	66	70	58	65	57	49	68
Fruit in composites	6	6	8	7	7	7	7	8	6	6	5	6
Dried fruit	14	10	9	9	7	10	7	7	7	2	6	8
Frozen/ tinned fruit	4	5	1	2	2	3	4	2	1	2	1	3
Fruit juice	56	55	56	56	51	56	54	56	62	56	53	56
<b>Girls</b>												
Any fruit and vegetables	97	97	97	98	99	97	93	96	93	93	93	96
Any vegetables and salads (excludes pulses)	72	67	70	79	71	68	69	69	65	64	66	69
Any fruit (excludes fruit juice)	81	82	82	84	81	82	71	72	69	65	69	76
Vegetables (fresh, raw, tinned and frozen)	61	53	61	64	59	52	57	50	51	49	52	55
Pulses	35	32	34	34	43	35	33	32	38	36	29	35
Salad	24	24	28	35	31	33	22	29	22	27	25	27
Vegetables in composites	3	6	3	9	6	9	4	7	8	7	8	6
Fresh fruit	77	77	81	82	78	78	68	67	65	60	66	72
Fruit in composites	6	4	7	6	5	8	8	7	6	8	3	6
Dried fruit	13	12	9	11	12	8	10	6	10	8	5	9
Frozen/ tinned fruit	1	2	4	4	5	4	3	3	2	3	3	3
Fruit juice	60	52	56	59	61	57	59	62	58	59	58	58
<b>Bases (unweighted)<sup>a</sup></b>												
Boys	241	253	235	236	244	256	256	260	286	267	231	2765
Girls	226	237	256	234	251	298	291	241	259	281	246	2820
<b>Bases (weighted)</b>												
Boys	224	233	215	235	235	248	239	237	258	275	242	2640
Girls	212	203	227	223	227	239	226	224	245	260	228	2514

<sup>a</sup> Bases given are for 'Any fruit and vegetables'. All other bases vary but are of a similar size.

Table 14.3

**Daily mean fruit and vegetable consumption, by food item, age and sex**

Aged 5-15

2008

Mean portions per day	Age											Total
	5	6	7	8	9	10	11	12	13	14	15	
Boys												
Any fruit and vegetables	3.2	3.3	3.2	3.3	3.1	3.2	3.2	2.9	3.2	3.0	2.9	3.1
Standard error of the mean	0.12	0.16	0.14	0.14	0.14	0.13	0.15	0.13	0.13	0.15	0.16	0.04
Any vegetables and salads (excludes pulses)	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8
Standard error of the mean	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.07	0.06	0.07	0.02
Any fruit (excluding fruit juice)	1.7	1.8	1.6	1.6	1.6	1.5	1.6	1.2	1.4	1.4	1.1	1.5
Standard error of the mean	0.09	0.12	0.10	0.10	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.03
Vegetables (fresh, raw, tinned and frozen)	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.5
Standard error of the mean	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.01
Pulses	0.3	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.3
Standard error of the mean	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.01
Salad	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Standard error of the mean	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
Vegetables in composites	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Standard error of the mean	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Fresh fruit	1.5	1.6	1.4	1.5	1.4	1.3	1.4	1.1	1.2	1.3	1.0	1.3
Standard error of the mean	0.08	0.11	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.10	0.10	0.03
Fruit in composites	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Standard error of the mean	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.00
Dried fruit	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Standard error of the mean	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Frozen/ tinned fruit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard error of the mean	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.00
Fruit juice	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6
Standard error of the mean	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
Bases (unweighted) <sup>a</sup>												
Boys	241	253	235	236	244	256	256	260	286	267	231	2765
Bases (weighted) <sup>a</sup>												
Boys	224	233	215	235	235	248	239	237	258	275	242	2640

<sup>a</sup> Bases given are for 'Any fruit and vegetables'. Other bases vary but are of a similar size.

Continued...



Table 14.3 continued

Aged 5-15

2007

Mean portions per day	Age											Total
	5	6	7	8	9	10	11	12	13	14	15	
<b>Girls</b>												
Any fruit and vegetables	3.3	3.1	3.4	3.6	3.6	3.4	3.0	3.4	3.3	3.2	3.3	3.3
Standard error of the mean	0.15	0.14	0.13	0.14	0.14	0.13	0.13	0.15	0.15	0.13	0.16	0.04
Any vegetables and salads (excludes pulses)	0.7	0.7	0.8	1.0	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9
Standard error of the mean	0.05	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.07	0.06	0.07	0.02
Any fruit (excluding fruit juice)	1.7	1.7	1.8	1.8	1.8	1.6	1.4	1.7	1.5	1.4	1.5	1.6
Standard error of the mean	0.12	0.12	0.10	0.10	0.11	0.08	0.09	0.11	0.10	0.09	0.11	0.03
Vegetables (fresh, raw, tinned and frozen)	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.5
Standard error of the mean	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.01
Pulses	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3
Standard error of the mean	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
Salad	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3
Standard error of the mean	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.04	0.01
Vegetables in composites	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Standard error of the mean	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.01
Fresh fruit	1.6	1.5	1.6	1.6	1.6	1.4	1.2	1.5	1.3	1.2	1.4	1.4
Standard error of the mean	0.11	0.11	0.09	0.10	0.11	0.08	0.08	0.11	0.10	0.08	0.11	0.03
Fruit in composites	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Standard error of the mean	0.01	0.01	0.02	0.01	0.01	0.03	0.02	0.02	0.02	0.02	0.01	0.01
Dried fruit	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Standard error of the mean	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
Frozen/ tinned fruit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standard error of the mean	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Fruit juice	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Standard error of the mean	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
<b>Bases (unweighted)<sup>a</sup></b>												
Girls	226	237	256	234	251	298	291	241	259	281	246	2820
<b>Bases (weighted)<sup>a</sup></b>												
Girls	212	203	227	223	227	239	226	224	245	260	228	2514

<sup>a</sup> Bases given are for 'Any fruit and vegetables'. All other bases vary but are of a similar size.

Table 14.4

**Daily fruit and vegetable consumption, by Strategic Health Authority<sup>a</sup> and sex**

Aged 15-15

2008

Portions per day	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>										
None	7	8	6	9	8	7	6	7	8	3
Less than 1 portion	3	4	4	3	3	8	2	4	3	5
1 portion or more but less than 2	27	17	21	18	16	16	14	16	20	16
2 portions or more but less than 3	19	23	24	24	25	22	20	21	16	21
3 portions or more but less than 4	13	19	18	18	19	17	18	20	17	21
4 portions or more but less than 5	15	12	12	11	13	13	16	13	11	15
5 portions or more	16	18	15	16	17	17	23	20	25	18
Mean	2.9	3.0	2.9	3.0	3.0	3.0	3.5	3.2	3.5	3.2
Standard error of the mean	0.19	0.12	0.12	0.16	0.12	0.12	0.12	0.14	0.20	0.12
Median	2.5	2.7	2.7	2.5	2.7	2.7	3.3	3.0	3.0	3.0
<b>Girls</b>										
None	5	6	4	4	6	3	3	5	2	7
Less than 1 portion	5	3	4	4	3	1	1	1	1	3
1 portion or more but less than 2	20	18	22	15	15	15	17	13	17	19
2 portions or more but less than 3	23	23	24	24	21	23	21	25	16	21
3 portions or more but less than 4	19	22	18	18	16	22	18	21	16	19
4 portions or more but less than 5	16	11	13	18	16	16	16	12	15	15
5 portions or more	13	17	15	18	23	20	24	23	33	16
Mean	3.0	3.1	2.9	3.3	3.5	3.4	3.6	3.5	4.1	2.9
Standard error of the mean	0.17	0.11	0.11	0.14	0.14	0.12	0.12	0.16	0.19	0.12
Median	2.7	2.8	2.7	3.0	3.0	3.0	3.3	3.2	3.7	2.8
<i>Bases (unweighted)</i>										
Boys	130	401	293	228	280	324	372	251	211	275
Girls	152	415	313	230	288	340	350	226	236	270
<i>Bases (weighted)</i>										
Boys	117	331	274	225	296	296	402	231	202	264
Girls	132	336	273	205	280	295	356	192	204	241

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

Table 14.5

**Daily fruit and vegetable consumption, by equivalised household income and sex**

Aged 5-15

2008

Portions per day	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Boys</b>					
None	2	4	6	9	12
Less than 1 portion	3	3	4	5	4
1 portion or more but less than 2	18	16	18	20	16
2 portions or more but less than 3	16	23	22	21	23
3 portions or more but less than 4	20	20	19	14	19
4 portions or more but less than 5	14	15	13	13	11
5 portions or more	27	19	17	17	16
Mean	3.6	3.3	3.1	2.9	2.8
Standard error of the mean	0.13	0.10	0.10	0.10	0.10
Median	3.3	3.0	2.8	2.5	2.5
<b>Girls</b>					
None	2	3	5	4	7
Less than 1 portion	0	2	3	3	3
1 portion or more but less than 2	9	17	19	17	22
2 portions or more but less than 3	20	20	24	24	22
3 portions or more but less than 4	20	19	20	20	17
4 portions or more but less than 5	18	19	12	13	12
5 portions or more	30	20	17	19	17
Mean	4.1	3.5	3.1	3.2	2.9
Standard error of the mean	0.13	0.11	0.10	0.10	0.09
Median	3.8	3.3	2.8	3.0	2.7
<i>Bases (unweighted)</i>					
Boys	319	423	555	525	498
Girls	352	461	488	541	527
<i>Bases (weighted)</i>					
Boys	294	394	526	517	484
Girls	302	394	436	484	490

**Daily fruit and vegetable consumption,  
by Spearhead status<sup>a</sup> and sex**

Aged 5-15

2008

Portions per day	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Boys</b>		
None	7	7
Less than 1 portion	4	3
1 portion or more but less than 2	17	18
2 portions or more but less than 3	21	23
3 portions or more but less than 4	18	19
4 portions or more but less than 5	14	12
5 portions or more	20	17
Mean	3.2	3.0
Standard error of the mean	0.05	0.07
Median	3.0	2.7
<b>Girls</b>		
None	4	5
Less than 1 portion	2	3
1 portion or more but less than 2	17	18
2 portions or more but less than 3	21	24
3 portions or more but less than 4	20	18
4 portions or more but less than 5	15	14
5 portions or more	22	18
Mean	3.4	3.1
Standard error of the mean	0.06	0.07
Median	3.0	2.8
<i>Bases (unweighted)</i>		
Boys	1748	1000
Girls	1758	1050
<i>Bases (weighted)</i>		
Boys	1680	944
Girls	1556	948

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

# Children's smoking and exposure to others' smoke

15

*Alison Moody, Natasha Reilly*

## Summary

- This chapter presents findings on the prevalence of smoking among children aged 8-15 and exposure to other people's smoke (secondhand smoke) among those aged 0-15. Smoking prevalence is measured using self-reported behaviour and saliva cotinine, a metabolite of nicotine and indicator of current smoking. Saliva cotinine has also been used to assess recent exposure to other people's tobacco smoke.
- A small proportion (2%) of children aged 8-15 reported that they were regular smokers (at least one cigarette a week). This was higher among older children, with 8% of boys aged 15 and 9% of girls aged 15 reporting that they smoked regularly.
- Saliva cotinine is likely to be a more accurate indicator of children's smoking status than self-report. The proportion of children aged 8-15 with a cotinine level of 15ng/ml or more (indicative of smoking) was higher than the proportion of children that reported regular smoking. This was particularly true of older children; while only 9% of those aged 15 reported that they smoked at least weekly, 17% were identified as current smokers when the proportion with cotinine levels of 15ng/ml or more was combined with the proportion that reported current smoking.
- Cotinine levels amongst non-smoking children aged 4-15 varied significantly by quintile of equivalised household income. Those living in households in the lowest quintile were more likely to have detectable levels of cotinine (85% of girls and 87% of boys) than those in the highest quintile (33% and 37% respectively). Correspondingly, geometric mean cotinine levels were higher in the lowest quintile (0.7ng/ml among girls, 0.6ng/ml among boys) than in the highest (0.1ng/ml among both boys and girls).
- Geometric mean cotinine levels were significantly higher for non-smoking children living in households where one or more adults smoked regularly than where no adults smoked regularly (1.49ng/ml compared with 0.14ng/ml in the 12 months after implementation of smokefree legislation). The same pattern was apparent for the proportion of these children with cotinine levels indicative of passive smoking (96% compared with 54%).
- Among non-smoking children aged 4-15, there was no significant change in cotinine levels or the proportion with detectable cotinine, immediately before and after implementation of the smokefree legislation. There was also no significant change in the proportion of non-smoking children aged 4-15 living in a household where at least one adult smoked regularly.
- There were some reported changes in the 12 months following implementation in children's exposure to other people's smoke. The proportion of children aged 0-12 that were looked after by a smoker for more than two hours a week was significantly reduced (from 14% of boys and 16% of girls pre implementation to 11% and 10% respectively post implementation). However, there was no significant change in the reported number of hours exposed to others' smoke.
- Children aged 8-15 were asked about locations where they were often near to people

who were smoking. The proportion saying they were not often near other smokers increased after 1st July 2007, to 31% of boys and 28% of girls. Fewer than before 1st July 2007 reported being near smokers in other people's homes, on public transport or in other places. However this decrease did not include children's own homes: there was no change in the proportion who reported being near people smoking in their own homes.

## 15.1 Introduction

This chapter examines the prevalence of smoking among children aged 8-15, and the exposure to other people's smoke of children aged 0-15. Self-reported and biological measures of smoking and exposure to smoke are analysed with reference to the recent smokefree legislation.

The chapter looks in particular at children's passive smoking levels, measured by analysis of saliva cotinine samples. Patterns of passive smoking in 2008 were examined, looking at age and sex, Strategic Health Authority, equivalised household income and Spearhead status.<sup>1</sup> To examine the effect of the smokefree legislation, cotinine levels were compared in the 12 months before and after 1st July 2007. Reported exposure to others' smoke was also compared in terms of whether children were looked after by a smoker, or were often near to other people smoking.

