Obesity among children under 11

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Contents

Summary

- This report presents key information about obesity among children aged under 11 living in England, based on data from the Health Survey for England. It is intended to support the development of an evidence-based approach to prevention, management and treatment of obesity in children.

- Between 1995 and 2003, the prevalence of obesity among children aged 2 to 10 rose from 9.9% to 13.7%.

- The percentage of children aged 2 to 10 who were overweight (including those who were obese) rose from 22.7% in 1995 to 27.7% in 2003.

- Overall, levels of obesity were similar for both boys and girls aged 2 to 10. For boys, obesity rose from 9.6% in 1995 to 14.9% in 2003, for girls obesity rose from 10.3% in 1995 to 12.5% in 2003.

- Between 1995 and 2003, levels of obesity rose among children aged 2 to 10. However, increases in obesity prevalence were most significant among older children aged 8 to 10, rising from 11.2% in 1995 to 16.5% in 2003.

- Obesity prevalence among children aged 2 to 10 varied according to region and area type. Obesity levels were lowest in Yorkshire and the Humber (11.4%) and the South East (13.4%) and highest in the North East (18.3%) and London (18.2%) in 2001 and 2002. Furthermore, obesity was higher among children living in inner city areas than among children living in all other types of area.

- In 2001 and 2002, levels of obesity for children aged 2 to 10 differed between various socio-demographic groups. For example, children living within households with the lowest levels of household income had higher rates of obesity than children from households with the highest levels of household income (15.8% compared with 13.3%). The same pattern was evident within different levels of area deprivation. Levels of obesity were 5 percentage points higher among children living within the most deprived areas (16.4%) than the least deprived areas (11.2%). Within socio-economic group (analysed using the National Statistics Social-Economic Classification, a classification similar to social class), 17.1% of children within semi-routine and routine households were obese compared with 12.4% of those from managerial and professional households.

- 19.8% of children living in households where both parents were either overweight or obese were themselves obese compared with 6.7% of children living in households where neither parents were overweight or obese and 8.4% of children living in households where one of the two parents was overweight or obese.

- This report uses the UK National Body Mass Index (BMI) percentile classification to describe childhood overweight and obesity among children aged 2-10. Explanation of this measure is given in the technical annex of this report.

1. Introduction

This report presents key information about obesity among children aged 2 to 10 living in England. It is intended to support the development of an evidence-based approach to the prevention, management and treatment of obesity in children. This report will therefore be of interest to those in the NHS, local authorities, non-governmental organisations and the independent sector with responsibilities for local action on diet, nutrition and physical activity. It will also be of interest to those within the food and leisure industries and academia.

The public health White Paper *Choosing Health: Making Healthy Choices Easier* set out government commitments for action on obesity, including stemming the rise in obesity among children aged under 11.[1] This reflects the Public Service Agreement (PSA) shared by the Department of Health, the Department for Education and Skills and the Department for Culture, Media and Sport to halt the year-on-year rise in obesity among children aged under 11 by 2010 in the context of a broader strategy to tackle obesity in the population as a whole.[2] The government's *Choosing Health White Paper Delivery Plan, Food and Health Action Plan,* and *Physical Activity Plan,* provide further details on the action that needs to be taken at national, regional and local level to improve people's health through improved diet and nutrition and increasing physical activity. They also outline action regarding work towards the PSA target on obesity.[3]

Choosing Health: Making Healthy Choices Easier used data from the Health Survey for England to show that levels of obesity among children aged 2-10 increased by 6 percentage points between 1995 and 2002, rising to 15.5% in 2002. This rise in childhood obesity was of particular concern as studies have shown that childhood and adolescent obesity can persist into adulthood where the health risks of obesity are more severe.[4] For example, obesity is one the key risk factors for diabetes and cardiovascular disease.

The National Audit Office has recommended that greater effort be given to establishing an evidence-based approach to issues surrounding obesity.[5] Furthermore, NHS Strategic Health Authorities and Primary Care Trusts are expected to make use of the best available evidence in establishing Local Development Plans on obesity. This report is intended to support the development of an evidence-based approach to tackling obesity by highlighting key areas relating to childhood obesity.

As a reflection of policy initiatives and targets, this report focuses on children under the age of 11. Section 3 presents trends in the prevalence of both obesity and overweight (including obese) among children aged 2-10. Section 4 looks at a range of social, demographic and behavioural factors that may be related with increased levels of obesity. These factors range from where a child lives to the level of income within their household, their consumption of fruit and vegetables, the prevalence of parental obesity and the child's level of physical activity. By analysing both the current trends of obesity and then specifically looking at factors associated with it, this report aims to provide a fuller picture of obesity among children living in England.

2. Methods

2.1 Health Survey for England

This report uses information collected from the Health Survey for England (HSE). HSE is an annual survey that is designed to monitor the nation's health. Every year around 16,000

adults and 4,000 children, representative of the whole population, are interviewed. As part of this process, height and weight measurements are collected which enables a Body Mass Index (BMI) figure to be calculated for each informant (see section 2.2). Height and weight information has been collected among children since 1995 using the same protocol so that data on levels of obesity among children can be derived. These are presented in section 3 which discusses trends in levels of childhood obesity from 1995 until 2003, where 2003 data are the latest data available.

Every year HSE focuses on a specific topic (such as cardiovascular disease) or population group of interest, such as people from minority ethnic backgrounds, as well as getting information from core sets of questions and measurements (such as height and weight). In 2002, the focus was the health and lifestyle of children and young adults.[6] This survey year included a boost sample of both of these groups, where more children and young adults were interviewed than in a standard HSE year (over twice the number of children aged 2-10 were interviewed in 2002 compared with 2001). This information was then combined with data collected from children and young adults interviewed during HSE 2001.[7] The purpose of this was to generate much larger sample sizes than are usually obtained from a single HSE year. Doing this allows more complex statistical analyses to be undertaken and statistically significant differences between smaller sub-groups (such as age groups) to be detected.[8]

This report draws on the availability of the combined 2001 and 2002 data to highlight key issues relating to childhood obesity. Therefore, the first section of this report focuses on trends in obesity across single years, but then uses the greater depth of information provided by the 2001 and 2002 combined data when analysing the relationships between social demographic factors and obesity.

2.2   Measuring obesity among children

In order to define overweight or obesity, a measurement is required that takes into account differences in weight due to height. A commonly accepted measure is Body Mass Index (BMI) which is defined as weight (kg) divided by height squared (m^2). The selection of BMI to measure levels of obesity among children is supported by the International Obesity Task Force.[9]

Measuring obesity among children uses different methodology than measuring obesity among adults. Different growth patterns among boys and girls at each age, mean that a universal categorisation cannot be used to define childhood obesity (as with adults). Each sex and age group therefore needs its own level of classification for obesity. This report uses the UK National BMI percentile classification to describe childhood overweight and obesity. This gives the BMI threshold for each age above which a child is considered overweight or obese.

2.3   Methodological approaches

Weighting

When interviewing children for HSE, it is standard protocol that only two children per household are eligible for interview. This means that in households with more than two children, a random selection is made to identify which two children should be interviewed. In households where there is only one child or a maximum of two children per household, these children would always be selected for interview. This protocol makes children's probability of selection for interview uneven. As such, since 1995, all child data has been weighted to take into account these different selection probabilities. Therefore all estimates presented in this

report have been weighted accordingly (see technical annex for a fuller description of the weighting process).

Statistical significance

This report focuses on findings that are statistically significant. This refers to the process of testing the survey estimates to ensure that the differences between sub groups are real and not the result of sampling error (see technical annex for a fuller description of significance testing). It should be noted that where the term 'significant' is used within this report, this refers to statistical significance and does not imply substantive importance. Furthermore, some findings have been presented that, though interesting, are not statistically significant. Where this has occurred, this point has been made explicit within the text.

3.   Trends in obesity and overweight

This section examines trends in overweight and obesity among children aged 2-10 with a valid BMI[10] between 1995 and 2003.[11] It looks specifically at trends in obesity and overweight among different age groups, differences between the sexes and also trends among children from households of different socio-economic status.

3.1   Overall trends in overweight and obesity, 1995 to 2003

The proportion of children who were overweight (including obese children) has tended to increase since 1995. From 1995 to 2003, the prevalence of overweight rose from 22.7% to 27.7%. The prevalence of obesity followed the same pattern, increasing from 9.9% in 1995, to 15.5% in 2002 and was 13.7% in 2003.

