

# Publication Report



## Primary 1 Body Mass Index (BMI) Statistics

School Year 2010/11

Publication date – 24 April 2012



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## About ISD

Scotland has some of the best health service data in the world combining high quality, consistency, national coverage and the ability to link data to allow patient based analysis and follow up.

Information Services Division (ISD) is a business operating unit of NHS National Services Scotland and has been in existence for over 40 years. We are an essential support service to NHSScotland and the Scottish Government and others, responsive to the needs of NHSScotland as the delivery of health and social care evolves.

**Purpose:** To deliver effective national and specialist intelligence services to improve the health and wellbeing of people in Scotland.

**Mission:** Better Information, Better Decisions, Better Health

**Vision:** To be a valued partner in improving health and wellbeing in Scotland by providing a world class intelligence service.

## Official Statistics

Information Services Division (ISD) is the principal and authoritative source of statistics on health and care services in Scotland. ISD is designated by legislation as a producer of 'Official Statistics'. Our official statistics publications are produced to a high professional standard and comply with the Code of Practice for Official Statistics. The Code of Practice is produced and monitored by the UK Statistics Authority which is independent of Government. Under the Code of Practice, the format, content and timing of statistics publications are the responsibility of professional staff working within ISD.

ISD's statistical publications are currently classified as one of the following:

- National Statistics (ie assessed by the UK Statistics Authority as complying with the Code of Practice)
- National Statistics (ie legacy, still to be assessed by the UK Statistics Authority)
- Official Statistics (ie still to be assessed by the UK Statistics Authority)
- other (not Official Statistics)

Further information on ISD's statistics, including compliance with the Code of Practice for Official Statistics, and on the UK Statistics Authority, is available on the [ISD website](#).

## Introduction

There is continued concern over the levels of obesity among children in Scotland. Obesity during childhood is a health concern in itself, but can also lead to physical and mental health problems in later life, such as heart disease, diabetes, osteoarthritis, back pain, increased risk of cancer, low self-esteem and depression. Obesity develops as a result of an imbalance between energy consumption and energy expenditure.

Body Mass Index (BMI) is one of the most widely used methods for assessing body composition or estimating levels of body fat. BMI is calculated by dividing an individual's weight (in kilograms) by their height (in metres) squared and gives an indication of whether weight is in proportion to height. In adults there are static cut off values for BMI indicating underweight, healthy weight, overweight and obesity; however these are not appropriate for children. The healthy BMI range for children changes substantially with age and is different between boys and girls. A certain BMI at one age may be the norm but at another age the same BMI may be unusually high or low. Interpretation of BMI values in children therefore depends on comparison with age- and sex-specific growth reference charts. These provide thresholds or cut-off points in the BMI distribution (BMI centiles), which can be used to estimate levels of obesity, overweight and underweight in children. Statistics in this release were derived using the UK 1990 growth reference for BMI (the standard approach in the UK).

The BMI centile cut-offs used to derive the percentages classified as overweight, obese and severely obese are those recommended for the purposes of population monitoring and epidemiological research. *The statistics do not represent the percentage of children clinically classified as overweight, obese or severely obese.* Use of the cut-offs recommended for clinical practice would result in lower percentages for overweight, obese and severely obese and BMI centile would be only one of a variety of factors taken into consideration before any clinical diagnosis is made.

This release updates annual statistics on high and low body mass index (BMI) for Primary 1 school children, and includes data to school year 2010/11. The statistics are derived from height and weight measurements recorded at Primary 1 health reviews and are available for all NHS Boards. However, figures for NHS Greater Glasgow & Clyde are not representative of the board area as a whole. Statistics are presented by: NHS Board, Council Area, Community Health Partnership, gender and Scottish Index of Multiple Deprivation (SIMD) quintile. The data are used nationally and locally to improve understanding of over- and underweight in children and to inform policy, planning and provision of services.

### Revision of previously published statistics

A change to the criteria for identifying likely errors in the recorded height and/or weight measurements (and hence derived BMI) and an improved method of deriving the Council Area, Community Health Partnership (CHP) and Scottish Index of Multiple Deprivation (SIMD) has been implemented. This has been applied to data for all years presented resulting in revisions to previously published figures for school years 2000/01 to 2009/10. The impact is in each year the reported percentages of children classified as overweight (including obese and severely obese), obese (including severely obese), and severely obese increase by an average of 1.3 percentage points across all participating boards areas. The reported percentages of children classified with a low BMI (underweight) and very low BMI (very underweight) increase by an average of 0.3 percentage points each

year across all participating boards. The revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Overall trends remain the same. For further information please see [Appendix A1](#) Background Information.

## Measuring obesity in children

For epidemiological purposes, an individual BMI is not meaningful in isolation, only in the context of the distribution of values for a population. Individuals can be assigned to categories e.g. overweight (using their BMI or centiles derived from BMI) to gauge where they lie in relation to the rest of the population - in particular, whether they have an unusually high or low BMI.

In adults, BMI can be directly classified into different categories (for example, the [World Health Organisation international classification](#) of "underweight" is BMI < 18.5) since age in adulthood doesn't greatly affect weight in relation to height. However, these adult BMI category cut-offs aren't appropriate for children since BMI changes markedly as a child ages. A certain BMI at one age may be the norm but at another age the same BMI may be unusually high or low. Interpretation of BMI values in children therefore depends on comparison with age- and sex-specific growth reference charts. These provide thresholds or cut-off points in the BMI distribution (BMI centiles), which can be used to estimate levels of obesity, overweight and underweight in children.

Statistics in this release are derived from the age- and sex-specific 1990 UK growth reference standards. These growth reference charts are based on data collected between 1978 and 1990 from UK surveys (they therefore represent children's weight relative to height before the recent rise in levels of obesity in children).

Each child's BMI is calculated then converted into centiles, using UK 1990 growth reference data based on sex and age in months and Cole's LMS method ([Cole TJ, Freeman JV and Preece MA](#). Body mass index reference curves for the UK, 1990. Arch Dis Child 1995; 73: 25-9). These centiles can then be used to categorise BMI as detailed in the following table:

Category	Definition	What this means
Very low BMI (very underweight)	Less than or equal to 2 <sup>nd</sup> centile	Children whose BMI is within the bottom 2% of the 1990 UK reference range for their age and sex.
Low BMI (underweight)	Less than or equal to 5 <sup>th</sup> centile	Children whose BMI is within the bottom 5% of the 1990 UK reference range for their age and sex.
Overweight	Greater than or equal to 85 <sup>th</sup> centile	Children whose BMI is within the top 15% of the 1990 UK reference range for their age and sex.
Obese	Greater than or equal to 95 <sup>th</sup> centile	Children whose BMI is within the top 5% of the 1990 UK reference range for their age and sex.
Severely obese	Greater than or equal to 98 <sup>th</sup> centile	Children whose BMI is within the top 2% of the 1990 UK reference range for their age and sex.

The number of children within each of these categories can then be used to calculate the percentage of children reviewed who are: very underweight, underweight, overweight, obese and severely obese. Children with a BMI over the 5th and below the 85th centile range are considered to be in the healthy weight range (although BMI may incorrectly categorise a small minority of children with heavy musculature as being overweight or obese).

The BMI centile cut-offs used to derive the percentages classified as overweight, obese and severely obese are those recommended for the purposes of population monitoring and epidemiological research. These thresholds are not the same as those recommended for clinical practice. Therefore the statistics do not represent the percentage of children clinically classified as overweight, obese or severely obese.

In the UK, it is generally agreed that the most appropriate clinical cut-off for classifying individual children as being underweight is  $\leq$  2nd centile. There is no agreed definition of underweight for population monitoring purposes but a reasonable threshold would be  $\leq$  5th centile (see Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007; 335: 194-7 and Dinsdale H, Rutter H et al. National Child Measurement Programme: Detailed Analysis of the 2006/07 National Dataset. National Obesity Observatory publication, June 2008). This publication uses a threshold of BMI  $\leq$  5<sup>th</sup> centile to define underweight (low BMI) and BMI  $\leq$  2<sup>nd</sup> centile to define very underweight (very low BMI).