### 15.1.1 Exposure to other people's smoke

Exposure to secondhand tobacco smoke, also known as passive smoking, environmental tobacco smoke, or tobacco smoke pollution, is widely accepted to have a negative impact on health. A recent report investigating these health consequences concluded that there is no risk-free level of exposure to secondhand smoke.<sup>2</sup> Children are particularly at risk from the effects of this exposure.<sup>3</sup> They have more rapid respiratory rates, and this means that they take proportionately more secondhand smoke into their lungs than adults. Their developing organs are also at greater risk from exposure to toxins. A recent British Medical Association (BMA) Scientific Board report summarised the evidence that exposure to secondhand smoke causes illnesses including cot death, respiratory illnesses, impaired lung function, middle-ear disease and asthma. There is also evidence suggesting that exposure to secondhand smoke can cause childhood cancers, cancer in adulthood, meningitis, and the initiation of cardiovascular disease.<sup>4</sup>

The BMA report built on previous work looking at secondhand smoke, including the work of the government's independent Scientific Committee on Tobacco and Health (SCOTH), whose 1998 report highlighted the adverse consequences of secondhand smoke for both children and adults. It concluded that 'Restrictions on smoking in public places and work places are necessary to protect non smokers. Parents need to be informed about the effects of secondhand smoke on their children.'<sup>5</sup>

On 1st July 2007 a new law came into force in England to make virtually all enclosed public places and workplaces in England smokefree.<sup>6</sup> The legislation was introduced with the recognition that individuals have a right to be protected from the harm of secondhand smoke. The aim of the legislation was to reduce ill-health and the number of deaths from medical conditions caused or exacerbated by secondhand smoke. A review of the policy one year after implementation found that compliance was high (98% of premises inspected were smoke free), and that use of NHS stop-smoking programmes had increased (22% more successful quitters).<sup>7</sup> It also found that the policy was well received (76% of people supported the legislation), as in other countries with smokefree legislation.<sup>8</sup>

This followed the earlier implementation of similar comprehensive smokefree legislation in Ireland (March 2004), Scotland (March 2006), and Wales (April 2007).

Evidence from Scotland has shown that exposure to secondhand smoke in public places has reduced, without a corresponding rise in exposure in the home.<sup>9</sup> There are also indications that exposure to secondhand smoke has reduced among young people in Scotland.<sup>10</sup>

One concern about the implementation of smokefree legislation was that it might lead to increased smoking by adults in the home, and therefore to increased exposure of children to secondhand smoke. Evidence from other countries suggests that this concern is unfounded, and in fact that smokefree laws have actually reduced smoking in the home, particularly around young children.<sup>9,11,12</sup>

## 15.1.2 Smoking

Many children suffer ill-health from smoking, which includes respiratory illness and increased risk of cancer and cardiovascular disease.<sup>3</sup> There is also evidence of an association between children smoking and other risky behaviours such as using alcohol or drugs.<sup>13</sup> Nicotine dependence in adolescents can occur within weeks of beginning occasional tobacco use.<sup>14</sup> Those who start smoking during childhood are more likely to continue smoking as adults, and less likely to give up than those who start smoking in later life. They are also likely to consume more cigarettes and suffer from a greater addiction to tobacco.<sup>13,15</sup> These factors, combined with a greater susceptibility of immature organs, result in increased risk from illnesses associated with smoking such as cancers and cardiovascular disease.<sup>4</sup>

In addition to targets to reduce overall smoking prevalence among adults that have been set out in Department of Health publications over the last decade, the 1998 White Paper *Smoking Kills*<sup>16</sup> set a target to reduce smoking prevalence among 11-15 year olds to nine percent by 2010. The Health Act 2006,<sup>17</sup> as well as introducing the smokefree legislation, introduced a further change in the law aimed at reducing the prevalence of smoking among young people. As a result, from October 2007 it became illegal to sell cigarettes to anyone under the age of 18.<sup>18</sup> The 2009 Health Bill<sup>19</sup> proposes to prohibit the display of tobacco products at the point of sale and create powers to control the sale of tobacco from vending machines. The intention is to reduce further the impact of tobacco on the health of the public and future generations, by protecting children and young people from the harmful effects of smoking.

This chapter focuses primarily on data from 2008, and the period immediately before and after the implementation of smokefree legislation. Trend data on smoking and other key variables are also available in 'Health Survey for England – 2008 Trend Tables' on The NHS Information Centre's website.<sup>20</sup>

## 15.2 Methods and definitions

### 15.2.1 Questions about cigarette smoking

Questions on children's smoking have been included in the Health Survey for England (HSE) every year since 1995. As in the 1997, 2002, 2006 and 2007 Health Surveys, the 2008 HSE sample was designed to boost the number of children surveyed. Most of the analysis in this chapter is based on a single year's data, because the sample provided a sufficiently large number of children. However, cotinine results are available only for children in the core sample (i.e. excluding the child boost) who had a nurse visit. Therefore for some cotinine analyses, 2006, 2007 and 2008 data have been aggregated to increase sample sizes.

To ensure greater privacy for those who do not want their parents to hear their responses and to encourage more honest answers, questions about cigarette smoking were collected by self-completion questionnaire. Nevertheless, there is still a risk that children will under-report smoking behaviour because they are worried that parents might see their answers. Comparisons with the survey of Smoking, Drinking and Drug Use among Young People (SDD),<sup>21</sup> conducted annually in secondary schools among children aged 11-15, indicate that both smoking and alcohol use are under-reported in home-based interview surveys vis-à-vis surveys carried out in schools (see section 15.4.3 below, and Chapter 16 on alcohol consumption).

Children aged 8-15 were asked whether they had ever tried a cigarette, and if so how often they smoked cigarettes (if at all) and how many cigarettes they had smoked in the last week (if any).

### 5.2.2 Exposure to other people's smoke

A question about exposure to other people's smoke was asked of parents/guardians to establish whether those aged 0-12 were looked after for at least two hours a week by



someone who smoked whilst looking after them. Those aged 13-15 were asked how many hours a week they were exposed to other people's smoke. In addition, a question to establish how many people smoked inside the home on most days was asked of a responsible adult.

The self-completion booklets for those aged 8-15 also contained two questions about whether children were often near people who were smoking in different locations (such as home, buses or trains, other people's homes), and if so, whether this bothered them.

### 15.2.3 Cotinine measurements

Saliva samples were taken from children aged 4-15 in the core sample during the nurse visit and were analysed for cotinine. This is a metabolite of nicotine which provides an indicator of recent exposure to tobacco or its smoke. Cotinine is generally considered the most useful of the various biological markers that are indicators of smoking.<sup>22</sup>

A saliva cotinine level of 15 or more nanograms per millilitre (ng/ml) has generally been regarded as indicative of smoking, and in most cases is unlikely to be due to anything other than direct inhalation or other personal use of tobacco.<sup>23,24</sup> Cotinine has a half-life in the body of between 16-20 hours, which means that it will detect regular smoking but may not detect occasional smoking if the last occasion was several days ago.<sup>24</sup> Sources of cotinine other than tobacco can for practical purposes be ignored.<sup>25</sup>

While inhalation of secondhand smoke can produce measurable levels of cotinine in non-smokers, it is only rarely likely to produce readings as high as 15ng/ml. The measurement of cotinine in the HSE provides an objective check on self-reported smoking behaviour. This is particularly useful in the case of children who may wish to conceal their behaviour from other household members who may be present during the interview.

Cotinine levels for this survey were measured using very sensitive methods of either gas chromatography or liquid chromatography coupled to tandem mass spectrometry with multiple reaction monitoring (see Section 9, Volume 2, Methods and documentation). The limit of detection is 0.1ng/ml.<sup>26</sup> Levels below this indicate no exposure at all to tobacco smoke.<sup>27</sup> Saliva cotinine levels of 0.1ng/ml to below 15ng/ml indicate exposure to secondhand smoke.

### 15.2.4 Mean cotinine levels

Since the cotinine measurements of active smokers are high in relation to non-smokers, mean cotinine levels that included both smokers and non-smokers would be expected to be distorted by the higher values. For this reason, tables are presented separately for smokers and non-smokers. This also allows examination of the levels of passive smoke intake of non-smokers more clearly.

Table 15.4 shows cotinine levels for self-reported current smokers aged 8-15, with an arithmetic mean for cotinine levels. Tables 11.5 to 11.10 show geometric mean cotinine values for self-reported and cotinine validated non-smokers. To be included within this category, children aged 8-15 had to report that they did not smoke cigarettes at least weekly (therefore including 1% who said they smoked sometimes but not every week), and to have a cotinine value of less than 15ng/ml; all children aged 4-7 were assumed to be non-smokers. Geometric means have been calculated for this group as they take into account any extreme values that might normally distort the average or mean for a sub-group.<sup>28</sup>

### 15.2.5 Smokefree legislation

On 1st July 2007 new legislation was introduced in England which made virtually all enclosed public places smokefree. Where relevant and numbers permit, analyses have been separated into responses or saliva samples collected in the 12 months before 1st July 2007 and those in the 12 months after that date, to examine whether the legislation has had any impact on passive smoking rates. There are not sufficient sample sizes to examine the impact of the legislation on children who smoke.

15.2.6 Weighting the data

Weights were applied to all 2008 data to correct for non-response to the interview. Weights were also applied specifically to the cotinine data to correct for non-response to the nurse visit and saliva sample (see Section 7, Volume 2, Methods and documentation).

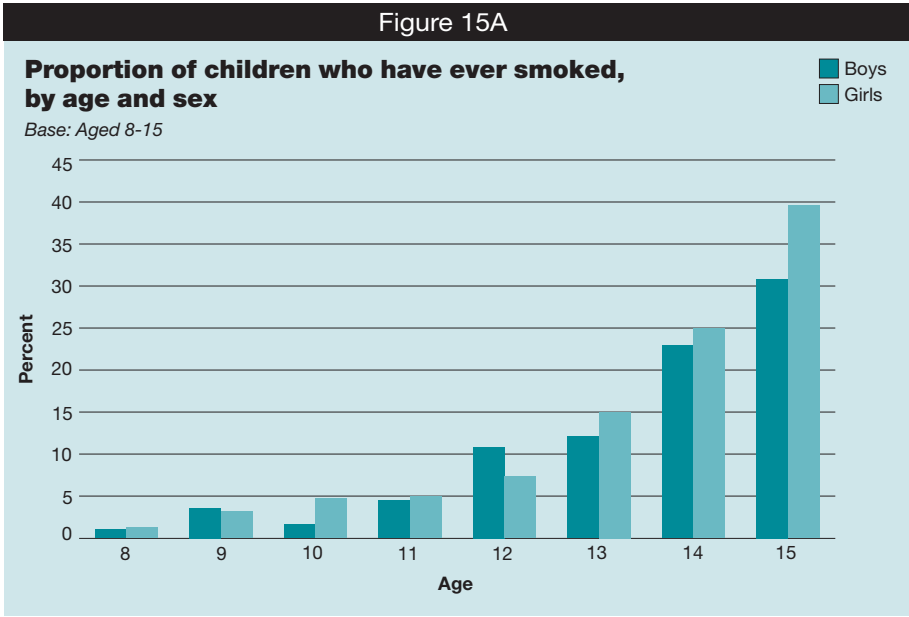
15.3 Children's self-reported smoking behaviour

Among children aged 8-15, 11% of boys and 13% of girls said that they had ever smoked. The proportion of children reporting that they had tried a cigarette increased with age, as would be expected. At age eight, 1% of both boys and girls reported that they had smoked a cigarette, but by age 15, 31% of boys and 40% of girls reported ever having smoked.

2% of children aged 8-15 reported that they smoked regularly (one or more cigarettes a week). The pattern by age was similar to that for ever having smoked: fewer than 1% of children aged 8-11 were classed as regular smokers, but by the age of 15, 8% of boys and 9% of girls fell into this category.

Among children aged 13-15 who had ever smoked, 23% of boys and 25% of girls reported having smoked in the last week. While base sizes are small, again there was significant variation by age: at age 14, 12% of boys and 19% of girls smoked in the last week, but at age 15, 35% of boys and 28% of girls reported having smoked in the last week.

Tables 15.1, 15.2, Figure 15A



15.4 Cotinine analysis

15.4.1 Introduction

Saliva samples were taken from children aged 4-15 in the core sample only, during the nurse visit, from which cotinine measurements were derived. Of 1292 boys and 1289 girls interviewed as part of the core sample, 772 boys and 746 girls provided a valid cotinine measurement. Table 15.3 compares the characteristics of children with a valid cotinine measurement with the total core sample who were eligible for inclusion. Amongst both boys and girls, the youngest participants (those aged 4-6) were slightly less likely to give a sample (some small children find it difficult to produce sufficient quantities of saliva for analysis). Weighting has been applied to the cotinine sample to adjust for this (and any other) imbalance in response.

Table 15.3

#### 15.4.2 Cotinine levels among children who currently smoked

2% of children aged 8-15 reported that they smoked at least one cigarette a week and have been classified as current smokers.<sup>29</sup> Among this group, 70% had cotinine levels above 15ng/ml, confirming that they had recently smoked. Self-reported smokers also included children who had not smoked in the last few days before the interview: 3% had no detectable cotinine, and a further 27% had a cotinine level between 0.1 and below 15ng/ml, indicating either passive smoking or smoking some days previously.

The mean cotinine level among the self-reported current smokers was 126ng/ml, and 10% had a level of 316ng/ml or above.

Table 15.4

#### 15.4.3 Cotinine levels and self-reported smoking

In 2008, as in previous HSE years, comparison of self-reported smoking with cotinine results suggests that a small proportion of children smoke but do not admit to doing so. As well as the 2% who reported smoking at least weekly, a further 3% of children aged 8-15 did not report regular smoking, but had a cotinine level of 15ng/ml or above, indicating that they had recently smoked. Once cotinine-confirmed smokers were included with self-reported smokers, 5% of children aged 8-15 could be identified as current smokers; among 11-15 year olds 7% were current smokers. This level is similar to the proportion of self-reported 'regular' smokers (smoke at least once a week) in the 2008 Smoking, Drinking and Drug Use among Young People (SDD) survey, as illustrated in Table 15A below.<sup>21</sup>

Table 15A			
Smoking among children aged 11-15: comparison of HSE and SDD 2008			
Age	HSE 2008 self-reported smoke weekly	HSE 2008 self-reported/cotinine level 15ng/ml or more	SDD 2008 Self-reported smoke weekly
	%	%	%
11	-	0	0
12	1	3	1
13	2	7	5
14	2	10	9
15	9	17	14
All 11-15	3	7	6

#### 15.4.4 Cotinine levels among non-smokers, by sex and age

Among children aged 4-15 who were cotinine validated non-smokers, the geometric mean cotinine level for boys and girls was 0.2ng/ml. Among girls, geometric mean cotinine levels were higher for those aged 4-12 than those aged 13-15 (0.22ng/ml compared with 0.16ng/ml). However, there was no similar pattern among boys.