Figure 1
Overweight and obesity prevalence among children aged 2-10, 1995-2003
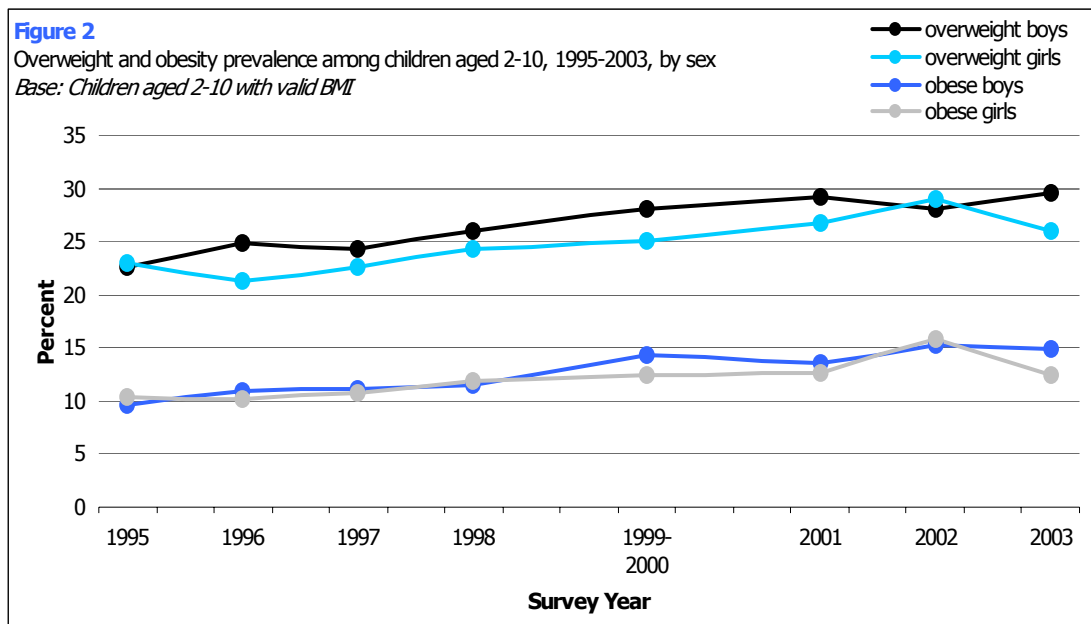*Base: Children aged 2-10 with valid BMI*
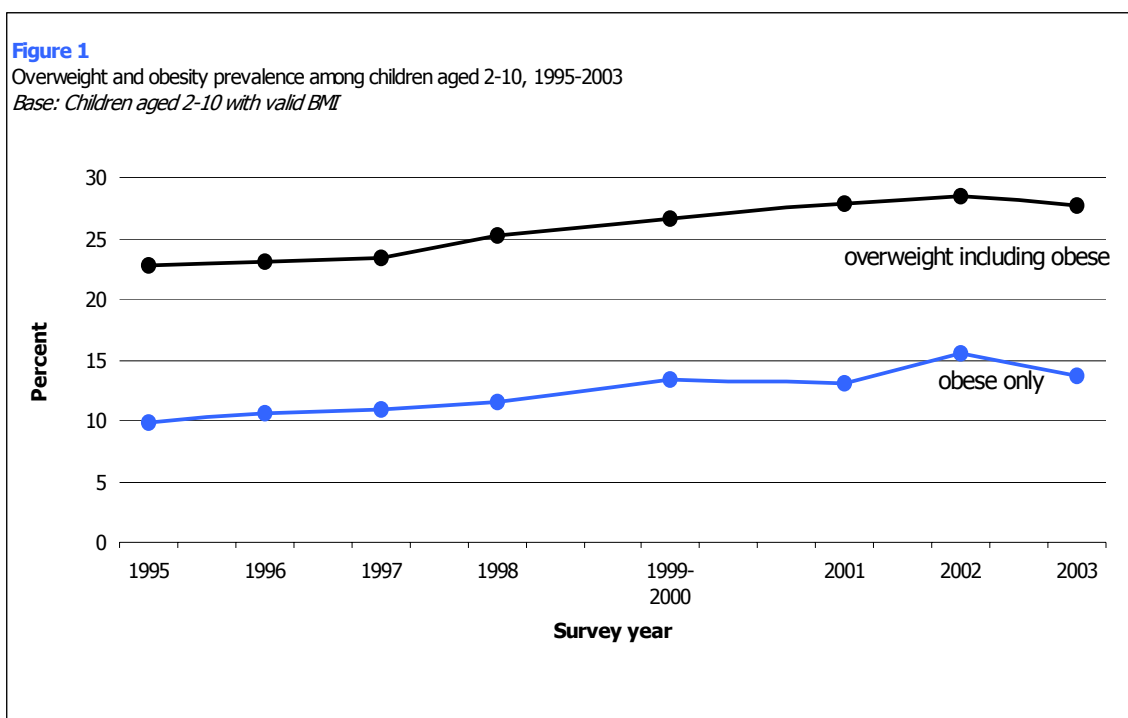
Obesity and overweight estimates in 2003 showed a slight decline compared with estimates for 2002. However, the difference between the two years was not significant. This means it is not possible to say whether this was a real decline in obesity prevalence, or whether simply by chance, fewer obese children were sampled in 2003.

(Table 1, Figure 1)

3.2 Trends in overweight and obesity among boys and girls

The prevalence of overweight and obesity among boys and girls was very similar, with both sexes showing gradual increases in both categories. For boys, levels of obesity rose from 9.6% in 1995 to 14.9% in 2003, equivalent figures for girls were 10.3% and 12.5%. Across the same time period, rates of overweight for boys increased from 22.5% to 29.6 % and for girls rose from 22.9% to 25.9%.

Figure 2
Overweight and obesity prevalence among children aged 2-10, 1995-2003, by sex
Base: Children aged 2-10 with valid BMI

As the rate of increase in obesity prevalence for both sexes was very similar, this report therefore focuses on all children rather than presenting all results by sex.

(Table 2, Figure 2)

3.3 Trends in overweight and obesity by age group

The increase in obesity between 1995 and 2003 consisted of increases across all four age groups presented (2-3, 4-5, 6-7, 8-10). However, the gradual overall increase in obesity from 1995 to 2003 masks some important differences between these age groups. Obesity has increased the most among older children aged 8-10 (11.2% in 1995, 16.5% in 2003) and the least among younger children aged 2-3 (9.4% in 1995, 11.2% in 2003). The increase in obesity among 8-10 year olds was significant, but there were no significant increases for the other age groups.

(Table 3, Figure 3)

Figure 3
Obesity prevalence among children aged 2-10, 1995-2003 by age group
Base: Children aged 2-10 with valid BMI

Legend: Age 2 to 3, Age 4 to 5, Age 6 to 7, Age 8 to 10
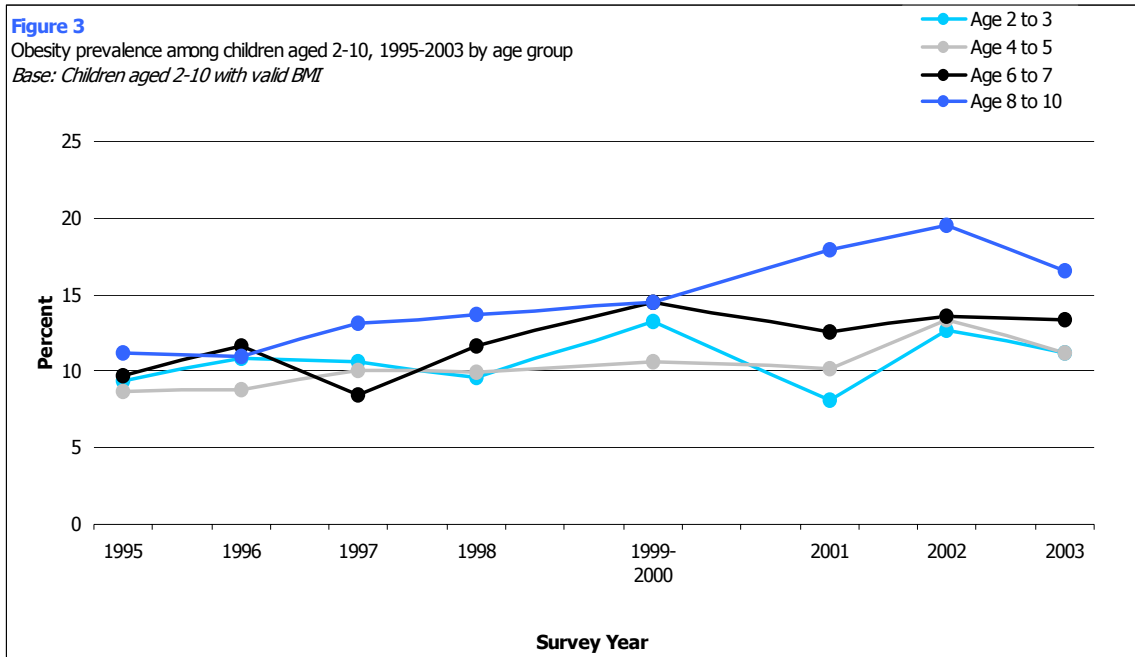
The increase in overweight (including obesity) followed the same pattern as that for obesity. Across most age groups, the proportion of overweight including obese increased. However, these increases were significantly greatest among the two older age groups, with a 7 to 8 percentage point increase in overweight including obese occurring between 1995 and 2003 for those aged 6-10.