The upper and lower limits for 95% confidence intervals have been included in the tables for all childhood BMI distribution percentages. A confidence interval gives an indication of the likely error around an estimate and should be considered when interpreting the BMI distribution percentages. Figures for Community Health Partnerships, Council Areas and NHS Boards with small numbers of children measured should be interpreted with care as the small numbers may result in fluctuations in the percentages from year to year etc. It is also possible to use confidence intervals to gain some indication of whether the percentage of Primary 1 school children classified as e.g. obese for a particular NHS Board is statistically significantly different from the average percentage for all participating Boards.

Further information on BMI statistics reference standards and thresholds, and confidence intervals, can be found in [Appendix A1](#) Background Information.

### **Data collection and coverage**

All NHS Boards in Scotland provide a Child Health Programme where children are offered routine reviews at various stages of their life. NHS Boards record these reviews using the Child Health Systems Programme (CHSP). Statistics in this release are derived from height and weight measurements collected at health reviews in Primary 1 and recorded on the CHSP School system.


There is variation in the timing of the Primary 1 measurement across NHS Boards, with some schools recording measurements early in the academic year and others towards the end of the academic year. Therefore the child's age at measurement can range from around 4.5 to 6.25 years. However, BMI centile results are adjusted for age.

The number of NHS Boards participating in CHSP School and recording reviews has increased since 2000/01 from four to all fourteen Boards in Scotland. This has resulted in an increase in the proportion of children in Primary 1 across Scotland included in the BMI statistics, from approximately 22% in 2000/01 to 74% in 2010/11. Therefore the trend for

'All participating NHS Boards' should be interpreted with a degree of caution. However, the trends observed among the four Boards participating in CHSP School throughout the eleven year period are similar to those for 'All participating NHS Boards'. The majority of NHS Greater Glasgow & Clyde (NHS GG&C) do not use CHSP School to record reviews. Height and weight data are recorded for approximately 14% of all NHS GG&C children eligible for Primary 1 in 2010/11. The data relates mainly to NHS GG&C children living in Renfrewshire CHP / Council area. The figures for NHS GG&C are therefore not representative of the board area as a whole. If measurements were available for the whole board area, the reported prevalence of overweight and obesity, and underweight, are likely to be higher than the figures for the partial area of NHS GG&C (mainly Renfrewshire CHP/Council area) reported here. This is because rates of overweight and obesity, and underweight, tend to be higher in the most deprived areas, and NHS GG&C board area as a whole has a higher proportion of the population living in deprived areas than Renfrewshire CHP/Council area. NHS GG&C plan to record height and weight measurements for all their council areas for school year 2011/12 for inclusion in next publication of these statistics (planned for December 2012).

The vast majority of independent primary schools (which account for approximately 2% of children in Primary 1 in Scotland) do not record height and weight data on CHSP School, although there are local arrangements in some NHS Board areas to record results for some schools. The BMI statistics for 2010/11 cover approximately 8% of children in Primary 1 in independent schools in Scotland. The proportion of children attending independent schools is highly variable between different areas. Children attending independent schools tend to be from less deprived areas and this should be borne in mind when interpreting the figures.

Estimates of the proportion of Primary 1 children measured are based on National Records of Scotland (NRS) mid-year (and small area) population estimates for children aged 5 years. These are a proxy for the true numbers of children eligible for Primary 1. Some children of Primary 1 age may not have measurements included in these figures because e.g. they are home-schooled or attend an independent school that does not have Primary 1 review data recorded on CHSP School. Some children may also live in one NHS Board / Council Area / Community Health Partnership (CHP) area and attend school in a different area. A few of the data completeness percentages are slightly greater than 100% because the population estimates are only a proxy for the true numbers of children eligible for Primary 1 in each area.

For more information, please see: [Estimated completeness of height and weight recording for Primary 1 School Children by NHS Board, Council Area and Community Health Partnership \(CHP\)](#) 

## Key points

- In 2010/11 a total of 41,019 valid height and weight measurements were recorded for children in Primary 1 in Scotland. This is approximately 74% of children in Primary 1.
- Based on centile cut-offs on the 1990 UK growth reference charts used for population monitoring purposes, in 2010/11, 21.4% of Primary 1 children were classified as overweight, including 9.6% obese and 5.5% severely obese. These are very similar to the levels of high BMI in 2009/10 (21.5% overweight, including 9.5% obese and 5.4% severely obese). Over the last decade, the prevalence of overweight and obesity has remained at a similar level of around one in five children in Primary 1.
- The percentage of Primary 1 school children classified as underweight ( $\leq 5^{\text{th}}$  centile) was 3.7% in 2010/11, including 1.8% very underweight ( $\leq 2^{\text{nd}}$  centile). These are similar to levels of low BMI in 2009/10 (3.4% underweight, including 1.6% very underweight). Levels of underweight have remained relatively stable over the period 2000/01 to 2010/11 at around 3% to 4%.



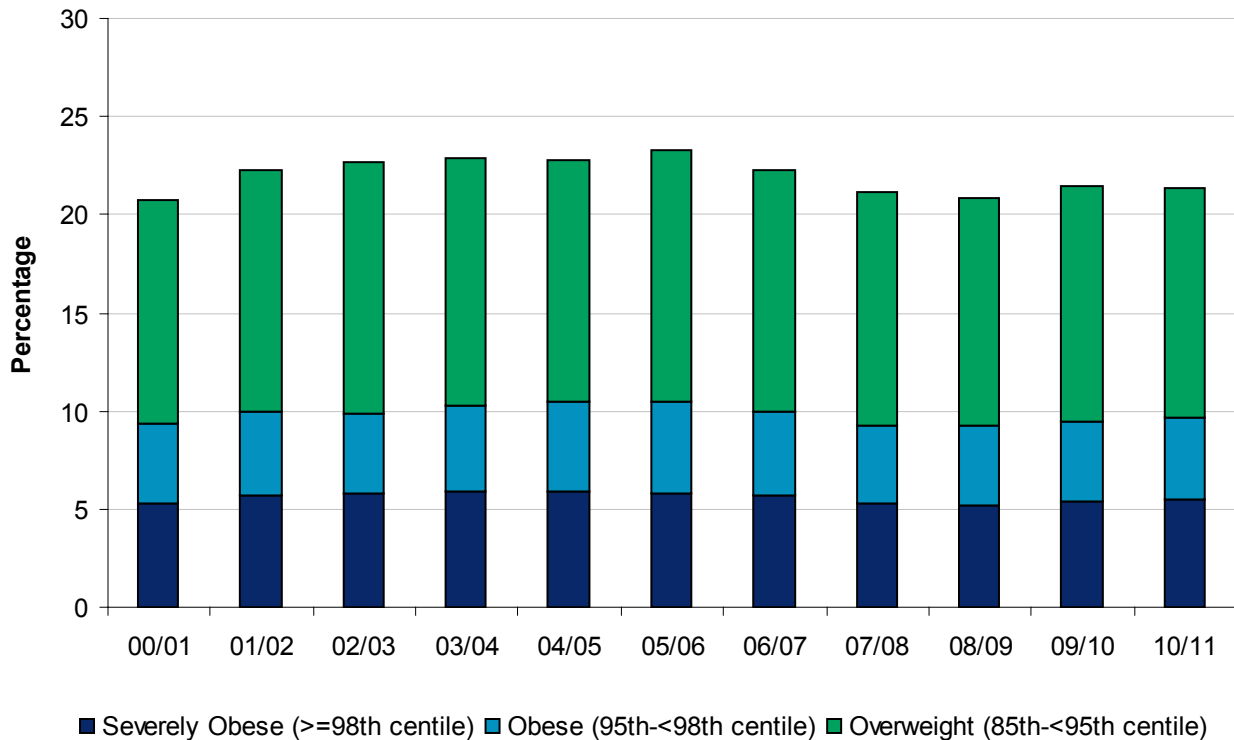
## Results and Commentary

### High BMI: Prevalence of overweight and obesity in Primary 1

Based on centile cut-offs on the 1990 UK growth reference charts used for population monitoring purposes, in 2010/11, 21.4% of Primary 1 children were classified as overweight, including 9.6% obese and 5.5% severely obese. These are very similar to the levels of high BMI in 2009/10 (21.5% overweight, including 9.5% obese and 5.4% severely obese).