Around two in five non-smokers aged 4-15 had no detectable cotinine (40% of boys and 42% of girls), while the remaining three in five had cotinine levels between 0.1 and below 15ng/ml, indicative of passive smoking or occasional own smoking (60% of boys and 58% of girls).

Table 15.5

#### 15.4.5 Cotinine levels among non-smokers, by Strategic Health Authority and sex

There was no significant variation in geometric mean cotinine levels by Strategic Health Authority (SHA) among children aged 4-15 who did not smoke. It should be noted that the base sizes for regions were small.

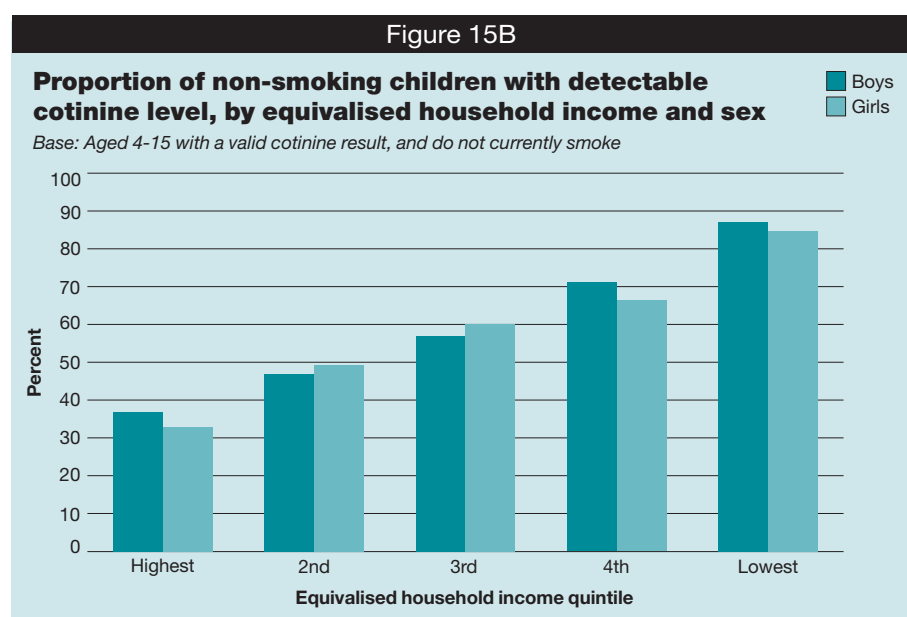
Table 15.6

#### 15.4.6 Cotinine levels among non-smokers, by equivalised household income and sex

Cotinine levels amongst non-smoking children aged 4-15 varied significantly by quintile of equivalised household income. Geometric mean cotinine levels decreased as income quintile increased. The mean level in the highest quintile was 0.1ng/ml for both girls and boys, compared with 0.7ng/ml for girls and 0.6ng/ml for boys in the lowest quintile, indicating that children from lower income households were more likely to be exposed to secondhand smoke.

The pattern of geometric means across equivalised income quintiles was confirmed by the proportions of non-smokers with no detectable levels of cotinine, or with levels indicative of secondhand smoke. In the highest income quintile, 67% of girls and 63% of boys had no detectable cotinine, compared with 15% of girls and 13% of boys in the lowest quintile. In contrast, 33% of girls and 37% of boys in the highest income quintile had levels of cotinine between 0.1 and below 15ng/ml, compared with 85% of girls and 87% of boys in the lowest quintile (see Figure 15B).

Table 15.7, Figure 15B



#### 15.4.7 Cotinine levels among non-smokers, by Spearhead status and sex

Among girls aged 4-15 who did not smoke, geometric mean cotinine levels were significantly higher in Spearhead PCTs than non-Spearhead PCTs<sup>1</sup> (0.26ng/ml compared with 0.18ng/ml). However, this was not the case for boys, where there was no significant difference between Spearhead and non-Spearhead PCTs (0.23ng/ml and 0.21ng/ml respectively).

Similarly, there was a higher proportion of girls with a cotinine level between 0.1ng/ml and below 15ng/ml in Spearhead PCTs than in non-Spearhead PCTs (65% and 54% respectively), although again this was not the case for boys (59% and 60% respectively).

Table 15.8

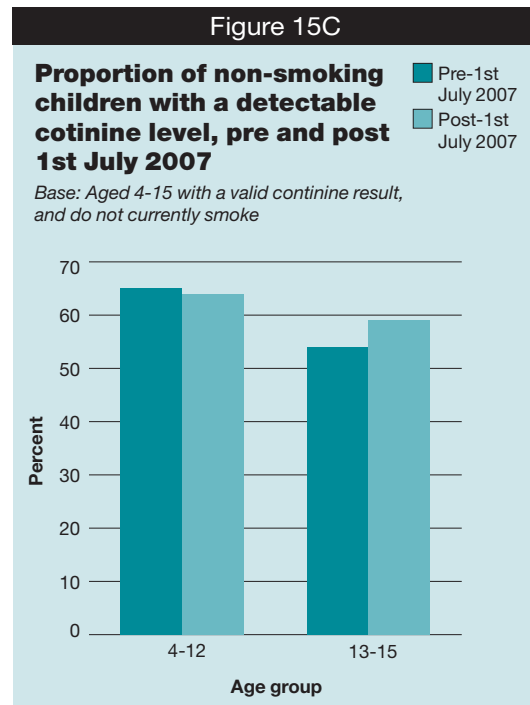
#### 15.4.8 Cotinine levels among non-smokers, pre and post 1st July 2007, by age

From July 2007, smoking became illegal in most enclosed public places. Saliva cotinine samples from non-smoking children aged 4-15 were analysed for the 12 months immediately before and after legislation was introduced, to see whether it had affected levels of passive smoking.

In the 12 months prior to the ban, children who did not smoke had a geometric mean cotinine level of 0.22ng/ml. Younger children aged 4-12 had a higher geometric mean cotinine level than those aged 13-15 (0.25ng/ml and 0.16ng/ml respectively). Cotinine levels did not change significantly after implementation of the legislation: in the following 12 months, children who did not smoke had a geometric mean cotinine level of 0.23ng/ml. The difference between younger and older non-smokers remained.

The proportion of non-smoking children who had a detectable level of cotinine remained unchanged after implementation of smokefree legislation (62% before and 63% after 1st July 2007). As with geometric mean cotinine levels, the proportion showing exposure to smoke was higher in younger children, as shown in Figure 15C: post implementation, 64% of non-smokers aged 4-12 and 59% of non-smokers aged 13-15 had geometric mean cotinine levels between 0.1 and below 15ng/ml. Although many children had been exposed to smoke, for most of them, this was at a relatively low level both before and after the ban: 90% of children had a cotinine level of 2.6ng/ml or less.

Table 15.9, Figure 15C



#### 15.4.9 Cotinine levels among non-smokers, pre and post 1st July 2007, by whether adults in the household smoked

In the 12 months following the implementation of smokefree legislation, 20% of children lived in a household where at least one adult smoked. This proportion had not changed significantly from the 12 months before the implementation, when 23% of children lived in households where at least one adult smoked, as shown in Table 15B below. As might be expected, non-smoking children living in households where one or more adults smoked had a much higher geometric mean cotinine level than children living in non-smoking households (1.49ng/ml and 0.14ng/ml respectively, post July 2007). There was no significant change in these geometric means before and after the implementation of the smokefree legislation.

Almost all non-smoking children in households where an adult smoked had detectable cotinine levels (96% post July 2007), compared with 54% of children in households with no adult smokers. 10% of children in homes where adults smoked had a cotinine level of 5.0ng/ml or higher post July 2007.

Tables 15B, 15.10

### 15.5 Children's reported exposure to other people's smoke pre and post 1st July 2007

Parents of children aged 0-12 were asked whether their children were looked after by a smoker for more than two hours per week. Before implementation of the smokefree legislation, 14% of boys and 16% of girls were looked after by a smoker for more than two hours, and this was more likely among children aged 5-12 (18% of boys and 19% of girls) than among pre-school children aged 0-4 (11% of boys, 13% of girls). After

Table 15B		
<b>Number of adult smokers in the house on most days, pre and post July 2007</b>		
<i>Aged 4-15 with a valid cotinine assay, and do not currently smoke</i>		
	<b>Pre 1st July 2007</b>	<b>Post 1st July 2007</b>
	<b>%</b>	<b>%</b>
Number of adult smokers:		
0	77	88
1	17	14
2	5	6
3 or more	1	1
<i>Unweighted bases</i>	<i>1222</i>	<i>1013</i>
<i>Weighted bases</i>	<i>1220</i>	<i>1010</i>

implementation, the proportions that were looked after by a smoker were significantly reduced to 11% of boys and 10% of girls, with similar changes in both age groups.

**Table 15.11**

A question was also asked about the number of hours per week that children were exposed to other people's smoke. Parents answered on behalf of children aged 0-12 as part of the interview, while children aged 13-15 answered on their own behalf in the self-completion booklet. The number of hours of weekly exposure to other people's smoke followed a similar pattern by age to that of being looked after by a smoker. Children aged 13-15 were more likely than younger children to be exposed, and for a greater number of hours. The mean number of hours of exposure rose from around one hour per week for children aged 0-4, to around two hours for children aged 5-12, and between six to seven hours for those aged 13-15. There was no significant change in the number of hours exposed to others' smoke pre and post the smokefree legislation.

**Table 15.12, Figure 15 D**

Children aged 8-15 were asked in which locations they were often near to people who were smoking. Before 1st July 2007, around a quarter said that they were not often near to others who were smoking (25% of boys and 24% of girls), and this proportion increased after 1st July, to 31% of boys and 28% of girls. After implementation, boys were slightly more likely than girls to report this.

The most frequently mentioned specific locations were at home and in other people's homes, while almost half of children mentioned 'other places'. After the smokefree legislation was introduced, children were less likely to report exposure to smoke in other people's homes (25% of boys and 31% of girls after 1st July 2007), on buses and trains<sup>30</sup> (10% of both sexes), and in other places (41% and 44% respectively). The proportion who reported being near people smoking in their own homes did not change significantly, with 26% of both boys and girls aged 8-15 reporting this post implementation.

Children who reported that they were often near to people smoking were asked whether they felt bothered by this, and the majority said that they were. There was no significant change in this result before and after the policy implementation (58% of children who were near others smoking were bothered by this, both before and after 1st July 2007). **Table 15.13**

## 15.6 Discussion

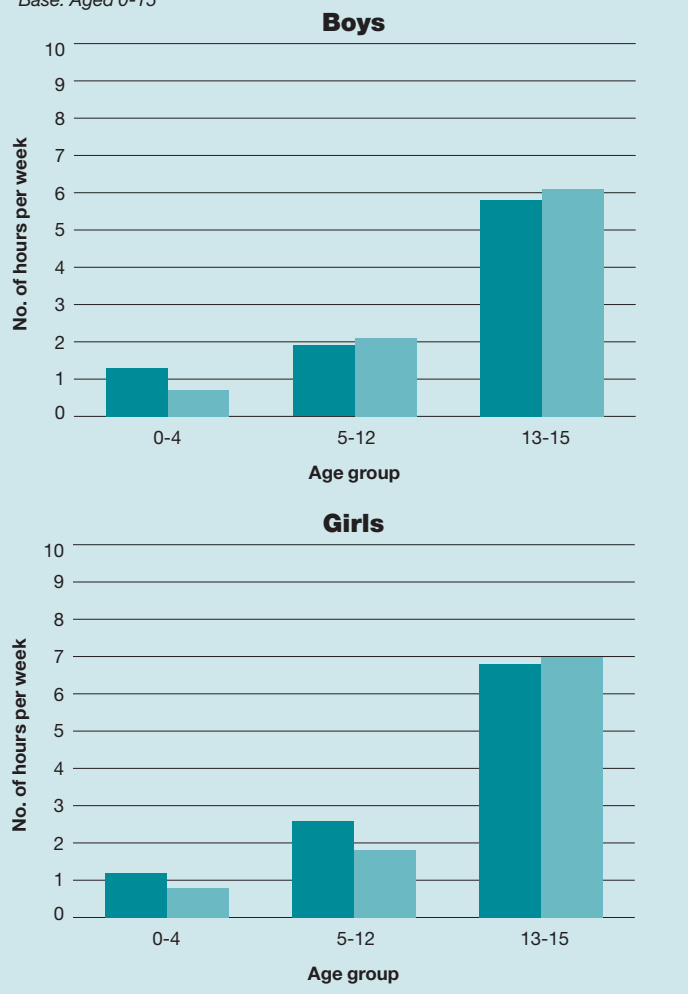
### 15.6.1 Current smoking and exposure to smoke

As in previous years, smoking increased with age, so that by age 15, 9% of children reported that they smoked at least one cigarette per week. Taking into account those who

Figure 15D

### Mean number of hours exposed to others' smoke, pre and post 1st July 2007, by age and sex

Base: Aged 0-15



did not report this level of smoking but who had cotinine levels of 15ng/ml or more, the proportion of current smokers almost doubled to 17% of children aged 15. It is notable that children's under-reporting of current smoking that has been observed in previous years of the HSE has continued. This confirms that in a survey conducted at home with other members of the household present, even when a self-completion format is offered, children are less likely to give frank answers than in a school-based survey such as the SDD. It is also notable that 70% of the self-reported current smokers had cotinine levels confirming smoking in the last few days, while very few in this group did not have detectable levels of cotinine.