(Table 3, Figure 4)

Figure 4
Overweight prevalence among children aged 2-10, 1995-2003 by age group
Base: Children aged 2-10 with valid BMI

Legend: Age 2 to 3, Age 4 to 5, Age 6 to 7, Age 8 to 10
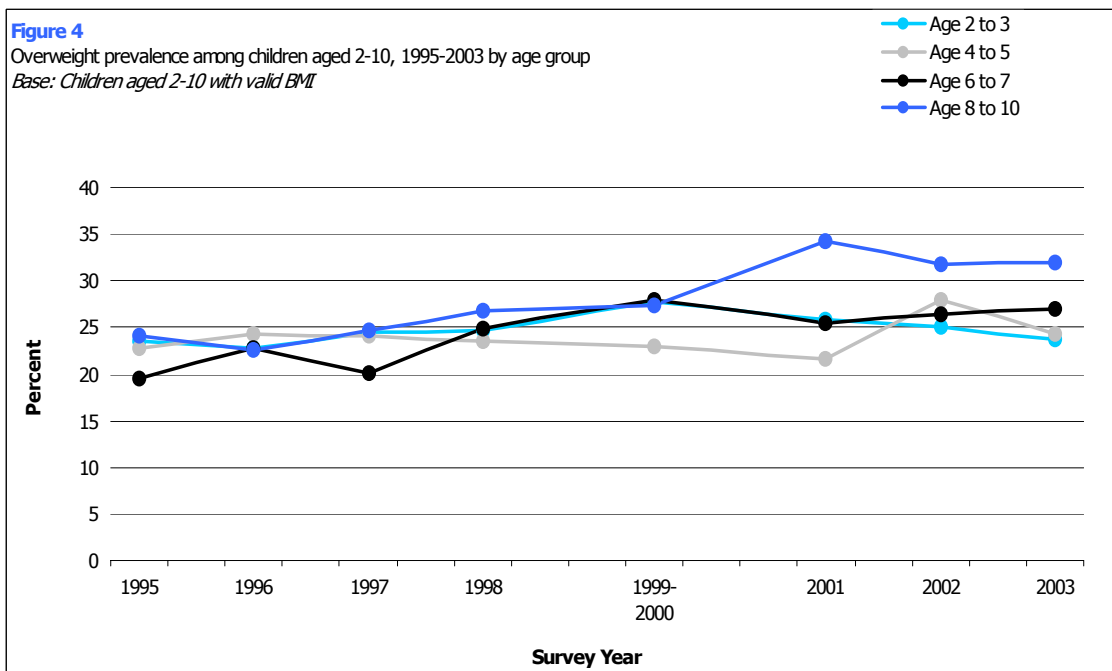
3.4 Trends in overweight and obesity by social class of head of household

The prevalence of childhood obesity was examined in relation to social class, as classified by the head of household's type of job.[12] In a two-parent household, the head of household is the father, in a one-parent household, it is the parent or legal guardian. The head of household's job can be classified into different categories ranging from professional occupations to unskilled manual occupations. For the following analysis, these groupings have been combined into two categories: manual and non-manual occupations.

Table 4 shows trends in childhood obesity and overweight (including obese) by social class from 1995 to 2003. Levels of obesity and overweight among children increased similarly for both groups. Between 1995 and 2003, obesity prevalence rose by 5 percentage points for those in manual households and rose by 3 percentage points for those in non-manual households. Increases in overweight (including obesity) followed the same pattern, increasing by 7 percentage points for those in manual households and 5 percentage points for those in non-manual households between 1995 and 2003.

For most years, there were no significant differences in levels of obesity between children living in manual households compared with those living in non-manual households. 1998, 2002 and 2003, however, were the exceptions, where significantly more children from manual households were obese compared with those from non-manual households. It will be of interest to see if this is indicative of an emerging trend in future survey years.

(Table 4)

4. Obesity by socio-demographic factors

Obesity prevalence among children aged 2-10 years was examined in relation to a number of socio-demographic indicators including geographic region, type of area, area deprivation (Index of Multiple Deprivation 2000) and household income. Levels of obesity were also assessed according to children's daily fruit and vegetable consumption, parental BMI status and children's levels of physical activity.

The risk of obesity and its associations with socio-demographic indicators was analysed using data collected from HSE 2001 and HSE 2002. HSE 2002 included a boost sample of children and young adults. Combining this information with data collected in HSE 2001 provides much larger sample sizes than focusing on a single HSE year and consequently allows robust statistical analyses to be undertaken.

4.1 Obesity by Government Office Region

When analysing levels of obesity by geographic region, there are a number of categories that can be used: counties, strategic health authority areas, postcode areas, electoral wards and so on. For this report, Government Office Region (GOR) was the preferred measure for analysis, as examination of smaller geographical areas requires much larger sample sizes than currently available.

Figure 5 shows levels of obesity by Government Office Region. Obesity prevalence was lowest in Yorkshire and the Humber (11.4%) and the South East (13.4%) and highest in the North East (18.3%) and London (18.2%).

Compared with the overall level of childhood obesity, only London had significantly different rates of obesity to the average.[13] Prevalence of obesity in London (18.2%) was 3 percentage points higher than the national average (14.8%).

(Table 5, Figure 5)
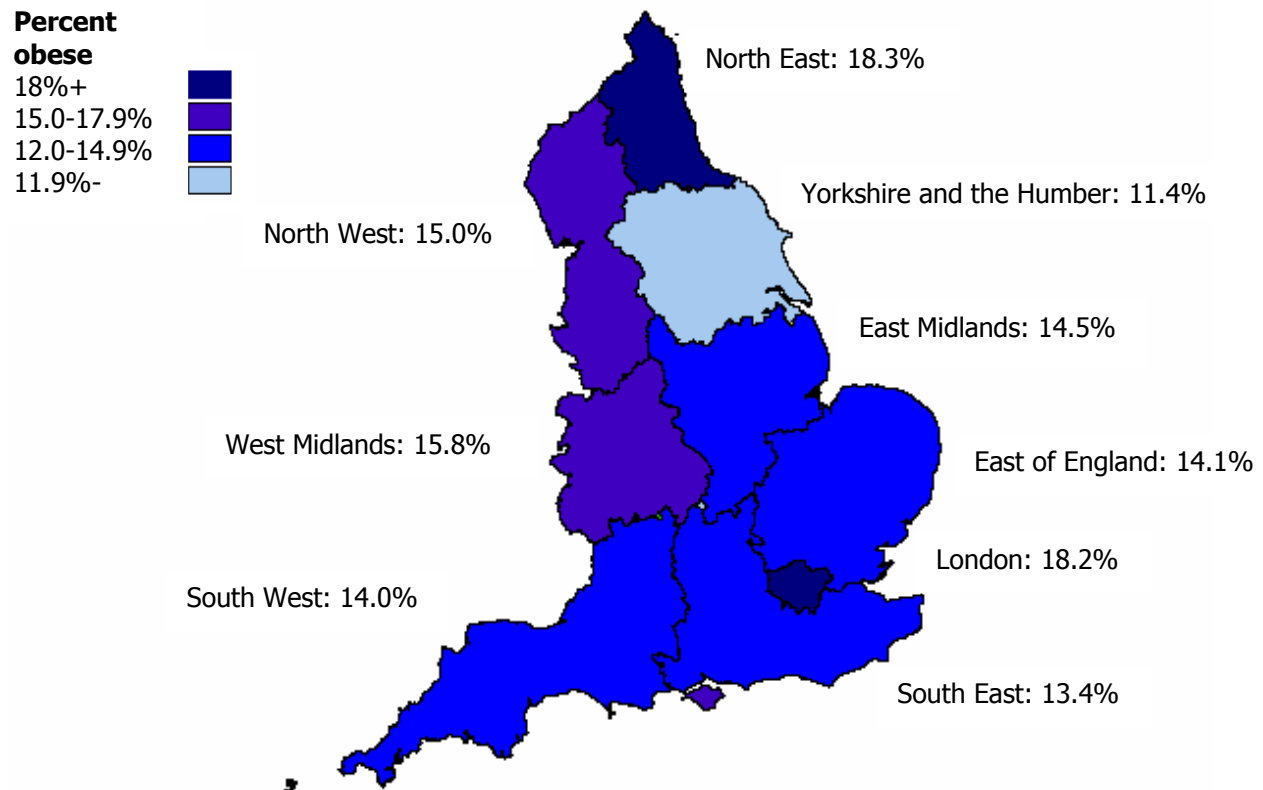
Figure 5: Obesity among children aged 2-10, by Government Office Region, 2001-2002