As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution. Over the decade, the prevalence of overweight and obesity has remained at a similar level of around one in five children in Primary 1.

**High BMI Distribution in Primary 1 School Children;  
All Participating NHS Boards, School Years 2000/01 to 2010/11<sup>1,R</sup>**



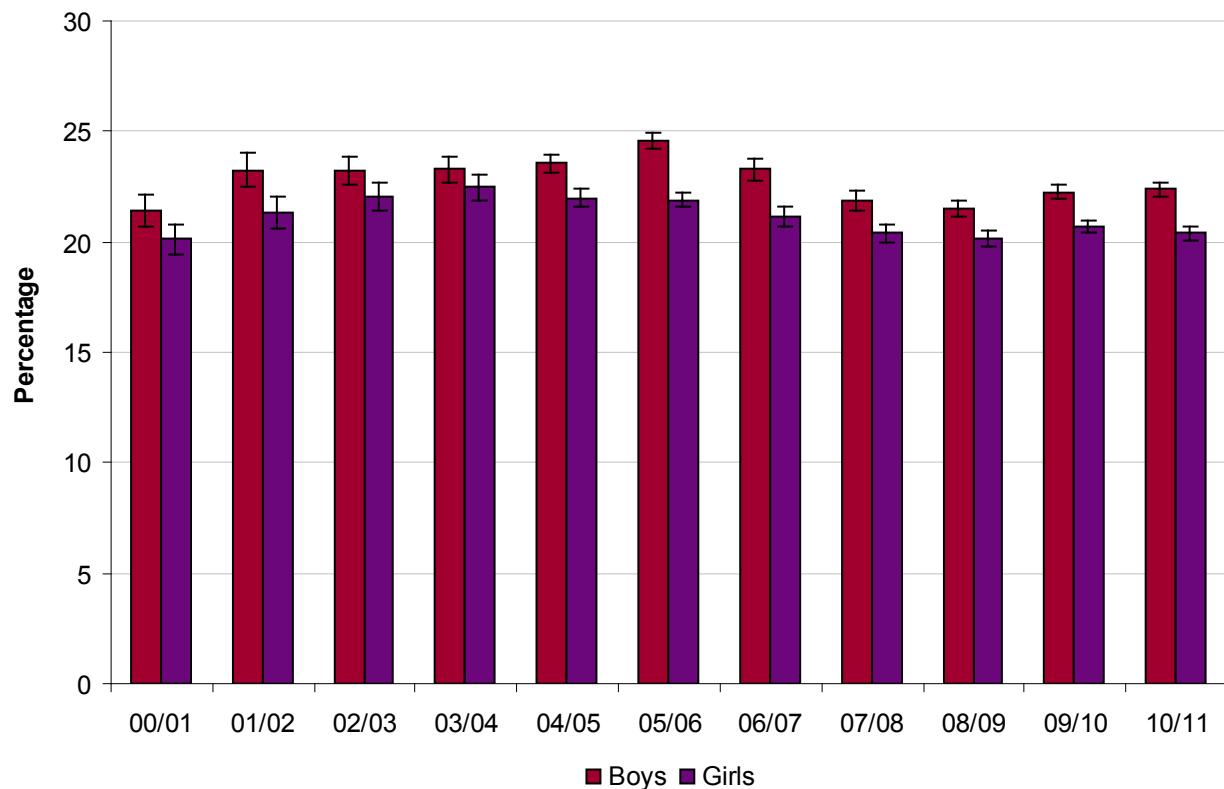
1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

R Revised: A change to the criteria for identifying likely errors in the BMI and an improved method of deriving the Council Area, Community Health Partnership (CHP) and Scottish Index of Multiple Deprivation (SIMD) has been implemented. This has been applied to data for all years presented resulting in revisions to previously published figures for school years 2000/01 to 2009/10. The impact is in each year the reported percentages of children classified as overweight (including obese and severely obese), obese (including severely obese), and severely obese increase by an average of 1.3 percentage points across all participating boards areas. The revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Overall trends remain the same. For further information please see Appendix A1.

Source: ISD Scotland, CHSP-S November 2011

The prevalence of overweight and obesity in Primary 1 is slightly higher amongst boys than girls. In school year 2010/11, 22.4% of boys were classified as overweight (including 10.2% obese, and 5.9% severely obese) compared to 20.4% of girls (including 9.0% obese, and 5.1% severely obese).

**Percentage Overweight (>=85<sup>th</sup> centile) and associated 95% confidence intervals:  
Primary 1 School Children by Gender;  
All Participating NHS Boards, School Years 2000/01 - 2010/11<sup>1,R</sup>**



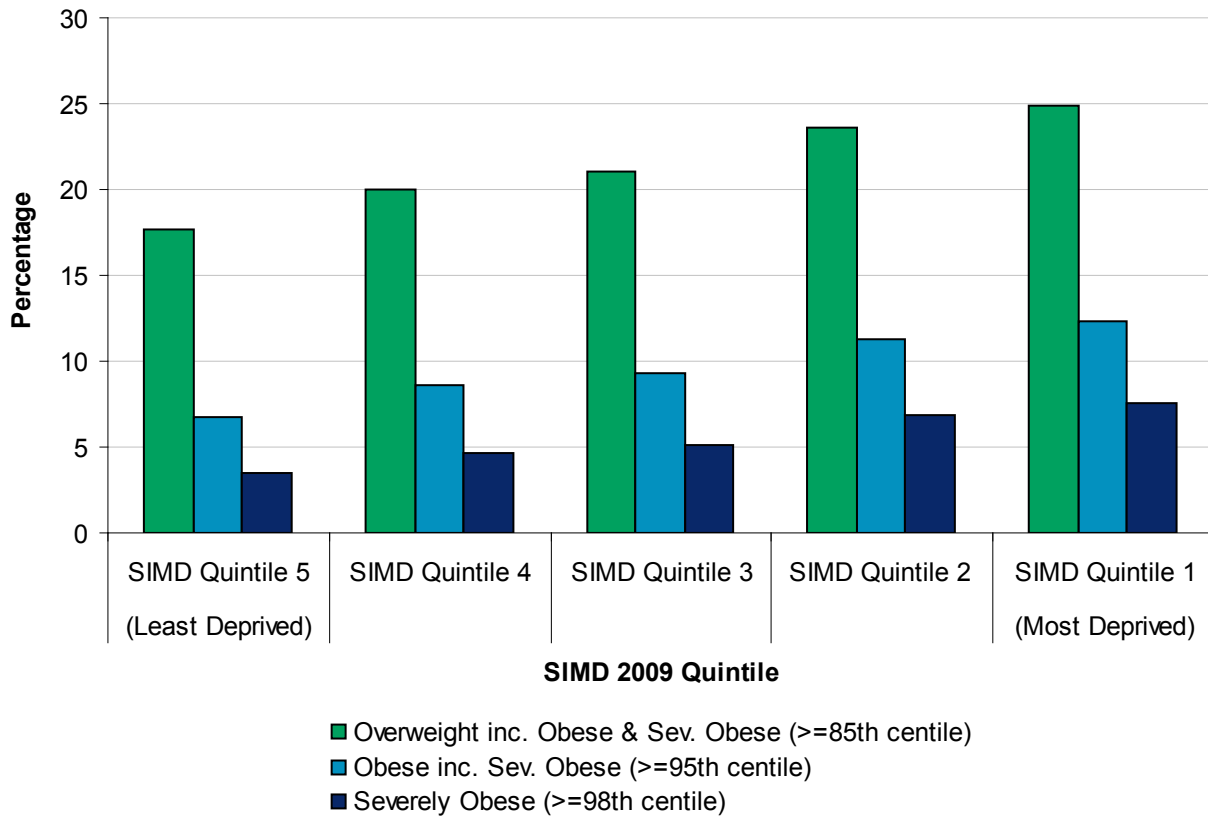
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Source: ISD Scotland, CHSP-S November 2011