Among children who did not currently smoke (validated by cotinine levels), 60% of boys and 58% of girls had detectable cotinine levels indicative of passive smoking. This was similar among boys and girls, and across age groups, indicating that while the likelihood of having same-age friends who smoked increased with age, this did not translate into increased risk of passive smoking.

#### 15.6.2 Influences on levels of secondhand smoke

Two of the key influences on the levels of secondhand smoke among children, probably related, were equivalised household income, and whether or not any adults in the household smoked. Cotinine levels varied significantly by equivalised household income, with children living in households in the lowest income quintile more than twice as likely to be exposed to secondhand smoke as children in the highest quintile. Not surprisingly, almost all children in households where adults smoked were exposed to passive smoking,



compared with three in five among children in households where no adults smoked. As Chapter 11 demonstrated, and as found in Scotland,<sup>31</sup> there were continuing inequalities both in smoking prevalence and in exposure to secondhand smoke by socio-economic group. Prevalence of smoking was much higher among adults in the lowest than the highest income quintiles, and among those living in Spearhead PCTs rather than non-Spearhead PCTs (see Chapter 11, section 11.3.4 and 11.3.5).

However, where smoking did not occur in the home most days, the largest fall in geometric mean cotinine from 2005 to the period immediately after the legislation was found among non-smoking children in households headed by adults in routine or manual occupations.<sup>32</sup>

As smokefree legislation tackles smoking in public places, there is the continuing need to address the issues of smoking at home, particularly when non-smokers, especially children, are living in the same household as smokers. As well as the evidence about the impact on children's health of secondhand smoke,<sup>4</sup> there is evidence that parental smoking behaviour, together with sibling and peer smoking, can influence children's and adolescents' decisions about starting or continuing to smoke.<sup>33,34,35</sup>

### 15.6.3 Impact of the smokefree legislation

Evidence from analysis of the HSE immediately before and after the implementation of the smokefree legislation shows few changes in levels of secondhand smoke among children. Among non-smoking children aged 4–15, there was no significant change in cotinine levels, nor in the proportions with detectable cotinine levels before and after implementation, and there was no change in the proportion living in a household where at least one adult smoked regularly. While there was also no significant change in the number of hours exposed each week to other people's smoke, there was a significant reduction in the proportion of children aged 0–12 being looked after by a smoker for more than two hours a week. Similarly, among children aged 8–15, there was a reduction in the proportion that reported they were often near people smoking in other people's homes, on public transport, or in other places. However, there was no change in the proportion in this age group that reported often being near other people smoking in their own homes.

Analysis of several years of HSE data has shown that the main fall in geometric mean cotinine, and the main increase in the proportion without exposure to smoke, occurred in 2005 to 2006, preceding the data reported in this chapter.<sup>32</sup>

One of the concerns about the implementation of smokefree legislation in public places was that adult smoking might increasingly be displaced to the home, and thus potentially increase passive smoking among other household members. Evidence among adults indicates that there has not been an increase in the proportion living in a household with someone who smokes most days (see Chapter 11, section 11.5.3), and evidence from this chapter confirms the same pattern. Furthermore, while there has been no reduction in the period immediately before and after the introduction of the legislation in the proportion of children living with adult smokers, or in cotinine levels among children in such households, at least there has not been any increase.

More research is needed to explore the longer term effects of the smokefree legislation on children. While future years of the HSE will continue to provide valuable information about levels of passive smoking, the achieved sample of children who smoke is too small for detailed analysis. It will be important to establish whether adolescent smoking behaviour, as well as adult behaviour, changes as the smokefree legislation becomes more embedded, and potentially the social acceptability of smoking reduces.

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- 15.1 Self-reported cigarette smoking status of children aged 8-15, by age and sex
- 15.2 Self-reported cigarette smoking in the last week by children aged 13-15, by age and sex
- 15.3 Comparison of those in whom salivary cotinine was measured with the total sample, by sex, age and smoking status
- 15.4 Saliva cotinine levels of children aged 8-15 who are self-reported current cigarette smokers
- 15.5 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by age and sex
- 15.6 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by Strategic Health Authority and sex
- 15.7 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by equivalised household income and sex
- 15.8 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by Spearhead status and sex
- 15.9 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, pre and post 1st July 2007, by age
- 15.10 Saliva cotinine levels of cotinine validated non-smokers aged 4-15, pre and post 1st July 2007, by number of adults smoking regularly in the home
- 15.11 The exposure to smoke from carers of children aged 0-12, pre and post 1st July 2007, by age and sex
- 15.12 Reported weekly hours of exposure to other people's smoke for children aged 0-15, pre and post 1st July 2007, by age and sex
- 15.13 Locations exposed to other people's smoke for children aged 8-15, pre and post 1st July 2007, by sex

Table 15.1

### Self-reported cigarette smoking status of children aged 8-15, by age and sex

Children aged 8-15

2008

Self-reported smoking status	Age								Total
	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%
<b>Boys</b>									
<b>Have ever smoked</b>	1	4	2	4	11	12	23	31	11
<b>Never smoked</b>	99	96	98	96	89	88	77	69	89
Only smoked once or twice	1	3	1	2	9	8	16	16	7
Used to smoke, but don't now	-	1	-	2	1	2	4	3	2
Smoke sometimes, not every week	-	-	-	-	-	0	1	3	1
Smoke 1-6 cigarettes per week	-	-	-	-	-	-	1	1	0
Smoke more than 6 cigarettes per week	0	-	0	-	1	1	1	8	1
<i>All regular smokers (one or more cigarettes a week)</i>	0	-	0	-	1	1	1	8	2
<b>Girls</b>									
<b>Have ever smoked</b>	1	3	5	5	7	15	25	40	13
<b>Never smoked</b>	99	97	95	95	93	85	75	60	87
Only smoked once or twice	1	3	3	4	7	9	16	19	8
Used to smoke sometimes	0	-	2	1	0	2	3	9	2
Smoke sometimes, not every week	-	-	0	-	-	1	2	3	1
Smoke 1-6 cigarettes per week	-	-	0	-	-	1	1	2	1
Smoke more than 6 cigarettes per week	-	-	-	-	0	2	2	7	2
<i>All regular smokers (one or more cigarettes a week)</i>	-	-	0	-	0	3	4	9	2
<i>Bases (unweighted)</i>									
<i>Boys</i>	206	220	232	239	240	263	253	223	1876
<i>Girls</i>	203	234	273	271	224	237	266	232	1940
<i>Bases (weighted)</i>									
<i>Boys</i>	205	211	223	219	214	237	259	233	1800
<i>Girls</i>	192	210	217	209	207	223	245	214	1716

Table 15.2

**Self-reported cigarette smoking in the last week by children aged 13-15, by age and sex**
*Aged 13-15 who have ever smoked<sup>a</sup>* 2008

Whether smoked in the last week	Age			Total
	13	14	15	
	%	%	%	%
<b>Boys</b>				
Yes	[14]	12	35	23
No	[86]	88	65	77
<b>Girls</b>				
Yes	[28]	19	28	25
No	[72]	81	72	75
<i>Bases (unweighted)</i>				
Boys	33	57	70	160
Girls	36	68	89	193
<i>Bases (weighted)</i>				
Boys	29	58	72	159
Girls	34	61	85	179

<sup>a</sup> Fewer than 1% of children aged 8-12 have smoked in the last week, and this age group has therefore not been included in the table.

Table 15.3

**Comparison of those in whom salivary cotinine was measured with the total sample, by sex, age and smoking status**
*Aged 4-15 and eligible for cotinine measurement (core sample)<sup>a</sup>* 2008

Age and smoking status	Boys		Girls	
	Sample with cotinine assay	Total sample	Sample with cotinine assay	Total sample
	%	%	%	%
<b>Age (4-15)</b>				
4-6	18	25	22	24
7-9	27	26	26	26
10-12	27	24	26	25
13-15	29	25	27	25
<b>Smoking status<sup>b</sup></b>				
Never smoked	88	89	87	87
Only smoked once or twice	8	7	7	8
Used to smoke, but don't now	2	2	3	2
Smoke sometimes, not every week	0	1	0	1
Smoke 1-6 cigarettes per week	0	0	1	1
Smoke 6+ cigarettes per week	1	1	1	2
<i>All regular smokers (one or more cigarettes a week)</i>	1	2	2	2
<i>Bases (unweighted)</i>				
Aged 4-15	772	1292	746	1289
Aged 8-15 (with valid smoking status)	540	1876	506	1940
<i>Bases (weighted)</i>				
Aged 4-15	752	1269	685	1196
Aged 8-15 (with valid smoking status)	526	1800	450	1716

<sup>a</sup> Cotinine is only measured in the core sample as part of the nurse visit.

<sup>b</sup> Smoking status questions are only asked of those aged 8-15.

Table 15.4

### Saliva cotinine levels among children aged 8-15 who are self-reported current cigarette smokers

Aged 8-15 with valid cotinine assay and currently smoke cigarettes<sup>a</sup>

2006-2008<sup>b</sup>

Saliva cotinine (ng/ml)	Total
50th percentile <sup>c</sup>	108.2
75th percentile	212.6
90th percentile	316.2
95th percentile	394.1
Mean saliva cotinine	126.1
Standard error of mean	3.6
% with no detectable cotinine	3
% with cotinine 0.1 to below 15ng/ml	27
% with cotinine 15ng/ml or more	70
<i>Bases (unweighted)</i>	62
<i>Bases (weighted)</i>	62

<sup>a</sup> To be included within this category, participants had to be self-reported current smokers (smoke at least one cigarette per week). Results for boys and girls have been combined; there was little variation by sex.

<sup>b</sup> To gain a sufficient sample size of self-reported smokers who also gave a valid cotinine result, data from 2006 – 2008 inclusive have been combined.

<sup>c</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

Table 15.5

### Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by age and sex

Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>a</sup>

2008

Saliva cotinine (ng/ml)	Age group		Total
	4-12	13-15	
	%	%	%
<b>Boys</b>			
50th percentile <sup>b</sup>	0.2	0.1	0.2
75th percentile	0.8	0.6	0.7
90th percentile	2.4	2.0	2.4
95th percentile	3.7	3.4	3.6
Geometric mean saliva cotinine <sup>c</sup>	0.23	0.20	0.22
Confidence interval	(0.19, 0.26)	(0.15, 0.25)	(0.19, 0.25)
% with no detectable cotinine	39	42	40
% with cotinine 0.1 to below 15ng/ml	61	58	60
<b>Girls</b>			
50th percentile	0.2	0.1	0.2
75th percentile	0.7	0.4	0.6
90th percentile	2.2	1.3	2.0
95th percentile	3.6	2.3	3.6
Geometric mean saliva cotinine	0.22	0.16	0.21
Confidence interval	(0.19, 0.25)	(0.12, 0.19)	(0.17, 0.23)
% with no detectable cotinine	41	44	42
% with cotinine 0.1 to below 15ng/ml	59	56	58
<i>Bases (unweighted)</i>			
Boys	531	194	725
Girls	532	170	702
<i>Bases (weighted)<sup>d</sup></i>			
Boys	599	209	809
Girls	579	184	763

<sup>a</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>b</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>c</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

<sup>d</sup> Data have been weighted to correct for non-response to the saliva sample.

Table 15.6

### Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by Strategic Health Authority<sup>a</sup> and sex

Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>b</sup>

2008

Saliva cotinine (ng/ml)	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
<b>Boys</b>										
50th percentile (median) <sup>c</sup>	[0.1]	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.2	0.1
Geometric mean saliva cotinine <sup>d</sup>	[0.26]	0.23	0.26	0.21	0.27	0.21	0.20	0.15	0.24	0.21
Confidence interval	(0.14, 0.47)	(0.16, 0.32)	(0.16, 0.41)	(0.13, 0.32)	(0.17, 0.42)	(0.14, 0.29)	(0.13, 0.30)	(0.10, 0.23)	(0.15, 0.38)	(0.12, 0.34)
% with no detectable cotinine	[41]	38	36	39	39	37	49	46	29	45
% with cotinine 0.1 to below 15ng/ml	[59]	62	64	61	61	63	51	54	71	55
<b>Girls</b>										
50th percentile (median)	[0.3]	0.1	0.2	0.2	0.3	0.2	0.2	0.1	0.0	0.1
Geometric mean saliva cotinine	[0.42]	0.17	0.24	0.18	0.27	0.23	0.22	0.17	0.13	0.19
Confidence interval	(0.20, 0.84)	(0.12, 0.22)	(0.16, 0.34)	(0.12, 0.26)	(0.18, 0.40)	(0.15, 0.35)	(0.14, 0.34)	(0.11, 0.25)	(0.08, 0.21)	(0.12, 0.28)
% with no detectable cotinine	[27]	47	37	40	36	38	39	45	57	47
% with cotinine 0.1 to below 15ng/ml	[73]	53	63	60	64	62	61	55	43	53
<i>Bases (unweighted)</i>										
Boys	45	111	72	66	61	81	86	64	64	75
Girls	48	111	77	63	66	69	85	64	54	65
<i>Bases (weighted)<sup>e</sup></i>										
Boys	31	113	80	67	65	98	119	75	76	84
Girls	34	111	84	60	72	80	124	71	57	70

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.

<sup>b</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>c</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>d</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

<sup>e</sup> Data have been weighted to correct for non-response to the saliva sample.

Table 15.7

**Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by equivalised household income and sex**
*Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>a</sup>*

2008

Saliva cotinine (ng/ml)	Equivalised household income quintile				
	Highest	2nd	3rd	4th	Lowest
<b>Boys</b>					
50th percentile (median) <sup>b</sup>	0.00	0.00	0.10	0.30	0.70
Geometric mean saliva cotinine <sup>c</sup>	0.11	0.12	0.20	0.32	0.62
Confidence interval	(0.07, 0.14)	(0.09, 0.15)	(0.14, 0.25)	(0.23, 0.44)	(0.45, 0.84)
% with no detectable cotinine	63	53	43	29	13
% with cotinine 0.1 to below 15ng/ml	37	47	57	71	87
<b>Girls</b>					
50th percentile (median)	0.00	0.00	0.20	0.20	0.80
Geometric mean saliva cotinine	0.10	0.13	0.21	0.29	0.69
Confidence interval	(0.07, 0.12)	(0.10, 0.16)	(0.15, 0.28)	(0.20, 0.40)	(0.48, 0.96)
% with no detectable cotinine	67	51	40	34	15
% with cotinine 0.1 to below 15ng/ml	33	49	60	66	85
<i>Bases (unweighted)</i>					
Boys	84	122	168	144	123
Girls	100	151	130	134	105
<i>Bases (weighted)<sup>d</sup></i>					
Boys	90	134	188	168	139
Girls	103	157	140	159	116

<sup>a</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>b</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>c</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

<sup>d</sup> Data have been weighted to correct for non-response to the saliva sample.