4.2   Obesity by type of region

Levels of obesity were also analysed in relation to the types of areas in which children lived. The different types of areas considered were: inner city, other dense urban/town centre, suburban residential and rural areas.

The prevalence of obesity was highest among children from inner city areas than from all other area types. Around one in five children from inner city areas were obese whereas less than one in six children from the other types of area were obese.

Analysis by Government Office Region showed that London had a high rate of obesity (see section 4.1), which could be indicative of an association between inner city areas and higher rates of childhood obesity.

(Table 5, Table 6)

4.3   Obesity prevalence among children, by area deprivation

The relationship between the prevalence of obesity among children and area deprivation was analysed using the Index of Multiple Deprivation 2000 (IMD).[14] The IMD takes into account the level of deprivation of local areas by focusing on six area characteristics. These are

income; employment; health deprivation and disability; education, skills and training; housing and geographical access to services. The index is presented in quintiles, ranging from the least deprived areas (first quintile) to the most deprived areas (fifth quintile).
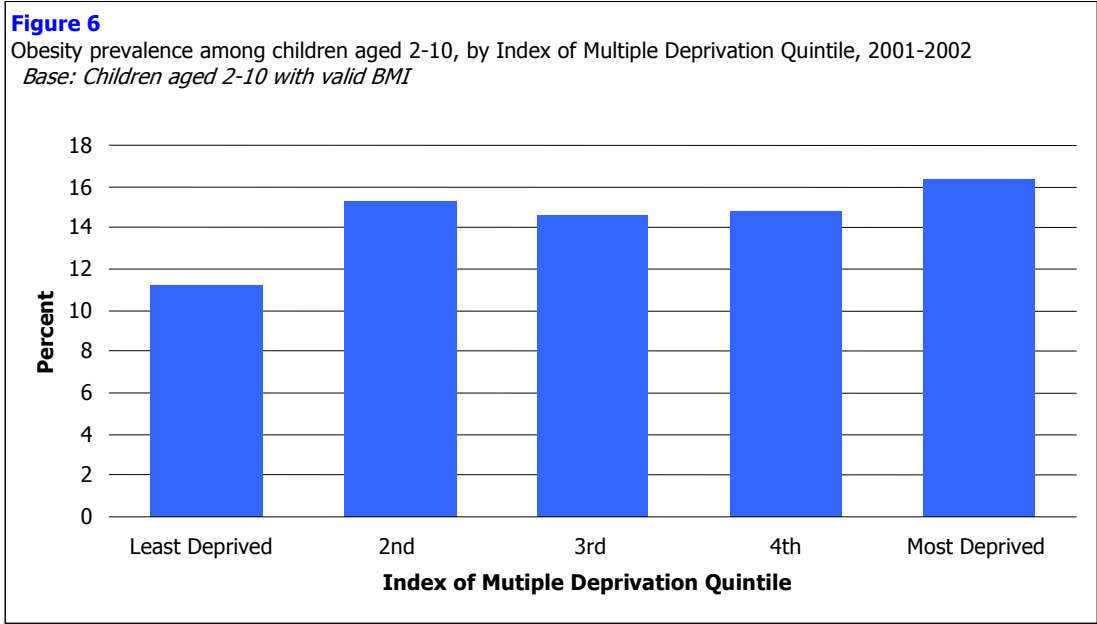
There was a clear association between the prevalence of obesity among children and area deprivation. Levels of obesity increased from 11.2% for those in the least deprived quintile to 16.4% for those in the most deprived quintile. The prevalence of obesity tended to increase as area deprivation increased, although there was not a consistent gradient (see figure 6). There were no significant differences between those in the second, third and fourth quintiles.

(Table 7, Figure 6)

Figure 6
Obesity prevalence among children aged 2-10, by Index of Multiple Deprivation Quintile, 2001-2002
Base: Children aged 2-10 with valid BMI

To summarise, these findings reveal that there is a tendency for obesity prevalence to increase as area deprivation increases.

4.4   Obesity prevalence among children, by household income

The prevalence of obesity among children aged 2 to 10 was analysed in relation to household income, which has been adjusted to take into account the number of persons in a household. Household income has been categorised into 5 specified groupings, ranging from the highest household income (first quintile) to the lowest (fifth quintile).[15]

There was a relationship between childhood obesity prevalence and household income. In particular, childhood obesity rates increased from 13.3% and 12.5% in the two highest income quintiles to 16.3% and 15.8% in the two lowest income quintiles.

(Table 8, Figure 7)

Figure 7
Obesity prevalence among children aged 2-10, by equivalised household income quintile, 2001-2002
Base: Children aged 2-10 with valid BMI and income information

[Bar chart showing Percent (y-axis, 0 to 18) by equivalised household income quintile (x-axis): Highest ≈13.3, 2nd ≈12.5, 3rd ≈14.2, 4th ≈16.3, Lowest ≈15.8]

equivalised household income quintile
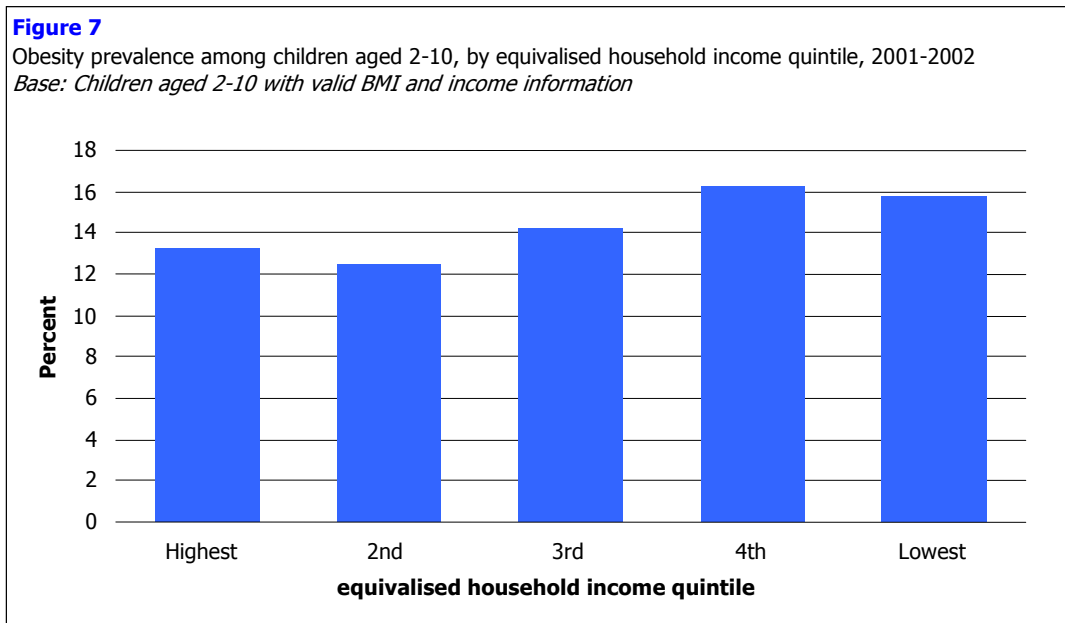
4.5   Obesity prevalence among children, by socio-economic classification (NS-SEC)

National Statistics Socio-Economic Classification (NS-SEC) is a classification of social position that was introduced in the 2001 census. It has similarities to Registrar General's Social Class, which was used in Section 3.4 to present trends since 1995. Since the introduction of NS-SEC in 2001, it has become a standard measure of socio-economic classification and hence it has been presented within this report using the combined HSE 2001 and 2002 data. Respondents are assigned to an NS-SEC category based on current or former occupation of the household reference person (see technical annex). The five categories presented are managerial and professional, intermediate (e.g. clerical, administrative, sales), small employers and self-employed workers, lower supervisory and technical, and semi-routine and routine occupations.