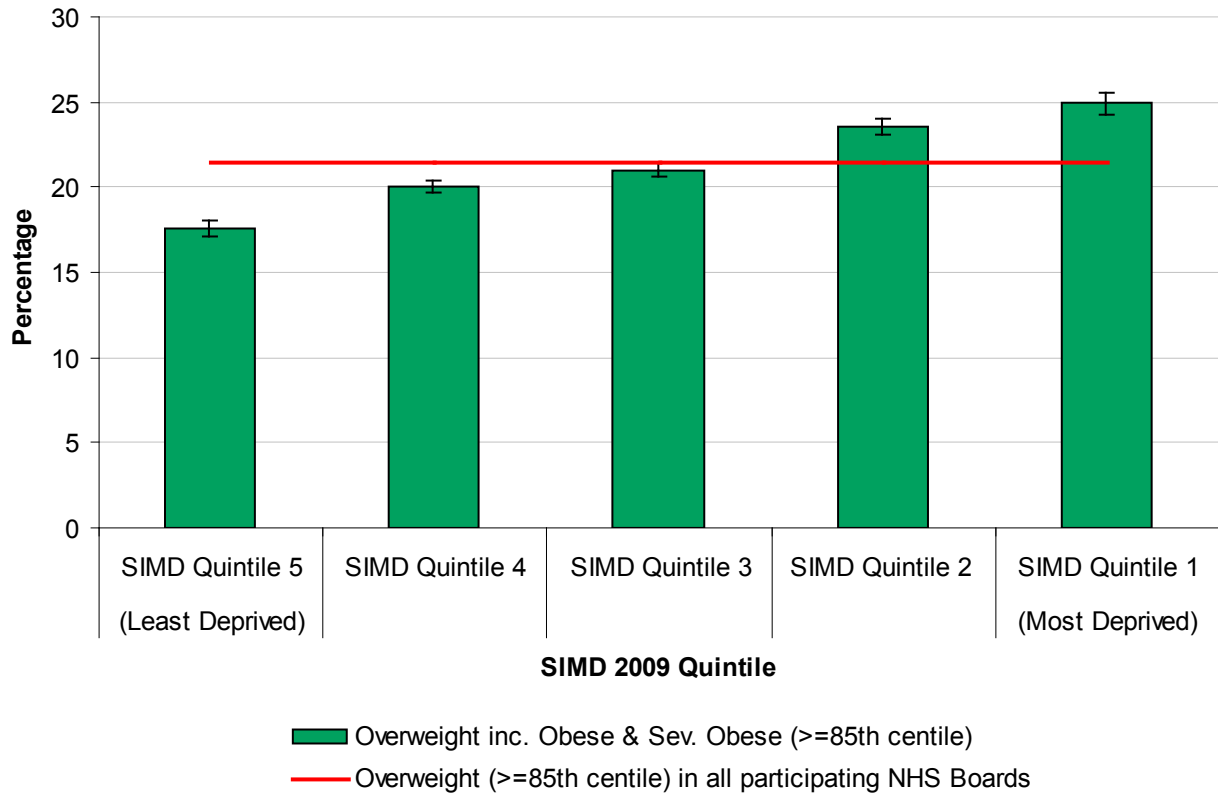
Figures for 2010/11 indicate that the prevalence of overweight and obesity amongst children in Primary 1 increases with deprivation. In the least deprived areas, 17.6% of children were classified as overweight (including 6.7% obese and 3.5% severely obese) while in the most deprived areas 24.9% were classified as overweight (including 12.3% obese and 7.6% severely obese).

**High BMI Distribution in Primary 1 School Children by Scottish Index of Multiple Deprivation (SIMD) 2009 Quintile; All Participating NHS Boards, School Year 2010/11**



Source: ISD Scotland, CHSP-S November 2011

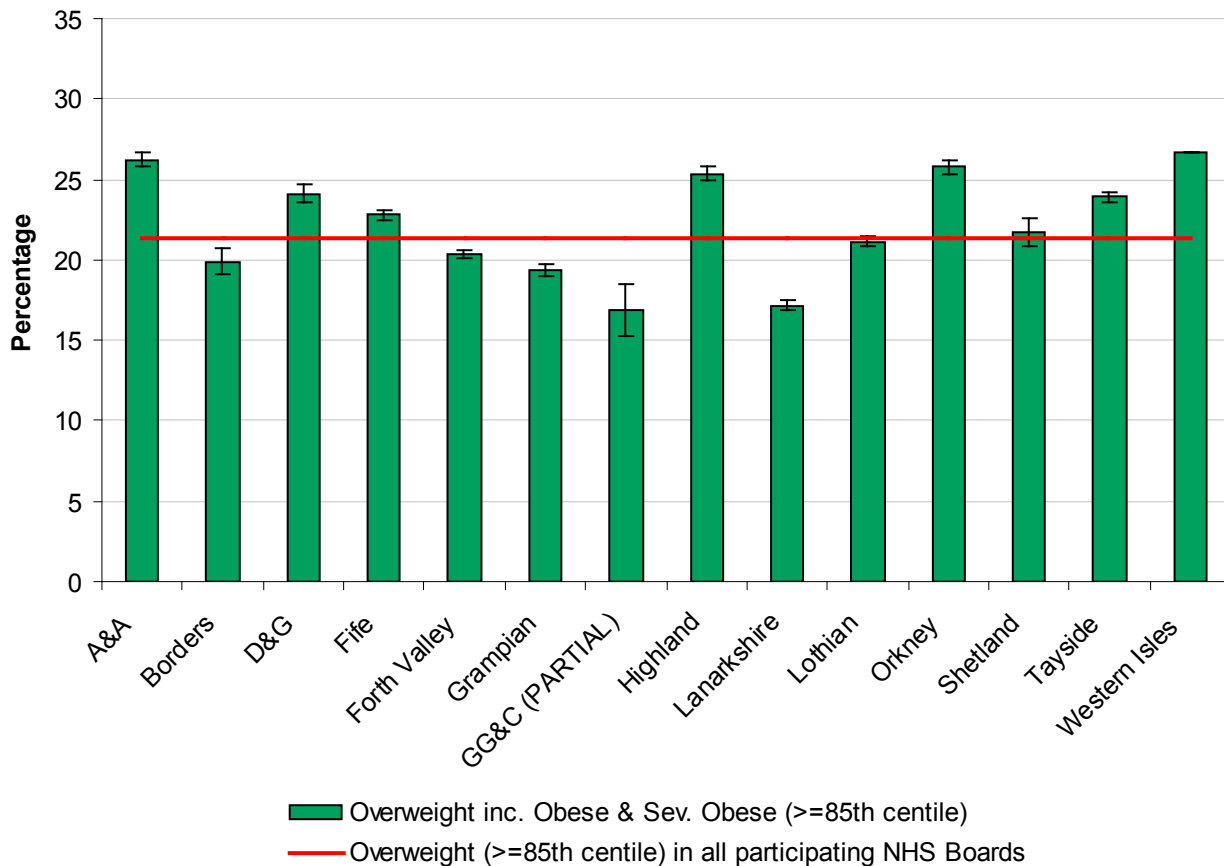
**Percentage Overweight: Primary 1 School Children by Scottish Index of Multiple Deprivation (SIMD) 2009 Quintile, All Participating NHS Boards, School Year 2010/11**



Source: ISD Scotland, CHSP-S November 2011

The prevalence of overweight and obesity varies between areas. Rates in a particular area can often fluctuate year on year. It is not unusual for areas with rates higher than the national average in a particular year to report rates lower than the national average in the previous year (and vice versa). Fluctuation in the reported rates partly reflects that figures relate to a different cohort of children each year. It is also important to consider how variation in the coverage of the BMI statistics between areas, and within an area from year to year, may affect reported rates.