Table 15.8

**Saliva cotinine levels of cotinine validated non-smokers aged 4-15, by Spearhead status<sup>a</sup> and sex**

Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>b</sup>

2008

Saliva cotinine (ng/ml)	Spearhead status	
	Non-Spearhead PCT	Spearhead PCT
<b>Boys</b>		
50th percentile (median) <sup>c</sup>	0.20	0.20
Geometric mean saliva cotinine <sup>d</sup>	0.21	0.23
Confidence interval	(0.17, 0.25)	(0.18, 0.29)
% with no detectable cotinine	40	41
% with cotinine 0.1 to below 15ng/ml	60	59
<b>Girls</b>		
50th percentile (median)	0.10	0.20
Geometric mean saliva cotinine	0.18	0.26
Confidence interval	(0.15, 0.21)	(0.20, 0.32)
% with no detectable cotinine	46	35
% with cotinine 0.1 to below 15ng/ml	54	65
<i>Bases (unweighted)</i>		
Boys	464	259
Girls	421	279
<i>Bases (weighted)<sup>e</sup></i>		
Boys	545	262
Girls	471	290

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>c</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal to or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>d</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

<sup>e</sup> Data have been weighted to correct for non-response to the saliva sample.

Table 15.9

**Saliva cotinine levels of cotinine validated non-smokers aged 4-15, pre and post 1st July 2007,<sup>a</sup> by age**
*Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>b,c</sup>*
*2006-2008*

Saliva cotinine (ng/ml)	Age group					
	Pre-1st July 2007			Post-1st July 2007		
	4-12	13-15	Total	4-12	13-15	Total
50th percentile <sup>d</sup>	0.14	0.10	0.10	0.20	0.10	0.20
75th percentile	0.9	0.4	0.8	0.9	0.4	0.8
90th percentile	2.9	1.4	2.6	2.8	2.0	2.5
95th percentile	4.6	2.7	4.3	4.0	3.6	4.0
Geometric mean saliva cotinine <sup>e</sup>	0.25	0.16	0.22	0.24	0.19	0.23
Confidence intervals	(0.21, 0.28)	(0.13, 0.18)	(0.19, 0.25)	(0.21, 0.28)	(0.15, 0.22)	(0.20, 0.25)
% with no detectable cotinine	35	46	38	36	41	37
% with cotinine 0.1 to below 15ng/ml	65	54	62	64	59	63
<i>Bases (unweighted)</i>	<i>864</i>	<i>280</i>	<i>1144</i>	<i>747</i>	<i>266</i>	<i>1013</i>
<i>Bases (weighted)<sup>f</sup></i>	<i>871</i>	<i>274</i>	<i>1145</i>	<i>752</i>	<i>257</i>	<i>1010</i>

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>b</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>c</sup> Results for boys and girls have been combined in this table to give sufficient base sizes; there was little variation by sex.

<sup>d</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>e</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

Table 15.10

**Saliva cotinine levels of cotinine validated non-smokers aged 4-15, pre and post 1st July 2007,<sup>a</sup> by number of adults smoking regularly in the home**

Aged 4-15 with a valid cotinine assay, and do not currently smoke<sup>b,c</sup>

2006-2008

Saliva cotinine (ng/ml)	Adults smoking regularly in the home			
	Pre-1st July 2007		Post-1st July 2007	
	No adult smoking in the home	One or more adults smoking in the home	No adult smoking in the home	One or more adults smoking in the home
50th percentile <sup>d</sup>	0.1	1.7	0.1	1.7
75th percentile	0.3	3.4	0.3	3.2
90th percentile	0.8	5.7	0.9	5.0
95th percentile	1.4	9.4	1.9	7.0
Geometric mean saliva cotinine <sup>e</sup>	0.13	1.41	0.14	1.49
Confidence intervals	(0.11, 0.14)	(1.12, 1.75)	(0.12, 0.15)	(1.23, 1.80)
% with no detectable cotinine	47	6	46	4
% with cotinine 0.1 to below 15ng/ml	53	94	54	96
Bases (unweighted)	888	256	811	202
Bases (weighted) <sup>f</sup>	882	263	808	202

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>b</sup> All aged 4 - 7 are assumed not to smoke currently. Those aged 8-15 are included if they say that they do not currently smoke (i.e. do not smoke at least once cigarette a week; those who smoke sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of under 15ng/ml.

<sup>c</sup> Results for boys and girls have been combined in this table to give sufficient base sizes; there was little variation by sex.

<sup>d</sup> Percentiles have been presented in this table for reference only. The percentiles show a set of points within a scale from 1-100 which is divided into groups based on order of magnitude. For example, those with a cotinine value that is equal or greater than the value of 90% of those who gave a cotinine measurement is expressed as the 90th percentile.

<sup>e</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed and exponential distribution. Therefore, using the arithmetic mean is not appropriate as this figure can be distorted by a small number of very high values. A geometric mean is an average calculated by multiplying a set of numbers and taking the nth root, where n is the number of numbers. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data. Confidence intervals around the estimate are presented rather than standard errors.

<sup>f</sup> Data have been weighted to correct for non-response to the saliva sample.

Table 15.11

**The exposure to smoke from carers of children aged 0-12, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Children aged 0-12

2007-2008

Exposure to smoke from carers	Age group					
	Pre-1st July 2007			Post-1st July 2007		
	0-4	5-12	Total	0-4	5-12	Total
	%	%	%	%	%	%
<b>Boys</b>						
Looked after by a smoker for more than 2 hours a week	11	18	14	8	15	11
Not looked after by a smoker for more than 2 hours a week	89	82	86	92	85	89
<b>Girls</b>						
Looked after by a smoker for more than 2 hours a week	13	19	16	6	15	10
Not looked after by a smoker for more than 2 hours a week	87	81	84	94	85	90
<i>Bases (unweighted)</i>						
Boys	394	734	1128	385	579	964
Girls	380	745	1125	360	551	911
<i>Bases (weighted)</i>						
Boys	746	670	1416	707	543	1250
Girls	717	664	1381	658	503	1161

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

Table 15.12

**Reported weekly hours of exposure to other people's smoke for children aged 0-15, pre and post 1st July 2007,<sup>a</sup> by age and sex**

Children aged 0-15

2006-2008

Hours per week exposed to smoke	Age group					
	Pre-1st July 2007			Post-1st July 2007		
	0-4	5-12	13-15 <sup>b</sup>	0-4	5-12	13-15 <sup>b</sup>
	%	%	%	%	%	%
<b>Boys</b>						
Not exposed	82	72	46	90	75	42
1-14 hours a week	15	24	42	8	20	47
15-28 hours a week	1	2	6	1	3	6
Over 28 hours a week	2	2	6	1	2	5
Mean number of hours exposed to others' smoke per week	1.3	1.9	5.8	0.7	2.1	6.1
Standard error of mean	0.61	0.50	0.73	0.18	0.30	0.98
<b>Girls</b>						
Not exposed	85	70	44	91	78	42
1-14 hours a week	14	24	43	7	19	46
15-28 hours a week	0	3	6	1	1	6
Over 28 hours a week	1	3	7	1	2	6
Mean number of hours exposed to others' smoke per week	1.2	2.6	6.8	0.8	1.8	7.0
Standard error of mean	0.39	0.48	0.81	0.26	0.24	1.02
<b>Bases (unweighted)</b>						
Boys	116	220	542	384	576	357
Girls	136	206	513	360	549	340
<b>Bases (weighted)</b>						
Boys	320	190	513	706	540	312
Girls	321	180	474	658	499	302

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on January to June 2007 (the question was not included in HSE 2006), and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>b</sup> Children aged 13-15 answered these questions for themselves in a self-completion booklet, whereas parents of children aged 0-12 answered on their behalf during the CAPI interview.

Table 15.13

**Locations exposed to other people's smoke for children aged 8-15, pre and post 1st July 2007,<sup>a</sup> by sex**

Children aged 8-15

2006-2008

Location of exposure <sup>b</sup>	Pre-1st July 2007	Post-1st July 2007
<b>Boys</b>		
At home	28	26
In other people's homes	29	25
On buses or trains <sup>c</sup>	14	10
In other places	48	41
None of these	25	31
Whether bothered by exposure to other people's smoke <sup>d</sup>		
Yes	56	59
No	44	41
<b>Girls</b>		
At home	27	26
In other people's homes	33	31
On buses or trains <sup>c</sup>	16	10
In other places	49	44
None of these	24	28
Whether bothered by exposure to other people's smoke <sup>d</sup>		
Yes	60	58
No	40	42
<b>Bases (unweighted)</b>		
Location of exposure		
Boys	2007	1838
Girls	1927	1775
Whether bothered		
Boys	1481	1238
Girls	1450	1253
<b>Bases (weighted)</b>		
Location of exposure		
Boys	1806	1672
Girls	1729	1599
Whether bothered		
Boys	1329	1135
Girls	1309	1131

<sup>a</sup> Smokefree legislation was implemented in England from 1st July 2007. To maximise sample size, data are shown here for the period pre-implementation, based on HSE July to December 2006 and January to June 2007, and post implementation, based on HSE July to December 2007 and January to June 2008.

<sup>b</sup> Children could select more than one answer.

<sup>c</sup> Although smoking on buses or trains was not legal after the smokefree legislation was implemented, a proportion of children mentioned this location.

<sup>d</sup> Analysis of whether children were bothered by exposure to others' smoke is based on those reporting exposure to others' smoke.

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# Children's experience of alcohol

# 16

Chloe Robinson

## Summary

- This chapter presents findings on the prevalence and frequency of alcohol consumption among children aged 8-15. Comparisons are made with the 2008 survey of Smoking, Drinking and Drug Use among Young People (SDD). In addition, the chapter looks at the types of drinks and amount of alcohol consumed by those aged 13-15.
- Children are likely to under-report their alcohol consumption in home-based surveys because they may be worried about parents seeing their answers. This should be borne in mind when interpreting the findings presented below.
- The proportion who reported ever having had a proper alcoholic drink increased with age, from 8% of boys aged 8 to 70% of boys aged 15, and from 5% of girls aged 8 to 74% of girls aged 15. Overall, 29% of boys and 32% of girls aged 8-15 reported having experience of drinking alcohol.
- 3% of boys and 2% of girls aged 8-15 reported usually drinking once a week or more. Frequency of drinking was clearly related to age. The proportion who reported drinking at least once a week increased from 1% of both boys and girls aged 8 to 11% of boys and 9% of girls aged 15 (the difference between boys and girls not being statistically significant).
- 11% of both boys and girls aged 13-15 reported drinking alcohol in the last seven days. Consumption of each type of alcoholic drink increased with age, except for consumption of wine and fortified wines.
- There were some differences in the types of drinks consumed by boys and girls. Boys were more likely than girls to have drunk beer, lager, cider or shandy (10% compared with 7%), whereas girls were more likely than boys to have drunk wine (5% compared with 3%).

## 16.1 Introduction

The Home Office report *Safe. Sensible. Social. The next steps in the Alcohol Harm Reduction Strategy* (June 2007) reviewed progress since the Government's Alcohol Harm Reduction Strategy was launched in 2004, and outlined renewed proposals to tackle the problems associated with alcohol misuse.<sup>1</sup> The report emphasised the need to focus attention on the minority of drinkers who cause the most harm to themselves and others, and identified underage drinkers as one of three problem groups to be specifically targeted. The objectives for young people focused on educating them about making responsible choices about alcohol and restricting the supply of alcohol to underage drinkers. Proposed measures include tougher law enforcement to prevent underage sales and clearer guidelines to young people and parents about the effects of youth alcohol use.

The 2003 British Medical Association report *Adolescent Health* noted that regular heavy alcohol consumption and binge drinking among young people are associated with other risk behaviours such as unprotected sex, and can have adverse effects on school performance. It warned that alcohol misuse is associated with a range of mental health disorders and an increased risk of physical health problems such as liver damage. Unhealthy drinking patterns in adolescence may also be linked to dependence in adulthood.<sup>2</sup> The way in which young people drink, and where they drink, add to the potential for short-term harm. Binge drinking in the teenage years has been shown to correlate very highly to problems of alcoholism, drug use, low educational attainment and criminal behaviour later in life.<sup>3</sup>

England has been identified as having one of the highest rates of regular drinking and drunkenness among young people in Europe.<sup>4,5</sup> Although there has been no clear trend in the prevalence of drinking among under-16s in recent years, consumption levels appear to be on the rise among those who do drink. Particular concern has been raised about increasing levels of consumption within the 11-13 age group and among adolescent girls.<sup>1,6</sup> It has been estimated that 360,000 children aged 11-15 were drunk in the last week, and 6,000 children aged 11-15 are admitted to hospital each year as a result of their alcohol consumption.<sup>7</sup>

The ambiguous role of alcohol in society is reflected in the official health education advice. For adults, there are guidelines on 'safe' drinking levels, the amount of alcohol that can be drunk without risking health.<sup>1</sup> Until 2009, there were no such guidelines for children or adolescents. The Royal College of Physicians has claimed that risk-free drinking does not exist for this age-group,<sup>8</sup> and the charity Alcohol Concern recommended that the government's alcohol strategy should aim not just to reduce alcohol consumption among children aged 15 and under, but to stop this age group from drinking alcohol at all.<sup>9</sup>

The Department for Children, Schools and Families (DCSF) published the Youth Alcohol Action Plan<sup>10</sup> in 2008, which set out the government's five priorities:

1. Stepping up enforcement activity to address young people drinking in public places.
2. Taking action with industry on young people and alcohol.
3. Developing a national consensus on young people and drinking.
4. Establishing a new partnership with parents on teenage drinking.
5. Supporting young people to make sensible decisions about alcohol.