Levels of childhood obesity were lowest among managerial or professional households (12.4%) and highest among semi-routine and routine households (17.1%).

(Table 9, Figure 8)

Figure 8
Obesity prevalence among children aged 2-10, by NS-SEC of household reference person, 2001-2002
Base: Children aged 2-10 with valid BMI
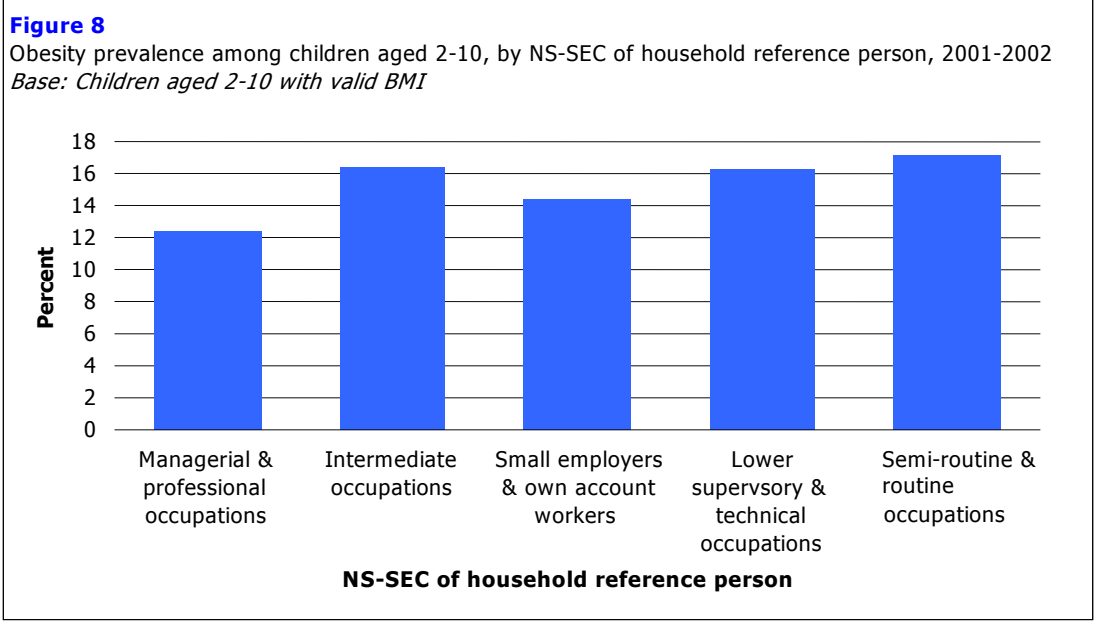
4.6   Obesity prevalence among children, by parental BMI status

Parental Body Mass Index (BMI) was used to assess the associations between parental obesity and the occurrence of obesity among children. BMI provides a measure of obesity that accounts for differences in weight due to height and is defined as weight (kg)/height squared (m^2).

In this context, obesity rates among children were analysed by comparing parental BMI status on three levels. These were children with neither parent classified as obese or overweight, children with one parent classified as obese or overweight and children with both parents classed as obese or overweight.[16] In the following analysis lone parent households were excluded and therefore this data is based on children who lived with both parents at the time of interview.

A clear relationship between parental BMI status and rates of obesity among children was evident. In households where both parents were classed as obese or overweight, 19.8% of children were obese. This is compared with just 6.7% of children in households where neither parent was obese or overweight.

Figure 9
Obesity prevalence among children aged 2-10, by parental BMI status, 2001-2002
Base: Children aged 2-10 with valid BMI
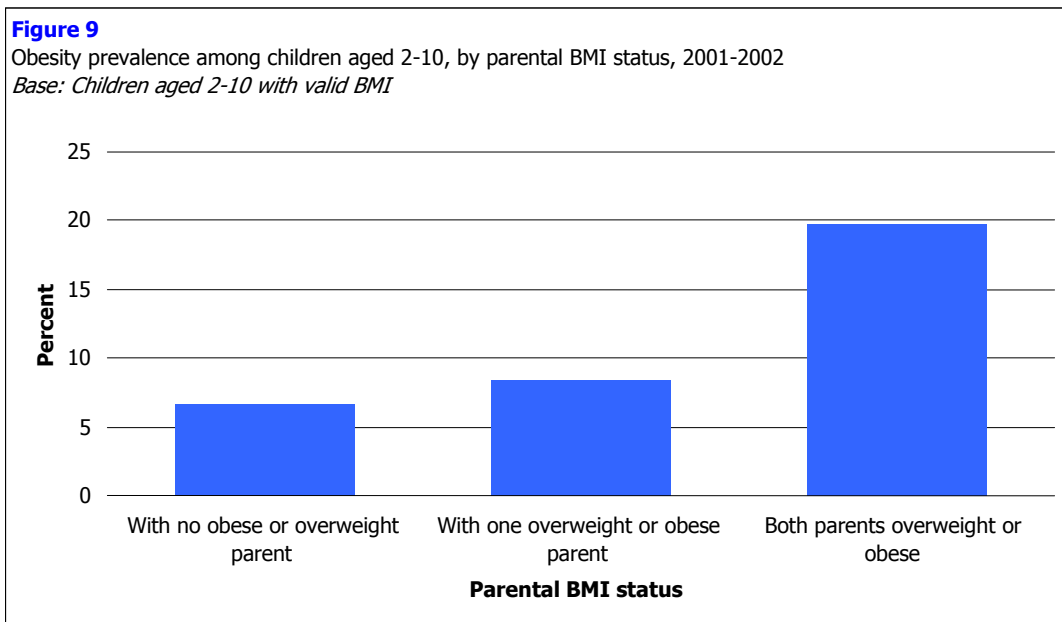
Levels of childhood obesity were also 11 percentage points higher in households where both parents were overweight or obese (19.8%), compared with households where just one parent was overweight or obese (8.4%). Interestingly, there were no significant differences in childhood obesity between households where neither parent was obese or overweight (6.7%) and those where one parent was overweight or obese (8.4%). The findings from this report highlight the importance of family behaviours and the influence they have on child obesity, as children within households where both parents are overweight or obese are themselves more likely to be obese.[17]

(Table 10, Figure 9)

4.7   Obesity prevalence among children, by daily fruit and vegetable consumption

Table 11 shows the prevalence of childhood obesity by different levels of fruit and vegetable consumption. Fruit and vegetable consumption was measured according to a 24-hour recall period and was grouped into three categories: one or less portions per day; more than one and less than five portions a day; five or more portions per day.[18] The following analysis is restricted to children aged 5-10 as these questions are only asked of children aged 5 and over.

There were no significant differences in levels of obesity between children who consumed either one or less portions of fruit and vegetables (15.2%), children who consumed more than one but less than five portions of fruit and vegetables (15.8%), and the minority of children who had consumed five or more portions a day (18.4%).