**Percentage Overweight and associated 95% confidence intervals:  
Primary 1 School Children by NHS Board of Examination<sup>1</sup>;  
All Participating NHS Boards, School Year 2010/11**



Key  
 A&A: Ayrshire & Arran  
 D&G: Dumfries & Galloway  
 GG&C: Greater Glasgow & Clyde

1. NHS Greater Glasgow & Clyde have only partially implemented CHSP School. The NHS GG&C figures relate mainly to children living in Renfrewshire CHP / Council Area and are therefore not representative of NHS GG&C as a whole (approximately 14% of all NHS GG&C children eligible for Primary 1). If measurements were available for the whole board area, the reported prevalence of overweight and obesity is likely to be higher than the figures for the partial area of NHS GG&C (mainly Renfrewshire CHP/Council area) reported here. [See Data collection and coverage](#) section for further information.
2. Confidence intervals for NHS Western Isles are not presented because the survey is estimated to cover the entire eligible Primary 1 population (the confidence interval is reduced to zero by the finite population correction factor).

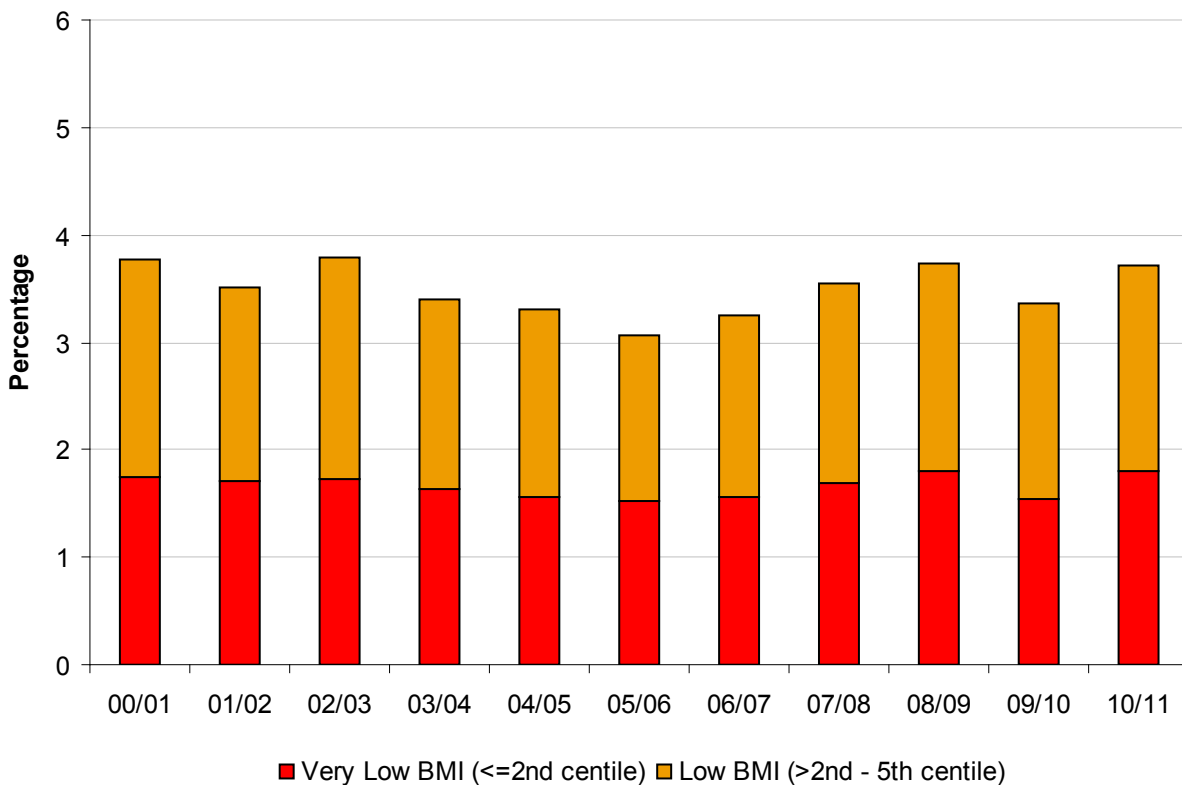
Source: ISD Scotland, CHSP-S November 2011

[High BMI distribution tables and charts](#)  are available by NHS Board, Council Area, Community Health Partnership, gender and Scottish Index of Multiple Deprivation (SIMD) quintile. The tables and charts should be read in conjunction with the Background and Explanatory notes which accompany them.

## Low BMI: Prevalence of underweight in Primary 1

Based on centile cut-offs on the 1990 UK growth reference charts used for population monitoring purposes, the percentage of Primary 1 school children with a low BMI  $\leq 5^{\text{th}}$  centile (classified as underweight) was 3.7% in 2010/11. This includes 1.8% with a very low BMI  $\leq 2^{\text{nd}}$  centile (classified as very underweight). Levels of low BMI have remained relatively stable over the period 2000/01 to 2010/11 at around 3% to 4%.

**Low BMI Distribution: Primary 1 School Children, All Participating NHS Boards, School Years 2000/01 - 2010/11<sup>1,R</sup>**



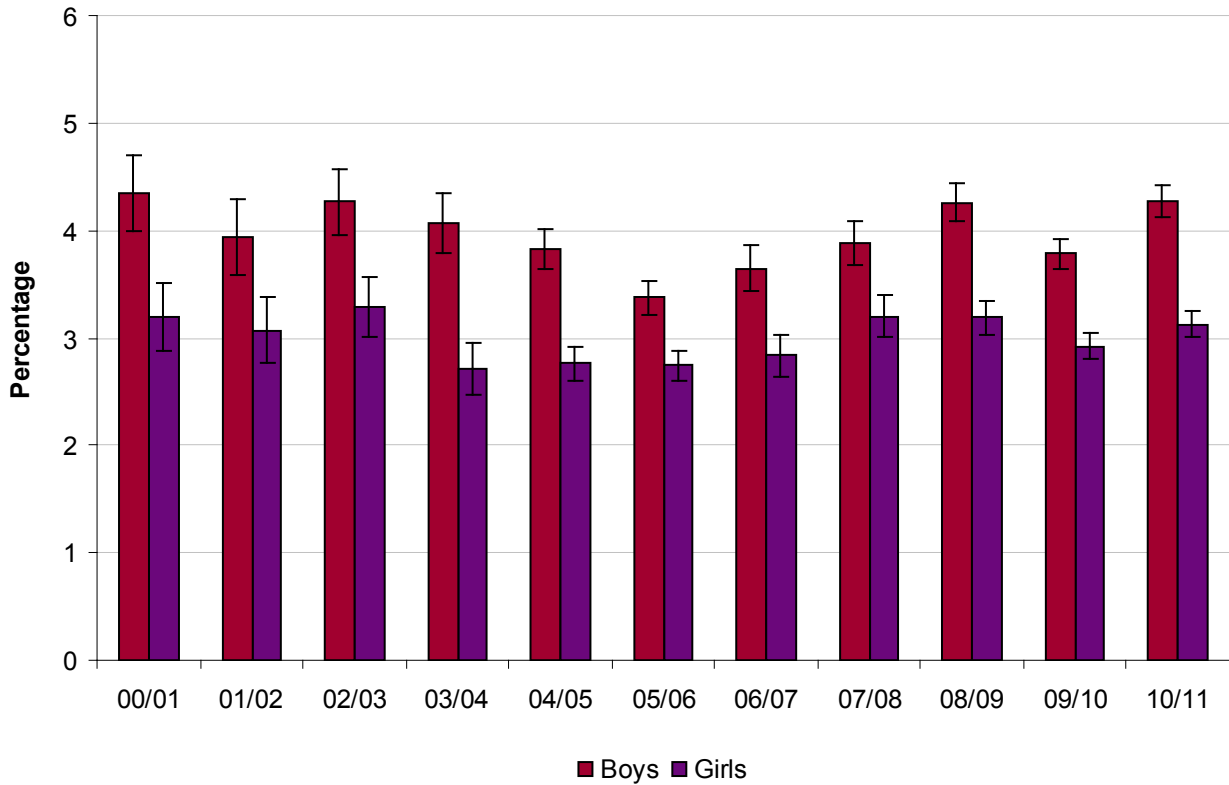
1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