The Youth Alcohol Action Plan is committed to producing authoritative age-based guidance for children, young people and their parents on the health risks of drinking alcohol, to help them make better informed decisions about when and how much they drink.<sup>1</sup> In 2009, the DCSF published a draft guidance document from the Chief Medical Officers of England, Wales and Northern Ireland<sup>11</sup> which formed part of a consultation on children, young people and alcohol. The five-point guidance includes a recommendation that children under the age of 15 do not drink any alcohol at all and that alcohol consumption for 15 to 17 year olds should be under the supervision of a parent or carer. The guidance emphasises that



drinking, even at the age of 15 or older, can be hazardous to health, and that if 15-17 year olds do consume alcohol they should do so infrequently, and certainly no more than one day a week. It states that parents, carers and professionals should be made aware of the importance of parental influence on their children's alcohol use, and advice should be provided on how to respond to alcohol use and misuse by children. The consultation<sup>12</sup> found that there is a broad base of support for the guidelines set out by Chief Medical Officers on safe levels of drinking, and responders welcomed the focus on parental responsibility. It is likely that a multi-faceted approach will be required to communicate the messages.

The 2008 survey of Smoking, Drinking and Drug Use among Young People (SDD) found that the proportion of children aged 11-15 who had ever had an alcoholic drink had decreased since 2005 (from 58% to 52%), having fluctuated around 60% since 1998. Among children who had drunk alcohol in the last 7 days, the mean number of units consumed was 14.6 (using a revised method of calculating units introduced in 2007). This has increased from 12.7 units in 2007.<sup>13</sup>

Findings on alcohol consumption among children have previously been included in the 1997, 2002, 2006 and 2007 Health Survey reports.<sup>14,15,16,17</sup> Comparisons with previous years suggest that the usual frequency of drinking alcohol has remained relatively stable. There has been a decrease between 2002 and 2008 in the proportion of children aged 13-15 who reported having drunk alcohol in the last 7 days; however, there were no significant differences in the mean number of alcohol units consumed between 2002 and 2006 (changes to the method of calculating units in 2007 mean that comparable data are not available). In 2007 questions were included on children's attitudes to drinking, and results are presented in the 2007 report.<sup>17</sup> This chapter provides results for 2008, and trend data on children's drinking and other key measures are published separately by The NHS Information Centre, *Health Survey for England 2008 Latest Trends*.<sup>18</sup>

## 16.2 Methods and definitions

### 16.2.1 Methods

Children were interviewed with their parents in the HSE interview, either with their parents answering on their behalf if aged up to 12 years, or answering their own questions with parents present if aged 13-15. As children may be reluctant to reveal details about their drinking behaviour in the presence of their parents, questions about alcohol consumption were asked of children aged 8-15 as part of a self-completion questionnaire in order to encourage honesty. Nevertheless, there is still a risk that children will under-report alcohol use because they are worried that parents might see their answers. Comparisons with the survey of Smoking, Drinking and Drug Use among Young People (SDD)<sup>13</sup> indicate that both smoking and alcohol use are under-reported in home-based interview surveys vis-à-vis surveys carried out in schools (see sections 16.3.1 and 16.3.2 below, and Chapter 15 on smoking).

All children aged 8 and above were asked about alcohol consumption. Children aged 8-12 were asked whether they had ever had a proper alcoholic drink (a whole drink, not just a sip), how old they were when they first did so, their usual frequency of drinking, and when they last had an alcoholic drink. Children aged 13-15 were asked, in addition to these questions, to provide details of the types and quantities of alcoholic drinks they had consumed in the last seven days.

Questions have been asked about children's alcohol consumption since 1995. Changes to the questionnaire were introduced in 1998 and again in 1999. Prior to 1998, children were asked to tick one of three categories to indicate their experience of alcohol: (1) never tasted alcohol, (2) tasted alcohol once or twice but never had a whole drink, or (3) had a whole proper drink of alcohol. In 1998, children were simply asked 'Have you ever had a proper alcoholic drink – a whole drink, not just a sip?' and asked to tick 'yes' or 'no'. This is the

same question as that used on the SDD survey. From 1999 onwards, children who answered 'no' when asked to state whether they had ever had an alcoholic drink were asked a follow-up question about whether they had ever drunk alcopops. Children are regarded as having had experience of drinking alcohol if they answer yes to either question.

A question about when the child last had an alcoholic drink and some subtle changes to the question about usual frequency of drinking were also introduced in 1998.<sup>19</sup>

## 16.2.2 Definitions

A unit of alcohol is 10ml of pure alcohol, and is taken to be approximately the amount contained in half a pint of ordinary strength beer or lager, a single pub measure (50ml) of fortified wine such as sherry or port, or a single pub measure (25ml) of spirits. The method used by the HSE to convert drinks to units remained essentially unchanged from 1991 for adults, and from 1995 for children, until 2005. The assumptions were similar to those which have been used by other major surveys since they were introduced by the General Household Survey (GHS) in 1990.<sup>20</sup> In recent years, it has become clear that these assumptions were no longer valid. The average strengths of beers and wines have increased in the intervening years, and pubs, bars and restaurants now serve drinks in a broader range of measures; specifically, standard glasses of wine, formerly 125ml, are likely to be 175ml or even 250ml.<sup>21</sup> From 2006, changes have been made in the way HSE and other surveys estimate alcohol consumption for adults, and equivalent changes were introduced for children from 2007.

Most of these changes affect the conversion to units rather than the questions asked of participants, but for wine the questions were changed and participants in the HSE in 2007 were asked to specify how much wine they had drunk, in terms of different sized glasses and bottles. Participants could record a combination of bottles, or part bottles, and different sized glasses – 250ml, 175ml and 125ml. The conversion from drinks to units for glasses or bottles of wine, small cans of beer and small cans/bottles of alcopops was revised for children in 2007, in line with revisions for adults introduced in 2006. Table 16A below shows the original conversion factors used by the HSE for children until 2006, and the revised conversion factors used from 2007.

Type of drink	Measure	Original equivalent units of alcohol	Revised equivalent units of alcohol
Beer, lager, cider or shandy	Pint	2 units	2 units
	Large can/bottle	2 units	2 units
	Small can/bottle	1 unit	1.5 units
Spirits or liqueurs	Glass	1 unit <sup>a</sup>	1 unit <sup>a</sup>
Sherry or martini	Glass	1 unit <sup>a</sup>	1 unit <sup>a</sup>
Wine	Bottle	6.0 units	9.0 units
	Large glass (250ml)	N/A	3.0 units
	Standard glass (175ml)	N/A	2.0 units
	Small glass (125ml)	N/A	1.5 units
	Glass (unspecified)	1 unit	N/A
Alcopops	Large can/bottle	2 units	2 units
	Small can/bottle	1 unit	1.5 units

<sup>a</sup> Participants are asked to count doubles as two glasses.

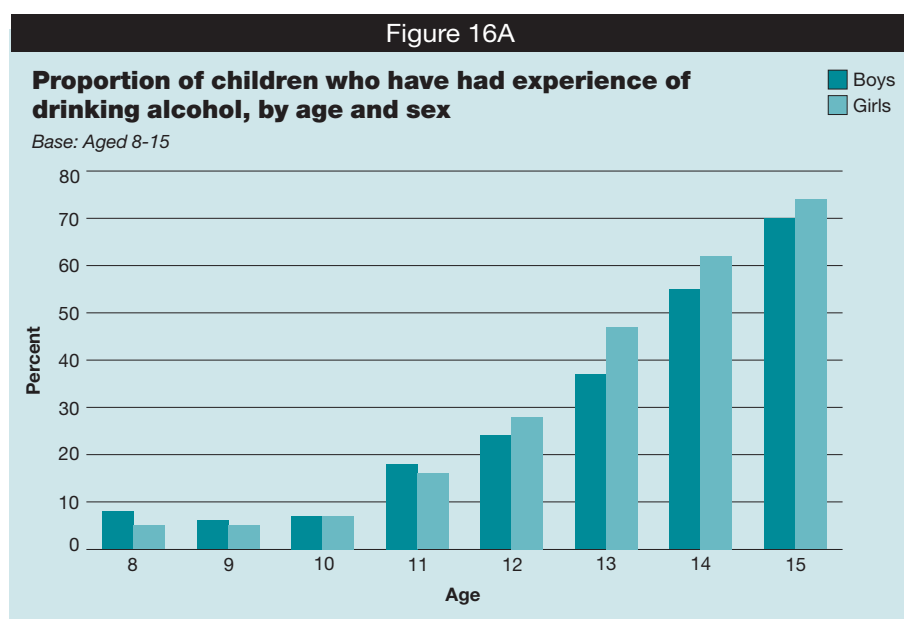
Although the adjustment outlined above has helped to improve the accuracy of alcohol consumption data, it is still not feasible in a survey of this nature to collect information about the exact strength or volume measure of some drinks consumed (for example, no distinction is made between beer and lager of different strengths, and children often do not drink spirits and fortified wines in standard pub measures), and so the total number of alcohol units is an estimate which involves some degree of approximation.

## 16.3 Experience of drinking alcohol

### 16.3.1 Experience of drinking alcohol among children aged 8-15

Table 16.1 and Figure 16A show the proportion by age of boys and girls who said they had ever had a whole proper alcoholic drink. The results shown are those obtained by the 'double-question' method outlined in section 16.2.1, that is, children are regarded as having experience of drinking alcohol if they answered 'yes' either to the question about whether they have ever had a proper alcoholic drink or to the question about alcopops. Overall, 29% of boys and 32% of girls aged 8-15 reported having experience of drinking alcohol. The proportion who have had experience of drinking alcohol increased with age, with 8% of boys and 5% of girls aged 8 having done so, compared with 70% of boys and 74% of girls aged 15.

Table 16.1



### 16.3.2. Comparison with the survey of Smoking, Drinking and Drug Use among Young People

Table 16B below shows a comparison with results from the 2008 survey of Smoking, Drinking and Drug Use among Young People (SDD), which is carried out annually among children aged 11-15 in secondary schools in England.<sup>13</sup> Results are presented in three separate columns for both boys and girls. The first column shows the proportion who have experienced alcohol as defined by the 'single' HSE question ('Have you ever had a proper alcoholic drink – a whole drink, not just a sip?'). This is the same question as that used in SDD. The second column shows the proportion who have experienced alcohol according to the 'double' HSE question (that is, including those who have had alcopops). The third column shows results from SDD.

Table 16B						
Experience of drinking alcohol						
Aged 11-15						
Age	Boys			Girls		
	HSE single question	HSE double question	SDD 2008	HSE single question	HSE double question	SDD 2008
	%	%	%	%	%	%
11	14	18	19	9	16	13
12	17	24	34	18	28	25
13	29	37	51	35	47	53
14	49	55	69	49	62	72
15	64	70	80	66	74	82
All 11-15	36	42	53	36	46	52

As the table shows, the single HSE question produced considerably lower estimates than the same question asked in SDD. This corroborates findings from HSE 2002, 2006 and 2007, and suggests that although questions about alcohol are asked as part of a self-completion questionnaire, children may still be concerned about parents seeing their answers. It is interesting to note that the double HSE question produced estimates that are closer to the results from SDD.

### 16.3.3 Frequency of drinking alcohol

Findings on children’s self-reported usual frequency of drinking are shown in tables 16.2, 16.3, 16.4 and 16.5. As most children, particularly in the younger age groups, are unlikely to have developed regular patterns of drinking, they might find the question on usual frequency difficult to answer. There was very little reporting of current alcohol consumption among children under the age of 12, with the vast majority saying they never drank or drank only a few times a year. Overall 3% of boys and 2% of girls aged 8-15 reported drinking once a week or more. The proportion who reported drinking at least once a week increased from 1% of both boys and girls aged 8 to 11% of boys and 9% of girls aged 15 (with the difference between boys and girls not being statistically significant). Figure 16B shows the proportion of children aged 11-15 who said they usually drank alcohol once a week or more often.

Tables 16.2-16.5, Figure 16B

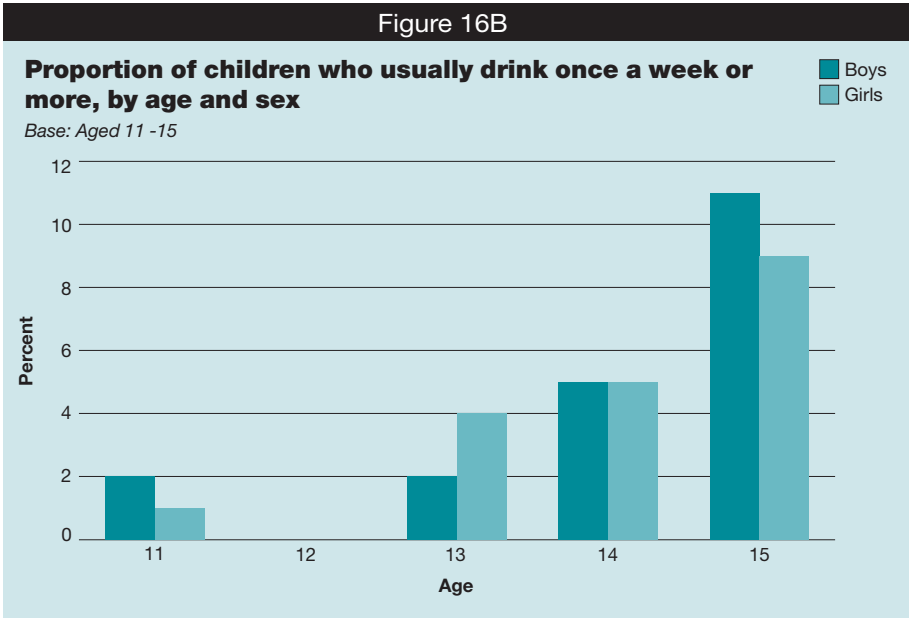


Table 16C below shows a comparison with the SDD survey<sup>13</sup> of the proportion of children aged 11-15 who reported usually drinking once a week or more. For reasons discussed above, the proportion of children who reported drinking regularly in HSE is considerably lower than that in SDD, but follows the same pattern of increasing with age.