Readers should interpret apparent differences in obesity between these groups with caution as the differences were not statistically significant and may have been prone to possible biases within the data. In particular, only around one eighth of children aged 5-10 actually consumed five or more portions of fruit and vegetables per day. With such small numbers of children, no significance should be attached to the levels of obesity evident for this group. Furthermore, details of children's fruit and vegetable consumption are collected through a proxy interview where parents or legal guardians provide answers on behalf of the child. Recent evidence has suggested that people who are obese may misreport food consumption when asked.[19] As parents of obese children are more likely to be either overweight or obese

themselves (see section 4.6), it may be that 'calorie rich' food consumption is under-reported and consumption of food such as fruit and vegetables is over-reported.
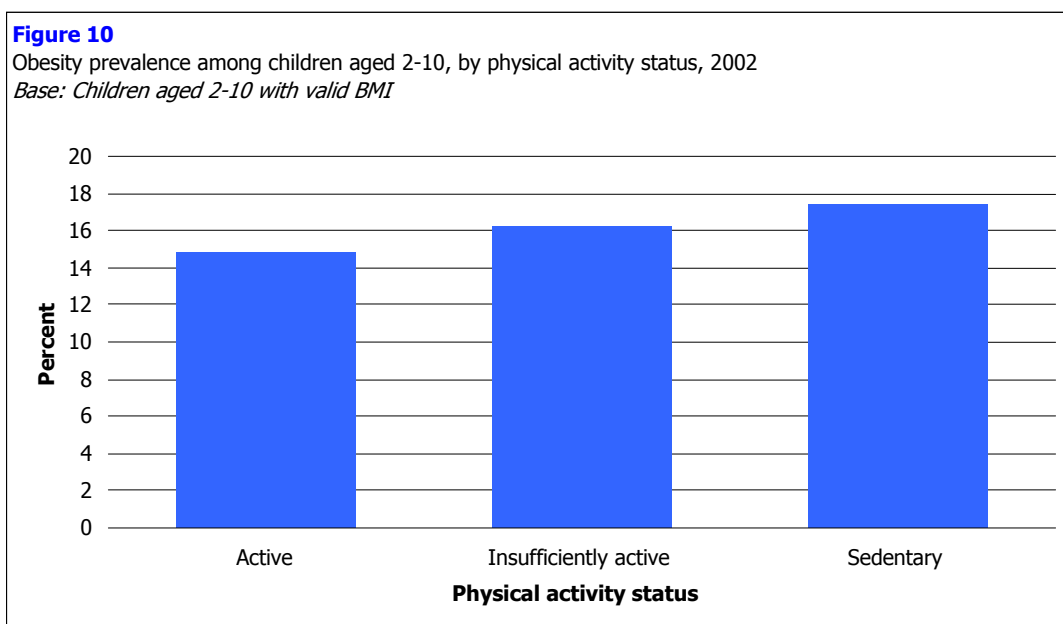
(Table 11)

4.8 Obesity prevalence among children, by child physical activity status

The relationship between childhood obesity and children's level of physical activity was also examined. This analysis was based on the HSE 2002 data only as questions on child physical activity were not asked in HSE 2001.[20]

Children's parents or guardians were asked questions about a range of children's activities such as walking, sports and exercise activities, and active play. Children were usually present and it is expected that they contributed to the answers. The levels of physical activity reported were then grouped into 3 categories: active, insufficiently active and sedentary. The definitions of these groups are presented below:

- *Active* – active for 60 minutes per day for 7 days in the last week. This group represents children who achieve the recommended levels of physical activity.
- *Insufficiently active* – active for 30-59 minutes per day for 7 days in the last week. This group represents those achieving at least 30 minutes (but less than an hour) of at least moderate intensity activity per day.
- *Sedentary* – active at a lower level or not active at all.

Although no statistically significant differences were observed, there was a tendency for obesity rates to rise as children's levels of physical activity fell. 14.8% of those who were highly active were obese compared with 17.4% of those classified as sedentary. However, as this analysis was based on HSE 2002 data only, the base sizes were not large enough to detect differences of statistical significance.[21]

Figure 10
Obesity prevalence among children aged 2-10, by physical activity status, 2002
Base: Children aged 2-10 with valid BMI

Additionally, the analysis was based on subjective evidence regarding children's levels of physical activity as reported by the parents or legal guardians of the child and therefore should be interpreted with caution. Previous research suggests that subjective physical

activity measures (such as questionnaires) are less appropriate for assessing relationships between children's levels of activity and obesity and overweight prevalence. [22]

(Table 12, Figure 10)

4.9   Obesity levels among older children and adolescents

Differences in obesity between age groups have already been highlighted in section 3.3 where it was shown that levels of obesity increased the most among children aged 6-10. Isolating the 2001 and 2002 combined data gives the opportunity to look briefly at levels of obesity among older children and adolescents aged 11-15 through focusing on published data from the HSE 2002 report. Here it is evident that levels of obesity similar to those shown for 8-10 years olds in section 3.3 persist into adolescence. Among older children and teenagers aged 11-15, the prevalence of obesity varied between 15.4% and 22.0% for boys and 15.6% and 19.8% for girls (see inset table).[23]

Obesity prevalence for children aged 11-15, 2001-2002					
Age	11	12	13	14	15
	%	%	%	%	%
Boys					
Obese	22.0	17.5	18.7	15.4	17.9
Girls					
Obese	18.1	19.3	19.8	18.7	15.6

Notes

[1] Department of Health. *Choosing Health: making healthy choices easier;* p. 43,HMSO, London, 2004

[2] Department of Health PSA targets published at:
www.hm-treasury.gov.uk/media/4B9/FE/fr04_psa_ch3.pdf

[3] *Delivering Choosing Health* is published at:
http://www.dh.gov.uk/assetRoot/04/10/57/13/04105713.pdf.
Choosing Activity: a physical activity action plan is published at:
http://www.dh.gov.uk/assetRoot/04/10/57/10/04105710.pdf.
Choosing *a Better Diet: a food and health action plan* is published at:
http://www.dh.gov.uk/assetRoot/04/10/57/09/04105709.pdf

[4] Glenny A, O'Meara S, Melville A, Sheldon TA, Wilson C. *The treatment and prevention of obesity: a systematic review of the literature*. Int J Obes, 1997; **21**: 715-737. Blair SN, Brodney S. *Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues*. Med Sci Sport Exer, 1999; **31**: S646-S662.

[5] *Tackling Obesity in England*. Select Committee on Public Accounts, Ninth Report. January 2002.

[6] Sproston K, Primatesta P (eds). *Health Survey for England 2002. Volume 1: The health of children and young people*. The Stationery Office, London, 2003.

[7] The combined 2001 and 2002 information was the data used for the HSE 2002 report which focused on the health of children and young adults. At the time this obesity analysis was produced, the 2003 data was not fully available, hence the combined 2001 and 2002 data were used for section 4 of this report.

[8] Statistical significance is explained in section 2.3 and the technical annex of this report.

[9] Bellizzi MC, Dietz WH. *Workshop on childhood obesity: Summary of the discussion*. Am J Clin Nutr, 1999; **70**: 173-175.

[10] All tables and figures are based on children with a valid BMI only. This means that they were weighed and measured using highly accurate Health Survey for England equipment. Children whose height or weight was estimated rather than measured by the interviewer are excluded from this analysis.

[11] The data for 1999 and 2000 have been combined due to small general population sample sizes in 1999 and 2000.

[12] See technical annex for a fuller description of social class and its categories

[13] Although the obesity estimates were highest in the North East, they were not significantly higher than the national average. This is because the sample of children from the North East was smaller than the sample from London making significant differences more difficult to detect.

[14] Refer to technical annex for a full description of how IMD was derived.

[15] Refer to technical annex for full description of how equivalised household income was derived.

[16] Adults classified as overweight had a BMI score over 25-30 (kg/m^2) and those who were categorised as obese had a BMI score of over 30 (kg/m^2).

[17] It is important to note that this analysis can not be replicated to compare a particular child's level of obesity with that of their siblings. Within the HSE interview, only two children per household are eligible for inclusion in the survey. A random selection is made where there are more than two children within a household. This protocol means that we could not present the full picture of siblings BMI in households where there were more than two children and a selection had been made. We would therefore be unsure whether any associations found were indicative of real patterns or the result of bias introduced through the child selection process.

[18] Fruit and vegetable consumption is measured in portions per day, where a portion is classified as an 80g serving. Consuming at least 5 portions of fruit and vegetables per day is the current dietary recommendation. A range of foods including fruit, vegetables, pulses, salads and fruit juice contributes to the total number of portions consumed.

[19] Fisher JO, Johnson RK, Lindquist C, Birch LL, Goran MI. *Influence of body composition on the accuracy of reported energy intake in children. Obesity Research,* Nov 2000: **8** (8): 597-603.

[20] The Chief Medical Officer recommends that all children should participate in physical activity of at least moderate intensity for *one hour per day*. At least twice a week this should include activities to increase bone strength, muscle strength and flexibility.

[21] See technical annex for a full explanation of statistical testing.

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[22] Rowlands AV, Ingledew DK, Eston RG. *The effect of type of physical activity measure on the relationship between body fatness and habitual physical activity in children: a meta-analysis*. Ann of Hum Biol, 2000; **27**: 479-497.