R Revised: A change to the criteria for identifying likely errors in the BMI and an improved method of deriving the Council Area, Community Health Partnership (CHP) and Scottish Index of Multiple Deprivation (SIMD) has been implemented. This has been applied to data for all years presented resulting in revisions to previously published figures for school years 2000/01 to 2009/10. The impact is in each year the reported percentages of children classified with a low BMI and very low BMI increase by an average of 0.3 percentage points each year across all participating boards. Some Boards/CHP/council areas/SIMD quintiles may see slightly larger differences in some years. The revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Overall trends remain the same. For further information please see Appendix A1.

Source: ISD Scotland, CHSP-S November 2011

The prevalence of underweight is slightly higher amongst boys than girls in Primary 1 (4.3% of boys compared with 3.1% of girls in 2010/11).

**Percentage Low BMI and associated 95% confidence intervals:  
Primary 1 School Children by Gender;  
All Participating NHS Boards, School Years 2000/01 - 2010/11<sup>1,R</sup>**



1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

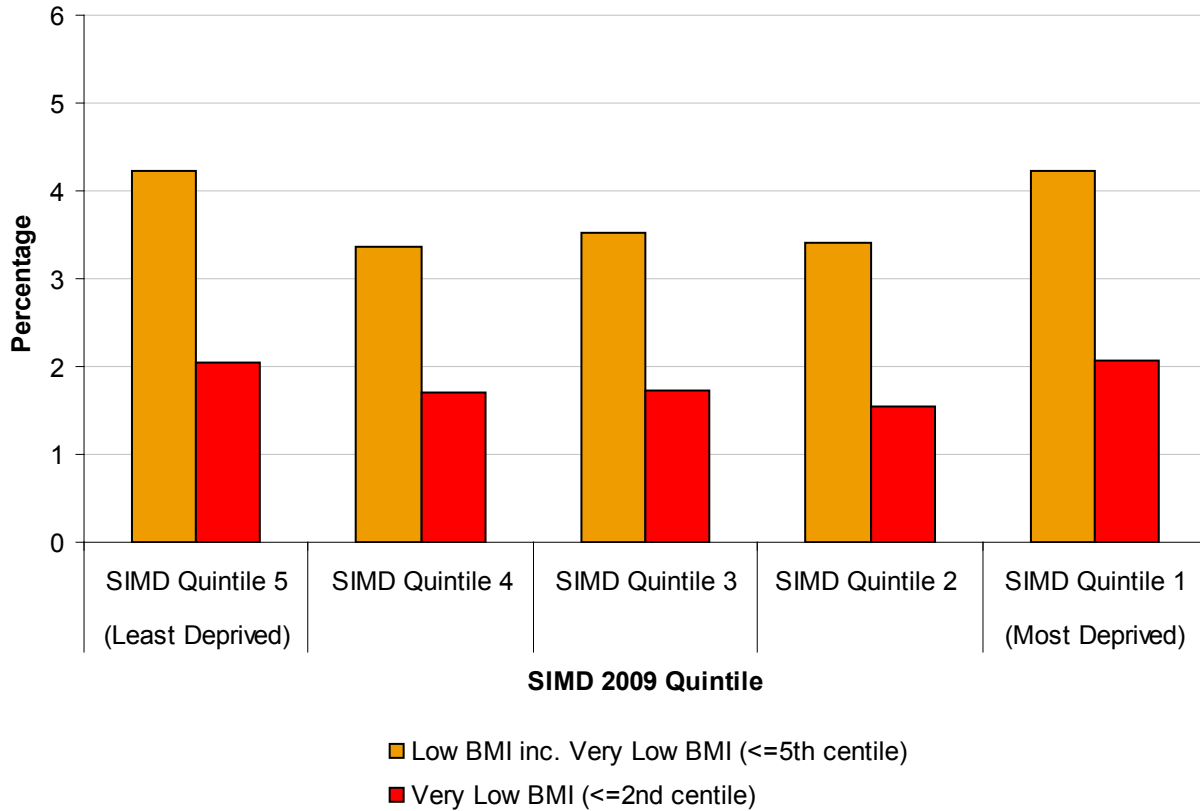
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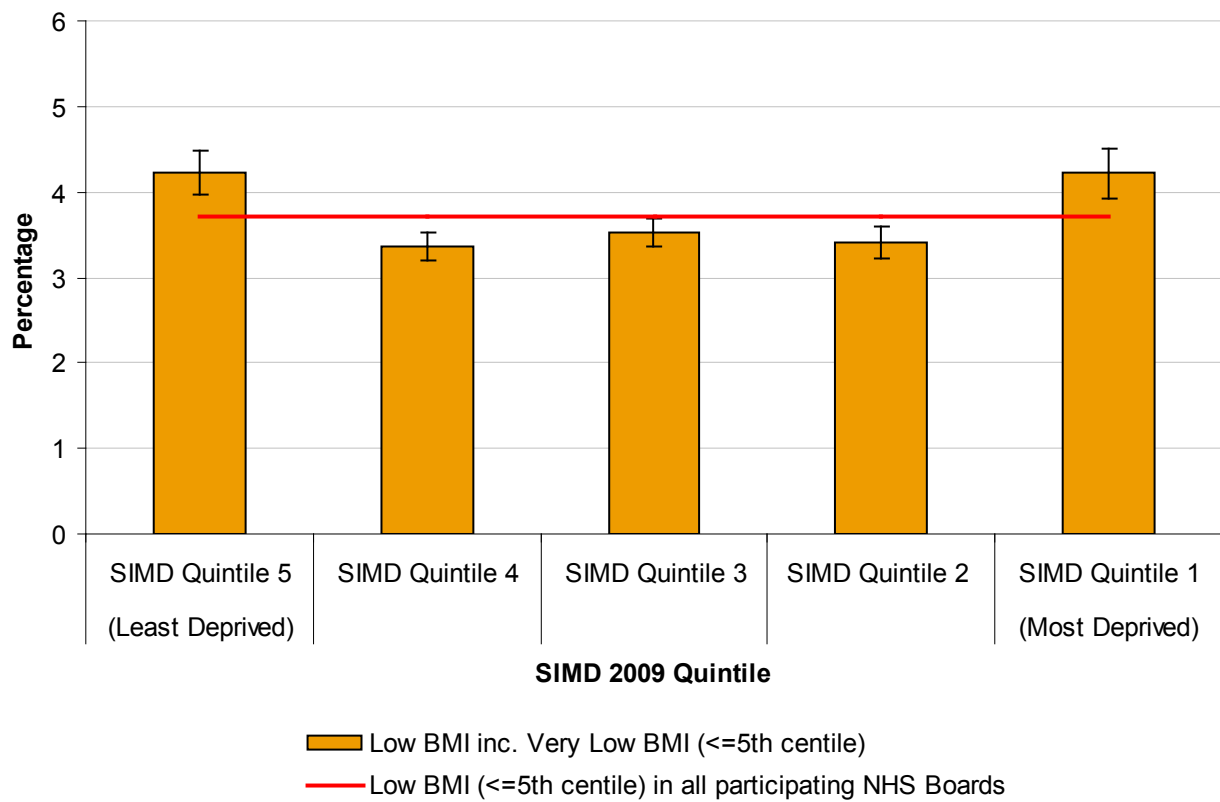
Figures for the last decade show that the prevalence of underweight tends to be higher in the most deprived areas (SIMD quintile 1). In 2010/11 the prevalence of underweight children in Primary 1 is slightly higher in the least deprived and most deprived areas, however this U-shaped pattern is not observed for all previous years.