Table 16C

Proportion usually drinking once a week or more

Aged 11-15

Age	Boys		Girls	
	HSE	SDD 2008	HSE	SDD 2008
	%	%	%	%
11	2	3	1	1
12	0	4	0	3
13	2	8	4	9
14	5	17	5	19
15	11	31	9	27
All 11-15	4	14	4	13

There was some regional variation in frequency of drinking when comparing Strategic Health Authority regions. The proportions of children drinking at least once a week were similar across regions, and nationally the proportion that said they never drink was 75% among boys and 73% among girls. However, the proportion of children who reported that they never drink was higher in London than other regions (87% of boys and 86% of girls in London said they never drink). There were no significant differences between boys and girls across regions.

There was a slightly different pattern between boys and girls according to quintile of equivalised household income. Girls living in households in the highest income quintile were more likely than girls in the other quintiles to say they had never had an alcoholic drink (84% in the highest quintile and 69%-74% in the second to fifth quintiles). There was less variation between income quintiles for boys, with those in the lowest quintile the most likely to say they had never had an alcoholic drink (80%). There was no variation between those living in Spearhead Primary Care Trusts and non-Spearhead Primary Care Trusts.<sup>22</sup>

**Table 16.3-5**

#### **16.3.4 Types of alcoholic drink**

11% of both boys and girls aged 13-15 reported drinking alcohol in the last seven days (a higher proportion than reported usually drinking at least weekly). These children were asked about the types of drinks and how much they had drunk. Beer, lager, cider or shandy were the drinks most frequently mentioned amongst boys, while among girls similar proportions mentioned alcopops, wine and beer, lager, cider or shandy. Consumption of each type of alcoholic drink increased with age, except for consumption of wine and fortified wines, which did not vary across the ages.

There were some differences in the types of drinks consumed by boys and girls. Boys were more likely than girls to have drunk beer, lager, cider or shandy (10% compared with 7%), whereas girls were more likely than boys to have drunk wine (5% compared with 3%).

Among the minority of children aged 13-15 who had drunk alcohol in the last seven days, there was considerable variation in the amount of alcohol they reported having drunk, ranging from less than one unit to 15 units or more.

**Tables 16.6-16.7**

## **16.4 Discussion**

When interpreting HSE data about children's drinking, it should be remembered that there is likely to be some under-reporting both of frequency of drinking and amount drunk.

Comparisons with the survey of Smoking, Drinking and Drug Use among young People (SDD) suggest that the data collection method influences responses among some children, and answering in the presence of parents sometimes inhibits honest reporting of drinking behaviour. Nevertheless, the HSE provides consistent trends over time (trend data are also published by The NHS Information Centre<sup>18</sup>).

Findings presented in this chapter suggest that age is a significant factor associated with children's alcohol consumption. The proportion of those ever having had an alcoholic drink increased with age, as did the frequency with which alcohol was consumed. Consistent with previous HSE findings, no significant differences between the sexes were observed in the 2008 survey, in terms of experience of drinking alcohol and frequency of consumption, suggesting that boys and girls had very similar patterns of alcohol consumption. Some differences between the sexes were observed in terms of the type of alcoholic drinks consumed, with boys being more likely to drink beer, lager, cider or shandy, and girls being more likely than boys to drink wine and alcopops. Again, these findings are consistent with previous HSE findings.

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- 18 [www.ic.nhs.uk/pubs/hse08trends](http://www.ic.nhs.uk/pubs/hse08trends)
- 19 Prior to 1998, the question read:  
How often do you usually have an alcoholic drink?  
Less than once a year  
Once or twice a year  
Once every couple of months  
Once or twice a month  
Once or twice a week  
Three or four times a week  
Five or six days a week  
Almost every day  
In 1998, the response categories were changed to:  
Almost every day  
About twice a week  
About once a week  
About once a fortnight  
About once a month  
Only a few times a year  
I never drink alcohol now.
- 20 Smyth M, Browne F. *General Household Survey 1990*. HMSO, 1992.
- 21 Goddard E. *Estimating alcohol consumption from survey data: improved method of converting volume to units*. ONS, 2007, available on <http://www.statistics.gov.uk/statbase/product.asp?vlnk=15067>
- 22 Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

- 16.1 Children's self-reported experience of drinking alcohol, by age and sex
- 16.2 Children's self-reported frequency of drinking alcohol, by age and sex
- 16.3 Children's self-reported frequency of drinking alcohol, by Strategic Health Authority and sex
- 16.4 Children's self-reported frequency of drinking alcohol, by equivalised household income and sex
- 16.5 Children's self-reported frequency of drinking alcohol, by Spearhead status and sex
- 16.6 Self-reported alcohol consumption in the last 7 days by children aged 13-15, by age and sex
- 16.7 Alcoholic drinks consumed in the last 7 days by children aged 13-15, by age and sex



Table 16.1

### Children's self-reported experience of drinking alcohol, by age and sex

Aged 8-15

2008

Experience of alcohol <sup>a</sup>	Age								Total
	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%
<b>Boys</b>									
Ever had proper alcoholic drink	8	6	7	18	24	37	55	70	29
<b>Girls</b>									
Ever had proper alcoholic drink	5	5	7	16	28	47	62	74	32
<i>Bases (unweighted)</i>									
Boys	203	223	231	239	241	267	255	223	1882
Girls	203	233	272	273	224	238	267	235	1945
<i>Bases (weighted)</i>									
Boys	202	213	221	219	215	240	261	233	1805
Girls	192	209	216	211	207	224	246	217	1722

<sup>a</sup> Results are based on those children who answered 'yes' either to the question about whether they have ever had a proper alcoholic drink, or to the question about whether they have ever had alcopops.

Table 16.2

### Children's self-reported frequency of drinking alcohol, by age and sex

Aged 8-15

2008

Frequency of drinking	Age								Total
	8	9	10	11	12	13	14	15	
	%	%	%	%	%	%	%	%	%
<b>Boys</b>									
Almost every day	0	-	-	1	-	-	-	-	0
About twice a week	-	-	-	0	-	1	-	5	1
About once a week	0	-	-	1	-	1	5	5	2
About once a fortnight	-	1	0	2	1	5	7	12	4
About once a month	1	-	1	1	2	5	10	13	4
Only a few times a year	3	3	3	9	13	21	28	25	14
Never drinks	95	97	96	86	83	67	50	38	75
Once a week or more <sup>a</sup>	1	-	-	2	-	2	5	11	3
<b>Girls</b>									
Almost every day	-	-	-	-	-	0	-	-	0
About twice a week	-	-	-	1	-	1	1	2	1
About once a week	1	-	-	-	-	3	4	7	2
About once a fortnight	-	0	-	0	-	2	7	11	3
About once a month	0	-	-	1	2	4	10	17	5
Only a few times a year	3	3	4	10	20	31	32	33	18
Never drinks	96	97	96	88	77	59	46	30	73
Once a week or more <sup>a</sup>	1	0	-	1	-	4	5	9	2
<i>Bases (unweighted)</i>									
Boys	202	221	229	237	239	264	252	220	1864
Girls	203	232	272	273	221	236	263	232	1932
<i>Bases (weighted)</i>									
Boys	202	212	219	217	214	238	259	229	1788
Girls	192	208	216	211	205	222	243	214	1712

<sup>a</sup> Figures for 'Once a week or more' are the sum of 'Almost every day', 'About twice a week' and 'About once a week'.



Table 16.3

**Children's self-reported frequency of drinking alcohol, by Strategic Health Authority<sup>a</sup> and sex**

Aged 8-15

2008

Frequency of drinking	Strategic Health Authority									
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West
	%	%	%	%	%	%	%	%	%	%
<b>Boys</b>										
Almost every day	-	-	-	-	-	-	-	-	2	-
About twice a week	-	1	1	1	1	1	0	2	1	0
About once a week	1	1	1	3	1	1	1	3	2	2
About once a fortnight	2	3	3	4	5	4	3	5	6	2
About once a month	4	3	5	3	6	6	2	8	2	6
Only a few times a year	17	20	16	11	10	15	7	15	17	15
Never drinks	76	73	72	77	78	72	87	67	70	75
Once a week or more <sup>b</sup>	1	1	2	5	2	3	1	5	5	3
<b>Girls</b>										
Almost every day	-	-	-	-	0	-	-	-	-	-
About twice a week	3	1	1	1	-	1	0	1	-	-
About once a week	1	1	3	2	2	3	1	2	3	2
About once a fortnight	2	4	3	2	2	2	2	3	4	3
About once a month	4	5	3	8	4	6	1	3	9	5
Only a few times a year	16	19	24	20	20	11	10	19	17	23
Never drinks	75	71	66	68	71	77	86	72	68	68
Once a week or more <sup>b</sup>	4	2	4	3	3	4	1	3	3	2
<i>Bases (unweighted)</i>										
Boys	88	283	202	155	179	222	239	170	145	181
Girls	102	291	229	161	210	223	225	149	160	182
<i>Bases (weighted)</i>										
Boys	80	233	190	154	195	205	262	156	139	174
Girls	86	235	202	142	203	189	231	124	138	161

<sup>a</sup> This table provides data for regional analysis by the configuration of Strategic Health Authorities (SHAs) in place from July 2006.<sup>b</sup> Figures for 'Once a week or more' are the sum of 'Almost every day', 'About twice a week' and 'About once a week'.

Table 16.4

**Children's self-reported frequency of drinking alcohol, by equivalised household income and sex**

Aged 8-15

2008

Frequency of drinking	Equivalised household income quintile				
	Highest %	2nd %	3rd %	4th %	Lowest %
<b>Boys</b>					
Almost every day	-	-	-	-	0
About twice a week	2	1	1	0	0
About once a week	1	3	1	2	2
About once a fortnight	5	3	4	4	2
About once a month	4	3	5	5	2
Only a few times a year	10	15	15	15	13
Never drinks	77	74	74	74	80
Once a week or more <sup>a</sup>	4	4	2	2	3
<b>Girls</b>					
Almost every day	-	-	-	0	-
About twice a week	-	0	0	1	1
About once a week	1	3	2	1	1
About once a fortnight	2	2	3	3	3
About once a month	3	5	6	5	3
Only a few times a year	10	19	21	15	22
Never drinks	84	71	69	74	70
Once a week or more <sup>a</sup>	1	3	2	3	2
<i>Bases (unweighted)</i>					
Boys	226	278	375	360	337
Girls	216	311	354	373	370
<i>Bases (weighted)</i>					
Boys	210	262	355	355	332
Girls	186	262	317	328	344

<sup>a</sup> Figures for 'Once a week or more' are the sum of 'Almost every day', 'About twice a week' and 'About once a week'.

Table 16.5

**Children's self-reported frequency of drinking alcohol, by Spearhead status<sup>a</sup> and sex**

Aged 8-15

2008

Frequency of drinking	Spearhead status	
	Non-Spearhead PCT %	Spearhead PCT %
<b>Boys</b>		
Almost every day	0	-
About twice a week	1	0
About once a week	2	1
About once a fortnight	4	3
About once a month	5	4
Only a few times a year	14	14
Never drinks	74	78
Once a week or more <sup>b</sup>	3	2
<b>Girls</b>		
Almost every day	0	-
About twice a week	0	1
About once a week	2	1
About once a fortnight	3	3
About once a month	5	4
Only a few times a year	17	19
Never drinks	73	72
Once a week or more <sup>b</sup>	3	2
<i>Bases (unweighted)</i>		
Boys	1177	676
Girls	1186	738
<i>Bases (weighted)</i>		
Boys	1137	641
Girls	1043	663

<sup>a</sup> Spearhead PCTs are the most health deprived areas of England. They are areas in the bottom fifth nationally for three or more indicators relating to life expectancy at birth, cancer and CVD mortality and the index of multiple deprivation.

<sup>b</sup> Figures for 'Once a week or more' are the sum of 'Almost every day', 'About twice a week' and 'About once a week'.

Table 16.6

**Self-reported alcohol consumption in the last 7 days by children aged 13-15, by age and sex**

Aged 13-15		2008		
Alcohol units	Age			Total
	13	14	15	
	%	%	%	%
<b>Boys</b>				
None	94	89	83	89
Less than 1 unit	1	2	2	2
1, under 2 units	0	1	2	1
2, under 4 units	1	2	4	2
4, under 6 units	1	1	2	1
6, under 10 units	1	2	5	2
10, under 15 units	2	1	2	2
15 or more units	-	1	1	1
<b>Girls</b>				
None	93	91	82	89
Less than 1 unit	1	1	2	1
1, under 2 units	1	1	1	1
2, under 4 units	1	3	5	3
4, under 6 units	2	1	1	2
6, under 10 units	1	1	4	2
10, under 15 units	-	1	2	1
15 or more units	1	0	2	1
<b>Bases (unweighted)</b>				
Boys	280	263	229	772
Girls	257	276	245	778
<b>Bases (weighted)</b>				
Boys	253	271	239	763
Girls	243	256	227	726

Table 16.7

**Alcoholic drinks consumed in the last 7 days by children aged 13-15, by age and sex**

Aged 13-15		2008		
Types of drink	Age			Total
	13	14	15	
	%	%	%	%
<b>Boys</b>				
Beer, lager, cider and shandy	5	10	17	10
Spirits and liqueurs	3	3	7	4
Fortified wines	1	-	2	1
Wine	1	3	3	3
Alcopops	4	5	6	5
Any alcoholic drink	6	11	17	11
<b>Girls</b>				
Beer, lager, cider and shandy	5	4	13	7
Spirits and liqueurs	3	3	7	4
Fortified wines	-	0	1	0
Wine	5	4	7	5
Alcopops	3	6	10	6
Any alcoholic drink	7	9	18	11
<b>Bases (unweighted)<sup>a</sup></b>				
Boys	279	262	229	770
Girls	256	275	245	776
<b>Bases (weighted)</b>				
Boys	252	270	239	761
Girls	241	255	227	723

<sup>a</sup> Bases shown are for valid cases on any alcoholic drink. Bases for the different types of drinks were of a similar magnitude.

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# Accelerometry: Data collection and processing



## A1 Equipment

The objective physical activity measurements in the HSE 2008 were taken using the Actigraph model GT1M (Actigraph, Pensacola, Florida, USA), a small and lightweight device (around the size of a matchbox) that is worn on the waist using a belt. The GT1M is a dual axis accelerometer; however, it was originally supplied with only one axis ‘turned on’<sup>1</sup> and was used in the HSE 2008 as a digital uni-axial accelerometer that records movement on the vertical axis.