[23] These figures were published in Stamatakis E. Chapter 9: Anthropometric measurements, overweight and obesity in Sproston K, Primatesta P (eds). *Health Survey for England 2002. Volume 1: The health of children and young people*. The Stationery Office, London, 2003.

Technical Annex

A   Measuring childhood obesity

This report uses the UK National BMI percentile classification to describe childhood overweight and obesity. This classification uses the 85th and 95th percentiles of the 1990 UK data as cut-off points for overweight and obesity respectively. This means that when the reference data was compiled in 1990, the prevalence of overweight and obesity among children of each age was held to be 15% and 5% of children respectively. This provides a benchmark against which to compare prevalence data from that point forward. In terms of categorising children's BMI status, it means, for example, that a child whose BMI corresponds to the 65th BMI percentile of the reference data will be classified as having a normal weight, a child at the 89th BMI percentile will be classified as overweight and a child at the 97th BMI percentile will be classed obese.

Using the UK National BMI percentile classification provides a reference point that is derived from information about the UK population. The National BMI percentile classification was used to present obesity trends estimates in the Chief Medical Officer's 2002 Annual Report. However, there are alternative methods for measuring childhood obesity. Specifically, the International Obesity Task Force (IOTF) has developed an international classification, using data collected from six countries (UK, Brazil, Hong Kong, The Netherlands, Singapore and United States). The IOTF definition may be better for comparing obesity rates between countries as the reference dataset is more ethnically diverse. There is ongoing debate regarding which classification of childhood obesity is more robust, however, a detailed discussion is beyond the scope of this report. For a more detailed examination of these issues, see the Health Survey for England 2002: The Health of Children and Young People.

B.   Weighting the data

Child selection weights

Since children were introduced into the Health Survey in 1995, it has become necessary to apply an inverse probability 'child weight' to the sample to compensate for limiting the number of children interviewed in a household to two (the sampling fraction therefore being lower in households containing three or more children). This 'child weight' is the total number of children aged 0-15 in the household divided by the number of selected children in the household. The weighted sample was then adjusted to ensure that the age/sex distribution matched that of all children in co-operating households. Child weights have been calculated in this way since 1995. Within this report, therefore, all data has been weighted to account for the different child selection probabilities within households.

HSE 2003, child weights and non-response

HSE 2003 was the first HSE report to publish data incorporating non-response weighting (weighting to account for non-response biases in the data). However, applying these weights represented a break with previous HSE practice and inhibited comparisons with previous years. As such, the 2003 estimates presented in this report have not been weighted for non-response biases and only include the child selection weights, as like all other survey years.

Weighted and unweighted bases in report tables

Data in the tables of this report have been weighted (see child selection weight above). Whenever tables include weighted data, both the unweighted and weighted bases are shown. The unweighted bases show the number of cases involved. The weighted bases show the relative sizes of the various sample elements after weighting.

The absolute size of the weighted bases has no particular significance as the weighted bases have been scaled to the achieved sample sizes.

C.   Testing statistical significance

Testing for statistical significance is a method used to ensure that differences evident in the data are real differences representative of the population and not the result of sampling error. In the context of this report, differences in obesity estimates between sub groups, such as age, sex and socio-demographic groups, were tested to ensure these differences were real and not that, by chance, more obese children were sampled among any given group.

To test for statistical significance between two survey estimates, this report has estimated the probability (p value) of the observed result occurring due to chance alone. If this probability is low (where the p value is less than 0.05, i.e. less that 5%), the differences between the estimates is then said to be statistically significant. For the purposes of this report, where statistically significant differences have been quoted, this means the probability of the two estimates actually being the same was shown to be $p<0.05$. Differences showing a high probability (of being the same), for example a p-value greater than 0.05 were not deemed as statistically significant.

It should be noted that the p value is dependent on the sample size, so that with large samples difference or associations which are very small still may be significant. Results should therefore be assessed on the magnitude of the difference or association as well as on the p value itself.

D.   Socio-demographic variables and glossary

Equivalised household income quintile

Household income can be used as an analysis variable, but there has been increasing interest in using measures of equivalised income that adjust income to take account of the number of persons in the household. The method used in the present report utilised the widely used McClements scoring system. The calculation of the equivalised income involves calculating a McClement score for each household (dependent on number, age and relationships of adults and children in the household), and then dividing the total household income by this score to get an equivalised household income. Once this has been done, levels of equivalised household income are ranked from top to bottom and split into fifths (quintiles), so that the first quintile represents households with the highest equivalised household incomes and the fifth quintile represent those households with the lowest equivalised income quintile.

HSE

HSE is the abbreviation used to denote the Health Survey for England. The Health Survey for England is an annual survey that is designed to monitor the nation's health. Every year around 16,000 adults and 4,000 children, representative of the whole population, are interviewed. This report is based on data and evidence collected from the HSE series.

Index of Multiple Deprivation

The Index of Multiple Deprivation 2000 (IMD2000) is a composite index of relative deprivation at small area level, based on six domains of deprivation: income; employment; geographical access to services; health and disability; education, skills and training; and housing. The method used in this report was same as that used in HSE 2002. Here the purpose was to group the IMD2000 scores of all electoral wards in England into quintiles (i.e. split into fifths), ranked in ascending order of deprivation score (quintile 1 being least deprived). The postcode address of households was linked to the electoral ward of residence, which had been allocated to a deprivation quintile. All individuals in each household were allocated to the deprivation quintile to which their household had been allocated.

Government Office Region

Government Office Region (GOR) is the key classification system used for regional statistics. There are nine Government Office Regions in England: North East, North West, Yorkshire and the Humber, East Midlands, West Midlands, East of England, London, South East and South West. The nine category system has been used since 1998, however, GOR boundaries may change from year to year as they reflect administrative boundaries.

Household reference person

The household reference person (HRP) is defined as the householder (a person in whose name the property is owned or rented) with the highest income. If there is more than one householder and they have equal income, then the household reference person is the eldest.

NS-SEC of household reference person

The National Statistics Social-Economic Classification (NS-SEC) is a social classification system that attempts to classify groups on the basis on employment relations, based on characteristics such as career prospects, autonomy, mode of payment and period of notice. By taking into account these associated features of employment, NS-SEC differs from the Registrar General's Standard Occupational Classification (See Social Class of head of household). There are fourteen operational categories representing different groups of occupations (for example higher and lower managerial, higher and lower professional) and a further three 'residual' categories for full-time students, occupations that cannot be classified due to lack of information or other reasons. The operational categories may be collapsed to form a nine, eight, five or three category system. The Health Survey for England uses the five category system in which informants are classified as:
- managerial and professional
- intermediate
- small employers and own account workers
- lower supervisory and technical
- semi-routine and routine

In the analysis presented in this report it is the NS-SEC of the Household Reference Person which is used.

Percentile

The value of a distribution which partitions the cases into groups of a specified size. For example, the 20th percentile is the value of the distribution where 20 percent of the cases have values below the 20th percentile and 80 percent have values above it. The 50th percentile is the median.

Social class of head of household

Social class was assigned on the basis of the occupation of the head of household using the Registrar General's Standard Occupational Classification. Occupations are assigned to six social class categories which can be grouped into manual and non-manual occupations (as used in this report). The table below shows which occupation and social class category forms part of the manual and non-manual groupings:

	Social class code	Occupation description
Non-Manual	I	Professional occupations
	II	Managerial and technical occupations
	IIINM	Skilled occupations (non-manual)
Manual	IIIM	Skilled occupations (manual)
	IV	Partly skilled occupations
	V	Unskilled occupations

In households where the head of household was not interviewed the social class of the head of household was derived from information obtained from their spouse or partner. Heads of households who were in the armed forces, whose occupation was not adequately described or who were full-time students were not allocated a social class and are not shown separately in the tables.