**Low BMI Distribution in Primary 1 School Children by Scottish Index of Multiple Deprivation (SIMD) 2009 Quintile, All Participating NHS Boards, School Year 2010/11**



Source: ISD Scotland, CHSP-S November 2011

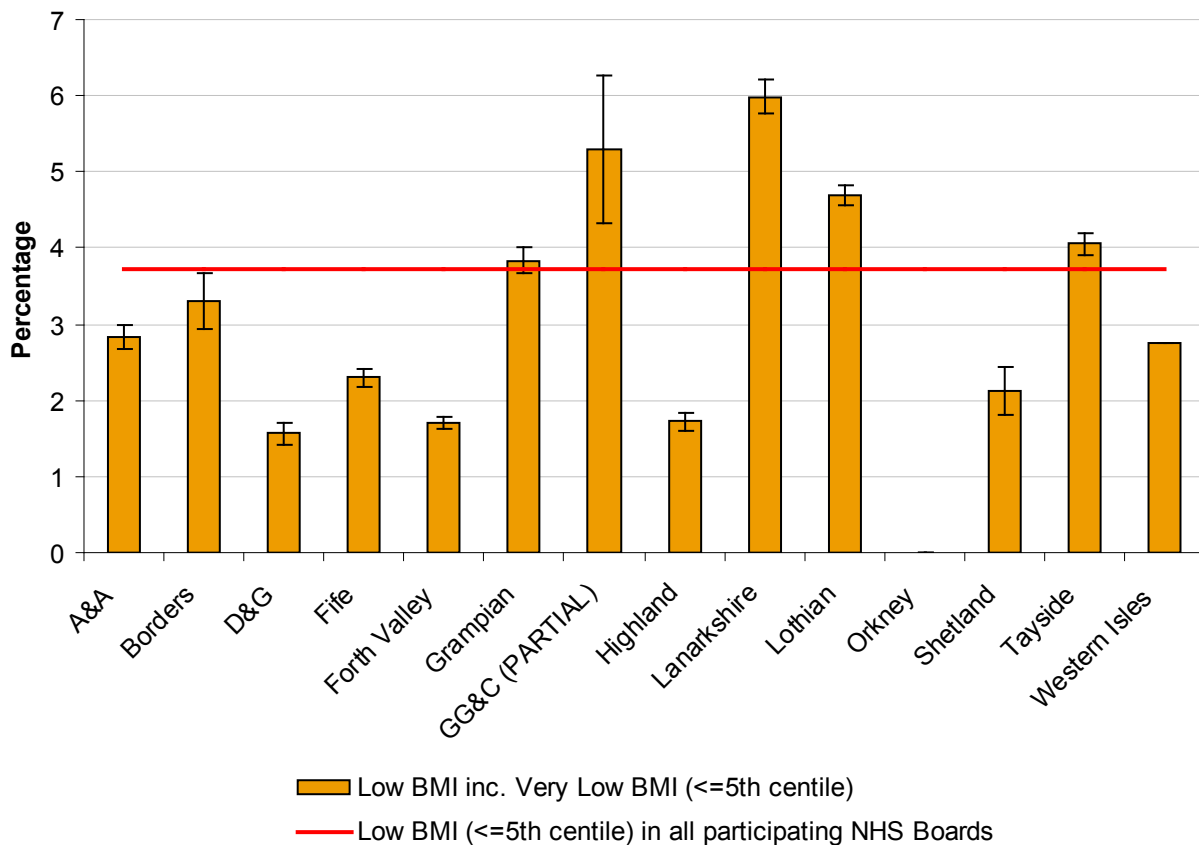
**Percentage Low BMI: Primary 1 School Children by Scottish Index of Multiple Deprivation (SIMD) 2009 Quintile, All Participating NHS Boards, School Year 2010/11**



Source: ISD Scotland, CHSP-S November 2011

The prevalence of low BMI varies between areas. Rates in a particular area can often fluctuate year on year. It is not unusual for areas with rates higher than the national average in a particular year to report rates lower than the national average in the previous year (and vice versa). Fluctuation in the reported rates partly reflects that figures relate to a different cohort of children each year. It is also important to consider how variation in the coverage of the BMI statistics between areas, and within an area from year to year, may affect reported rates.

**Percentage Low BMI and associated 95% confidence intervals:  
Primary 1 School Children by NHS Board of Examination<sup>1</sup>;  
All Participating NHS Boards, School Year 2010/11**




Key

A&A: Ayrshire & Arran  
 D&G: Dumfries & Galloway  
 GG&C: Greater Glasgow & Clyde

1. NHS Greater Glasgow & Clyde have only partially implemented CHSP School. The NHS GG&C figures relate mainly to children living in Renfrewshire CHP / Council Area and are therefore not representative of NHS GG&C as a whole (approximately 14% of all NHS GG&C children eligible for Primary 1). If measurements were available for the whole board area, the reported prevalence of underweight is likely to be slightly higher than the figures for the partial area of NHS GG&C (mainly Renfrewshire CHP/Council area) reported here. [See Data collection and coverage](#) section for further information.
2. Confidence intervals for NHS Western Isles are not presented because the survey is estimated to cover the entire eligible Primary 1 population (the confidence interval is reduced to zero by the finite population correction factor).

Source: ISD Scotland, CHSP-S November 2011

[Low BMI distribution tables and charts](#)  are available by NHS Board, Council Area, Community Health Partnership, gender and Scottish Index of Multiple Deprivation (SIMD) quintile. The tables and charts should be read in conjunction with the Background and Explanatory notes which accompany them.

## Glossary

CHSP School  
BMI

Child Health Systems Programme - School  
Body Mass Index [weight (in Kg) divided by height (in m) squared]

## List of Tables

Table No.	Name	Time period	File & size
B1 – B5	<a href="#">Primary 1 Statistics for High BMI (includes data by NHS Board, Council Area, Community Health Partnership, gender and deprivation)</a>	School years 2000/01 to 2010/11	Excel [518kb]
B6 – B10	<a href="#">Primary 1 Statistics for Low BMI (includes data by NHS Board, Council Area, Community Health Partnership, gender and deprivation)</a>	School years 2000/01 to 2010/11	Excel [399kb]
C1 – C2	<a href="#">Estimated data completeness - height and weight recording for Primary 1 School Children by NHS Board and Council Area</a>	School years 2000/01 to 2010/11	Excel [289kb]

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## Further Information

The NHS Information Centre has published [New Guidance on Producing UK level Child Obesity Statistics](#) which outlines the available data sources for child obesity statistics for England, Northern Ireland, Scotland and Wales and the differences in collection and analysis methods.

The [Scottish Health Survey](#) presents BMI statistics for children aged 2-15 years. See [Health Survey for England](#), [Welsh Health Survey](#) and [Health Survey Northern Ireland](#) for obesity data for other UK countries.

BMI statistics for children in reception year (typically aged 4-5 years) and school year 6 (typically aged 10 to 11 year) in England are published in the [2010/11 National Child Measurement Programme \(NCMP\)](#) report.

Further information is also available in the [Child Weight and Growth](#) section of the ISD website.

Information on other ISD publications and datasets can be found on the [ISD website](#).