Accelerometers were chosen in preference to pedometers. Pedometers are small, robust and relatively inexpensive devices which, when worn at the hip, count the number of steps walked per day. They have been shown to be effective as a tool in motivating as well as monitoring physical activity,<sup>2</sup> so are not suitable for measuring usual activity levels in the HSE. They also measure a much more limited range of activity than accelerometers.

## A2 Data collection

### A2.1 Exclusion criteria

Children aged 4-15 and adults aged 16 and over were eligible to be in the accelerometry sub-sample; there was no upper age limit. To keep household burden to a reasonable level, a maximum of two adults per household or one adult and one child per household were invited to wear an accelerometer.

Before participants were asked to wear an accelerometer, eligibility was checked, and the following exclusion criteria were applied:

- Younger than 4 at the initial interview;
- Pregnant (known by the participant), since HSE convention is to take no measurements from pregnant women;
- Confined to bed or in a wheelchair;
- Recent abdominal surgery or health problem that would make a belt round the waist uncomfortable;
- Latex allergy (the belt on which the accelerometer was worn contained latex).

### A2.2 Accelerometry sample

4,507 adults aged 16 or older and 1,707 children aged 4-15 were asked to participate in the accelerometry sub-study. A sub-sample of HSE participants was randomly selected (see Chapter 1, section 1.4.4 of this volume for brief description and Volume 2, Methods and documentation, Chapter 2 for full description of the sample design).

### A2.3 Fieldwork procedure

Participants were asked to wear the accelerometer during waking hours for seven consecutive full days. At the end of the initial interview, interviewers obtained agreement for participation in this element of the study, provided the accelerometers and explained

procedures. The protocols used for the placement are provided in Volume 2, Appendix B.

Participants were given an information leaflet (with separate versions for adults and children) and provided with an opportunity to ask any questions. They were given a telephone number to call if they had any queries during the period of measurement. The interviewer obtained verbal consent from the participant as part of the placement procedure.

For participants in the core sample, accelerometers were collected as part of the nurse visit which followed the interview. For those who refused a nurse visit or those in the child boost sample where there was no nurse visit, the interviewer returned to collect the accelerometer.

#### **A2.4 Interviewer training**

As part of the project-specific training they received, interviewers were given training specifically focused on the use of the Actigraph. Training included practical sessions about how the Actigraph should be worn and demonstrations of how to fit the Actigraph, as well as covering issues such as gaining consent, information required to be given to participants, the fieldwork process and answering questions that participants may have.

NatCen's Operations Department attended a separate session to train them in the use of the Actigraphs, the process of data download, and storage and preparation of the Actigraphs to be sent out to interviewers. The training also covered the use of the Actigraphs with participants so that the Operations Team could support the interviewers in the field and answer questions or queries.

#### **A2.5 Measures to encourage maximum participation**

Wearing an accelerometer for a week represents an additional burden for participants, and previous research suggests that participation declines towards the end of the measurement week. Therefore selected participants were offered a £20 high street voucher to thank them for their participation.

In addition, other compliance boosting techniques were applied:

- The interviewer gave the participant a list of tips and hints and frequently asked questions about wearing the accelerometer correctly;
- The interviewer made a reminder telephone call in the middle of the measurement week;
- Participants were shown an example of accelerometer output to demonstrate that it is possible to tell when it is not being worn.

#### **A2.6 Log book**

Accelerometer wear was possible during most activities during waking hours. However, there were some occasions where the accelerometer could not be worn, or was likely to under-represent the intensity of activity undertaken (since the uni-axial setting of the Actigraph recorded activity only in the vertical plane). Therefore the accelerometer may not have been worn during, or the measurement recorded may have under-represented some periods of relatively intense activity.

For this reason, while participants were not asked to keep detailed logs of their activity, they were asked to record a small number of specific items in a log book during the week of accelerometer wear. The log book recorded:

- Any periods where the accelerometer was taken off for swimming (since it is not waterproof);
- Any contact sports such as martial arts or rugby, if the participant chose not to wear the accelerometer to avoid injury, or damage to the device;
- Any periods of cycling or rowing, where the vertical activity recorded by the uni-axial accelerometer was likely to under-represent the intensity of activity involved.

The log book data have not been used in the analyses in this report (Chapters 3 and 6), although the data have been processed and will be available for future analyses. The

decision was taken to exclude logbook data from the analyses to avoid affecting the objective measurements by inclusion of subjective records. A small number of people (particularly those who cycle, row, or swim frequently) may have had their physical activity underestimated and their physical activity category wrongly assigned. However, this is likely to be a small proportion of participants. A far larger number would be affected by the introduction of subjective error from the logbooks. The difficulties associated with using log book data include potential errors with recording times for particular activities, and assumptions that have to be made for instance about:

- The level of intensity of activity if a participant did not wear the accelerometer e.g. for swimming or playing rugby;
- Whether the period for which the accelerometer was not worn was entirely spent in the stated activity, or whether some of the time was spent at a lower intensity, e.g. showering or changing afterwards;
- How much additional intensity should be added for an activity like cycling, where the accelerometer will have recorded some activity.

### **A3 Data processing**

Data collection and analytical procedures related to accelerometry in the HSE 2008 are described in Table A1. The raw data were analysed using custom software KineSoft version 3.0.98 to produce a series of standardised outcome variables.<sup>3,4</sup> The main variables of interest were average minutes of sedentary, light, moderate, and vigorous intensity physical activity per day. Intensity variables for activity and sedentary behaviour were analysed with the following time period groupings: daily, weekday, weekend day.

For a day to be valid for inclusion in the analyses, participants had to have worn the accelerometer for a minimum of 600 minutes (10 hours). Participants with at least four days of valid wear have been included in the analyses to provide average daily estimates. For analyses of summary physical activity levels, including whether participants had met government recommendations for weekly activity, only those with seven valid days were included.

In tables presenting average daily time in the various physical activity intensities (sedentary, light, moderate, vigorous and the summary variable moderate and vigorous activity, abbreviated to MVPA), an adjustment has been made for average wear time using regression techniques (taking into account the complex survey design). This allows comparisons between groups after adjusting for any differences in their average wear time.

Table A1

**Accelerometry data collection and analytical procedures****General information**

Device	Actigraph
Model	GT1M
Piezosensor orientation	Uni-axial
Number of accelerometers used	1042
Serial number range	LYN2B03080001 to LYN2B52070013*
Average number of deployments per unit	4.3 (ranging from 1 to 10)
Pre-deployment calibration check	No

**Setup information**

Deployment method	Accelerometers were delivered and attached by a trained interviewer during the household interview
Monitor initialisation	Pre-initialised centrally with a 0500 start time; however, the start time was adjusted to 0000 on the second day of wear for all participants
Requested days of wear	8 calendar days in order to attain 7 full days (i.e. 10080 minutes)
Mode	Counts only
Epoch	1 minute
Wear instructions	During all waking hours (except water based activities)
Location worn	Right hip at mid clavicular line (via adjustable nylon waist belt)

**Analytical decisions**

Non-wear time appropriation	Continuous zeros for 60 minutes or more (allowing 2 minutes of interruption) were re-coded as non-wear
Valid day criteria	10 hours of wear
Valid file	At least 4 valid days
Modelling/imputation of missing data	None
Daylight saving time	Files crossing DST in the spring or autumn of 2008 were corrected for the missing or repeat hour
Cutpoint reference(s)	For participants 4-15, age-specific cutpoints were used; these were developed by the Freedson group. <sup>5</sup> For participants aged 16 and over, the cutpoints used were developed by Troiano et al. <sup>6</sup> to determine light, moderate, and vigorous intensity physical activity. The sedentary cutpoint, although not empirically derived, has been published previously by Mattocks et al. <sup>7</sup>

\* Other monitors in addition to this serial number range were used LYN1A34050123, LYN1A40064289, LYN2BA05076328, and four files where the serial number was absent.

**References and notes**

- 1 The second axis of the GT1M accelerometer was available if a firmware update was downloaded and installed. Due to the large number of accelerometers used there were several firmware versions used in the HSE 2008. The firmware versions used, and the percentage of data obtained with that version, were as follows:  
2.3.1 (1.3%); 2.4.2 (7.0%); 3.0.0 (32.4%); 3.2.0 (27.0%); 4.2.0 (17.8%); 4.3.0 (13.8%); 5.0.0 (0.5%); 5.1.0 (0.1%).
- 2 Tudor-Locke C, Bassett D. *Pedometers: Walking by the numbers*. Consum Rep. October 2004;30-31. Quoted in Bravata D, Smith-Spangler C, Sundaram V et al. *Using Pedometers to Increase Physical Activity and Improve Health: A Systematic Review*. JAMA, 2007;**298**(19):2296-2304
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# Step test:

## Details of data processing and variable definitions

### Processing the data and deriving variables for fitness

This note provides technical detail of the methods for deriving fitness variables used in this report.

#### Data processing

The heart rate (HR) time-series data obtained for each participant were first annotated by phase: rest, exercise, and recovery. The start of recovery was taken to be the end of the step test, as recorded from the stop watch.

Measurement 'noise' in the HR data were classified as values outside the 25-220 beats per minute (bpm) range, as well as HR accelerations above 50 bpm between two consecutive measurements. Resting HR was derived as the minimum non-noisy HR observed, and this was the base against which all other HR observations were expressed as HR above rest (HRaR). It was usually the lowest non-noisy heart rate taken during the blood pressure measurements.<sup>1</sup>

#### Derivation of the $VO_{2max}$ fitness variables

The mass-specific mechanical work rate for lifting the body (lift power) in Joules per minute per kilogram (J/min/kg) is given by the product of body lift frequency (step frequency divided by four, since there are four step movements to each body lift), step height, and the gravitational constant:

$$\text{Lift power (J/min/kg)} = \text{lift frequency (lifts/min)} \times \text{step height (m)} \times 9.81 \text{ m/s}^2$$

An estimation equation has been derived for the physiological activity intensity (PAI) or net energy turnover rate required to cover the mechanical work for the step protocol. This was derived from a validation study in 51 men and women calibrating the step test against submaximal oxygen consumption,<sup>2</sup> complemented by internal comparisons for different step heights,<sup>3</sup> to derive the following equation:

$$\text{PAI (J/min/kg)} = 3.72 \times \text{Lift Power} + 64.1 \times \text{time} - 13.2 \times \text{time}^2 + 0.99 \times \text{time}^3$$

Omitting data from the first minute of stepping, a linear regression was fitted between this estimated physiological activity intensity and the observed non-noisy HRaR values to yield slope ( $\beta_{\text{step}}$ ) and intercept ( $\alpha_{\text{step}}$ ). This was done for participants who stepped for at least 4 minutes.

Similarly, the first 90 seconds of recovery heart rate values were fitted in a quadratic regression equation against recovery time, from which the one minute recovery HRaR ( $\text{recovHRaR}_{\text{step}}$ ) was derived by insertion of 60 seconds in the resulting regression equation.

Using the validation dataset,<sup>2</sup> an estimation of the *sub-maximal* physiological activity intensity during treadmill walking and running was derived, which utilises the five calibration parameters available in the survey ( $\beta_{\text{step}}$ ,  $\alpha_{\text{step}}$ , one minute recovery HRaR, step test duration and resting heart rate).

$$\begin{aligned} \text{PAI}_{\text{walk/run}} \text{ (J/min/kg)} = & (4.2 + 0.45 \times \beta_{\text{step}} - 0.014 \times \text{recovHRaR}_{\text{step}}) \times \text{HRaR} + \\ & 0.37 \times \alpha_{\text{step}} + 14.8 \times \text{step test duration} - 0.63 \times \text{recovHRaR}_{\text{step}} - 0.14 \times \text{RHR} - 149 \end{aligned}$$

An estimate of the maximal physiological activity intensity ( $VO_{2max}$ ) can be derived by substitution of HRaR by an estimate of the maximal HRaR, predicted from age.<sup>4</sup> To this an

estimate of resting metabolic rate (RMR)<sup>5</sup> is added to yield maximal total metabolic rate. To convert Joules into millilitres of oxygen, Joules are divided by the energetic value of oxygen, 0.23 J/ml:<sup>6</sup>

$$VO_{2\max} (\text{ml O}_2/\text{min/kg}) = (\text{max PAI}_{\text{walk/run}} + \text{RMR}) / 0.23$$

## References and notes

- 1 Occasionally, participant's heart rate during the recovery phase after stopping the step test was lower than the 'resting' heart rate during blood pressure measurement (for example, some people do not like having their blood pressure measured). In those cases, the resting heart rate actually comes from the last section of the recovery phase.
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- 3 This work was conducted by the MRC Epidemiology Unit in Cambridge, whose staff we thank for their contributions to HSE 2008.
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- 6 Consolazio CF, Johnson RE, Pecora LJ. *Physiological measurements of metabolic functions in man*. New York: McGraw Hill, 1963.

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## **Research Department of Epidemiology and Public Health, UCL Medical School**

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The Research Department of Epidemiology and Public Health, chaired by Professor Sir Michael Marmot, is a leading centre for research into the social determinants of health. The department has a strong interdisciplinary structure. The Department houses over 170 staff, in 11 main research groups, namely the Joint Health Surveys Unit, part of the Health and Social Surveys Research Group; Cancer Research UK-funded Health Behaviour Research Centre; Central and Eastern Europe Research Group; Dental Public Health; Health Care Evaluation Group; International Centre for Life Course Studies; MRC Unit for Lifelong Health and Ageing (including the National Survey of Health and Development); Psychobiology Group; Clinical Epidemiology Group; Genetic Epidemiology Group; and the Whitehall II Study. Collaborative research is conducted through the International Institute for Society and Health and across the Division.

The Department's research programme is concerned particularly with social factors in health and illness and inequalities in these, including national cross-sectional surveys of health and behaviour (such as diet), longitudinal studies of cardiovascular disease (Whitehall studies) and the English Longitudinal Study of Ageing (ELSA); international studies of cardiovascular disease and diabetes; sociodemographic indicators of need; and the socio-economic and policy implications of an ageing population.