Tables

Table 1   Trends in overweight and obesity prevalence among children, by survey year (1995-2003)

Aged 2-10 with valid BMI   *1995-2003*

BMI status	Survey year							
	1995	1996	1997	1998	1999-2000	2001	2002	2003
	%	%	%	%	%	%	%	%
Obese	9.9	10.6	10.9	11.6	13.4	13.1	15.5	13.7
Overweight including obese	22.7	23.1	23.4	25.2	26.6	27.9	28.7	27.7
Bases (weighted) *Aged 2-10*	*2527*	*2783*	*4089*	*2552*	*2355*	*2129*	*4654*	*1774*
Bases (unweighted) *Aged 2-10*	*2227*	*2412*	*4381*	*2267*	*2217*	*1893*	*3984*	*1733*

Table 2   Trends in overweight and obesity prevalence, by survey year (1995-2003) and sex

Aged 2-10 with valid BMI   *1995-2003*

BMI status	Survey year							
	1995	1996	1997	1998	1999-2000	2001	2002	2003
	%	%	%	%	%	%	%	%
Males								
Obese	9.6	11.0	11.1	11.4	14.3	13.5	15.2	14.9
Overweight including obese	22.5	24.8	24.3	26.0	28.1	29.1	28.5	29.6
Females								
Obese	10.3	10.2	10.7	11.8	12.4	12.7	15.8	12.5
Overweight including obese	22.9	21.2	22.6	24.3	25.0	26.7	28.9	25.9
Bases (weighted)								
Males	*1261*	*1418*	*2007*	*1336*	*1204*	*1035*	*2364*	*876*
Females	*1266*	*1365*	*2082*	*1216*	*1152*	*1094*	*2290*	*897*
Bases (unweighted)								
Males	*1113*	*1234*	*2159*	*1185*	*1145*	*913*	*2036*	*864*
Females	*1114*	*1178*	*2222*	*1082*	*1072*	*980*	*1948*	*869*

Table 3 Trends in overweight and obesity prevalence among children, by survey year (1995-2003) and age

Aged 2-10 with valid BMI   *1995-2003*

BMI status	Survey year							
	1995	1996	1997	1998	1999-2000	2001	2002	2003
	%	%	%	%	%	%	%	%
Aged 2-3								
Obese	9.4	10.9	10.6	9.6	13.2	8.1	12.7	11.2
Overweight including obese	23.5	22.7	24.5	24.6	27.8	25.8	25.1	23.7
Aged 4-5								
Obese	8.7	8.8	10.1	9.9	10.6	10.2	13.4	11.2
Overweight including obese	22.8	24.3	24.1	23.5	22.9	21.7	27.9	24.4
Aged 6-7								
Obese	9.7	11.7	8.5	11.7	14.5	12.6	13.6	13.4
Overweight including obese	19.5	22.8	20.1	24.9	28.0	25.5	26.5	26.9
Aged 8-10								
Obese	11.2	11.0	13.1	13.7	14.5	17.9	19.5	16.5
Overweight including obese	24.2	22.6	24.6	26.8	27.4	34.3	31.8	32.0
Bases (weighted)								
Aged 2-3	*491*	*540*	*806*	*497*	*445*	*388*	*817*	*290*
Aged 4-5	*607*	*632*	*910*	*573*	*529*	*505*	*1003*	*388*
Aged 6-7	*555*	*669*	*946*	*604*	*564*	*466*	*1141*	*438*
Aged 8-10	*874*	*941*	*1428*	*878*	*817*	*770*	*1693*	*658*
Bases (unweighted)								
Aged 2-3	*456*	*480*	*884*	*463*	*428*	*352*	*716*	*287*
Aged 4-5	*544*	*560*	*990*	*516*	*504*	*448*	*874*	*381*
Aged 6-7	*486*	*584*	*993*	*525*	*525*	*404*	*969*	*423*
Aged 8-10	*741*	*788*	*1514*	*763*	*760*	*689*	*1425*	*642*

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Table 4 Trends in overweight and obesity prevalence among children, by survey year (1995-2003) and social class

BMI status	Survey year							
	1995	1996	1997	1998	1999-2000	2001	2002	2003
	%	%	%	%	%	%	%	%
Non-Manual								
Obese	9.1	11.3	10.4	10.2	12.9	12.6	14.3	12.4
Overweight including obese	22.4	24.5	24.6	24.7	25.4	26.1	26.9	27.1
Manual								
Obese	10.6	10.0	11.4	13.1	14.4	14.3	17.0	16.0
Overweight including obese	23.3	22.5	22.9	25.6	28.2	30.7	30.5	30.6
Bases (weighted)								
Non-Manual	*1138*	*1303*	*1782*	*1227*	*1180*	*1078*	*2491*	*961*
Manual	*1197*	*1295*	*2113*	*1236*	*1060*	*950*	*1951*	*726*
Bases (unweighted)								
Non-Manual	*1028*	*1152*	*1973*	*1097*	*1134*	*973*	*2172*	*938*
Manual	*1028*	*1104*	*2218*	*1092*	*975*	*839*	*1640*	*711*

Table 5 Obesity prevalence among children, by Government Office Region

BMI status	Government Office Region								
	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East England	London	South East	South West
	%	%	%	%	%	%	%	%	%
Obese	18.3	15.0	11.4	14.5	15.8	14.1	18.2	13.4	14.0
Bases (weighted)									
Aged 2-10	*394*	*950*	*750*	*615*	*748*	*791*	*830*	*1077*	*683*
Bases (unweighted)									
Aged 2-10	*355*	*806*	*634*	*540*	*636*	*693*	*701*	*922*	*588*

Table 6   Obesity prevalence among children, by area type

Aged 2-10 with valid BMI   *2001-2002*

BMI status	Area type			
	Rural	Suburban residential	Other dense urban/town centre	Inner city
	%	%	%	%
Obese	14.9	14.3	14.8	19.3
Bases (weighted) *Aged 2-10*	*1419*	*4218*	*857*	*345*
Bases (unweighted) *Aged 2-10*	*1243*	*3622*	*735*	*276*

Table 7   Obesity prevalence among children, by Index of Multiple Deprivation (2000) Quintile

Aged 2-10 with valid BMI   *2001-2002*

BMI status	Index of Multiple Deprivation Quintile				
	1st (least deprived)	2nd	3rd	4th	5th (most deprived)
	%	%	%	%	%
Obese	11.2	15.3	14.6	14.8	16.4
Bases (weighted) *Aged 2-10*	*1020*	*1024*	*1147*	*1354*	*2183*
Bases (unweighted) *Aged 2-10*	*894*	*887*	*1006*	*1164*	*1823*

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Table 8   Obesity prevalence among children, by equivalised household income quintile

Aged 2-10 with valid BMI   *2001-2002*

BMI status	Equivalised annual household income quintile				
	Highest	2nd	3rd	4th	Lowest
	%	%	%	%	%
Obese	13.3	12.5	14.2	16.3	15.8
Bases (weighted) *Aged 2-10*	*955*	*1133*	*1361*	*1351*	*1431*
Bases (unweighted) *Aged 2-10*	*861*	*1028*	*1208*	*1118*	*1144*

Table 9   Obesity prevalence among children, by NS-SEC of household reference person

Aged 2-10 with valid BMI   *2001-2002*

BMI status	NS-SEC of household reference person				
	Managerial & professional occupations	Intermediate	Small employers & own account workers	Lower supervisory & technical occupations	Semi-routine & routine
	%	%	%	%	%
Obese	12.4	16.4	14.4	16.3	17.1
Bases (weighted) *Aged 2-10*	*2623*	*555*	*746*	*758*	*1903*
Bases (unweighted) *Aged 2-10*	*2300*	*494*	*630*	*666*	*1588*

Table 10 Obesity prevalence among children, by Parental BMI Status[1]

Aged 2-10 with valid BMI and valid parental BMI   *2001-2002*

BMI status	Parental BMI status		
	With no obese or overweight parent	With one overweight or obese parent	Both parents overweight or obese
	%	%	%
Obese	6.7	8.4	19.8
Bases (weighted)			
Aged 2-10	*292*	*778*	*710*
Bases (unweighted)			
Aged 2-10	*252*	*685*	*612*

[1]Lone parent households were excluded in this analysis. Therefore these categories are mutually exclusive.

Table 11 Obesity prevalence among children aged 5-10, by daily fruit and vegetable consumption

Aged 5-10 with valid BMI   *2001-2002*

BMI status	Portions of fruit and vegetables consumed		
	One or less portions per day	More than one, less than five portions per day	Five or more portions per day
	%	%	%
Obese	15.2	15.8	18.4
Bases (weighted)			
Aged 5-10	*1393*	*2882*	*609*
Bases (unweighted)			
Aged 5-10	*1190*	*2449*	*515*

Table 12 Obesity prevalence among children, by child physical activity status

Aged 2-10 with valid BMI   *2002*

BMI status	Physical activity status		
	Active	Insufficiently Active	Sedentary
	%	%	%
Obese	14.8	16.2	17.4
Bases (weighted)			
Aged 2-10	*3170*	*661*	*791*
Bases (unweighted)			
Aged 2-10	*2718*	*562*	*677*