## Rate this publication

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## Appendix

**A1 – Background Information****Revision of previously published statistics**

This publication includes the following main changes:

- Following review of the criteria for identifying likely errors in the recorded height and/or weight measurements (and hence derived BMI), it was identified that the previous criteria were over conservative and were excluding a number of measurements which were valid. Likely errors in the BMI are identified through calculating how many standard deviations an individual BMI measurement is away from the mean (also known as the standard deviation score). A rule-of-thumb for normal distributions is that virtually all the values should fall within three standard deviations either side of the mean value. However the rise in obesity since the UK 1990 growth reference for BMI data were collated (based on surveys between 1978 and 1990) means there has been a shift in the distribution of BMI for the child population. While previously very few children would have a BMI more than three standard deviations from the mean, this is no longer the case when comparing actual BMI against the UK 1990 growth reference for BMI. If the surveys were conducted now, the reference data for the distribution of BMI would look very different. The range of valid BMI standard deviation scores included in these statistics has therefore been extended from -3 to +3 to the range -7 to +7. This means several hundred records per year previously excluded from the statistics will now be included as most will be correct measurements. The vast majority of the additional records now included relate to children with a BMI which falls between three and four standard deviations from the mean and therefore classified as severely obese according to the epidemiological cut-off value of the 98th centile. The final dataset includes very few measurements which are more than four standard deviations from the mean.
- A revised method has been used to derive the Council Area, Community Health Partnership (CHP) and Scottish Index of Multiple Deprivation (SIMD) quintile due to limitations identified in postcode derived information in historic data from CHSP School. The CHSP School system is dynamic, with ongoing updating of records. Historically each year's release of BMI statistics has been based on the latest available data from the CHSP School to allow for additions and amendments to the data. It has recently been identified that where a child's postcode of residence has changed, in some instances the derived Community Health Partnership, Council Area and deprivation quintile may not reflect where the child lived at the time of their Primary 1 review. Therefore the postcode of residence used in these statistics has been re-derived from postcode history data to more accurately reflect where the child lived at the time of the Primary 1 review. Functionality to store the child's postcode at the time of their Primary 1 review was added to the CHSP School system prior to school year 2010/11 so this is not an issue for data recorded from this point. The overall 'All participating NHS Boards' total and NHS Board rates are not affected as these are based on Board of examination rather than postcode of residence (with the exception of a small area which falls under the administration of the former NHS Argyll & Clyde).



The changes have been applied to data for all years presented and therefore result in revisions to previously published figures for school years 2000/01 to 2009/10.

The impact is in each year the reported percentages of children classified as overweight (including obese and severely obese), obese (including severely obese), and severely obese increase by an average of 1.3 percentage points across all participating boards areas. The reported percentages of children classified with a low BMI and very low BMI increase by an average of 0.3 percentage points each year across all participating boards. Some Boards/CHP/council areas/SIMD quintiles may see slightly larger differences in some years. The revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Overall trends remain the same. Further information is available in [Appendix A1](#) – Background Information.

Other revisions are:

- Inclusion of NHS Shetland figures for 2008/09 for the first time. NHS Shetland added this data to CHSP School retrospectively.
- NHS Western Isles had not recorded all height and weight measurements for 2009/10 on the system at the time of data extract for the last publication which was released in December 2010. These records have now been recorded on CHSP School and figures for 2009/10 are revised accordingly.

### Reference standards used to derive BMI statistics

#### *1990 UK growth reference standards*

In 1995, reference growth curves for the weight and height of UK children were published, replacing the Tanner-Whitehouse reference curves used since the 1960s. The curves represent UK children in 1990 and are widely accepted as the reference for growth screening for the UK. The reference data used were collected between 1978 and 1990 (and therefore represent weight relative to height before the recent rise in levels of obesity in children) and were obtained by combining data from 11 distinct surveys that were representative of children in England, Scotland and Wales. From this national dataset, BMI reference curves for children and young people were established, providing BMI centiles covering birth to 23 years of age.

We have used 1990 UK Reference data and Cole's LMS method to produce BMI centiles for Scottish children ([Cole TJ, Freeman JV and Preece MA](#). Body mass index reference curves for the UK, 1990. Arch Dis Child 1995; 73: 25-9) as recommended in [SIGN guidance](#).

New UK-WHO growth charts for infants and children aged up to four years have recently been adopted in the UK (the charts were introduced in Scotland in January 2010). The new charts are based on combined UK1990 and World Health Organisation (WHO) growth reference data. The UK 1990 Growth Charts will continue to be used for children over 4 years.

#### *International growth reference standards*

The [World Health Organisation has published international reference standards](#) for infants and children. These reference standards are derived from growth data from the [Multicentre Growth Study](#) relating to approximately 8500 children from six different countries around the world (Brazil, Ghana, India, Norway, Oman and USA).

Use of international reference standards allows international comparisons to be made (Scottish figures derived using these standards aren't available here).

## **Thresholds for defining very low BMI, low BMI, overweight, obese and severely obese**

This release look at trends in the percentages of children classified as very low BMI, low BMI, overweight, obese and severely obese, as defined according to centile cut-offs from the UK 1990 growth reference standards charts (very low BMI  $\leq$  2nd centile, low BMI  $\leq$  5th centile, overweight  $\geq$  85th centile, obese  $\geq$  95th centile, severely obese  $\geq$  98th centile).

The BMI centile cut-offs used to derive the percentages overweight, obese and severely obese in these pages, are those recommended in [SIGN](#) guidance for the purposes of population monitoring and epidemiological research. Use of the corresponding thresholds recommended by SIGN for clinical practice (overweight  $\geq$  91st centile, obese  $\geq$  98th centile, severely obese  $\geq$  99.6th centile) would result in lower percentages for overweight, obese and severely obese and BMI centile would be only one of a variety of factors taken into consideration before a clinical diagnosis is made.

In the UK, it is generally agreed that the most appropriate clinical cut-off for classifying individual children as being underweight is  $\leq$  2nd centile. There is no agreed definition of underweight for population monitoring purposes but a reasonable threshold would be  $\leq$  5th centile (see Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007; 335: 194-7 and Dinsdale H, Rutter H et al. National Child Measurement Programme: Detailed Analysis of the 2006/07 National Dataset. National Obesity Observatory publication, June 2008).

## **Confidence intervals**

The upper and lower limits for 95% confidence intervals have been included in our tables for all childhood BMI distribution percentages. Confidence intervals provide a measure of the potential error between the observed rates and the true population values. A 95% confidence interval means that if identical studies were carried out repeatedly on different samples from the same population, we would expect 95% of confidence intervals calculated in this way to contain the true population value. In simpler terms there is a 95% chance that the range contains the true population value.

For a given level of confidence, the width of the confidence interval depends on two things:

- The sample size (in this case, the number of reviews with valid height and weight measurements recorded). The larger the number of valid measurements, the greater the precision and the narrower the confidence intervals;
- The variability in the results being observed (in this case the BMI centile). The larger the variability, the poorer the precision and the wider the confidence intervals.

A finite population correction factor has been applied to the calculation of the confidence intervals to account for the added precision gained by surveying a larger percentage of the population. A finite population correction reduces the width of the confidence intervals depending on how large the number of children measured is in relation to the eligible Primary 1 population. Where the survey covers 100% of the population, the confidence

interval is reduced to zero by the finite population correction factor. In previous publications the confidence intervals were produced using the Wilson method for proportions (Wilson EB. Probable inference, the law of succession, and statistical inference. J Am Stat Assoc 1927, 22, 209-12). The previous method resulted in wider confidence intervals, particularly where the BMI distribution percentages were based on a small number of reviews (for example, for the Island Boards and some Community Health Partnerships).

It is also possible to use confidence intervals to gain some indication of whether, for example, the percentage of Primary 1 school children classified as obese for a particular NHS Board is statistically significantly different from the average percentage for all participating Boards. Consider the situation where the percentages of Primary 1 children classified as obese in NHS Boards 'X' and 'Y' are below the average percentage for all participating Boards. The confidence interval for NHS Board 'X' includes the average percentage but the confidence interval for NHS Board 'Y' does not (the upper bound of the NHS Board 'Y' confidence interval is lower than the average percentage). We can say that we are 95% confident that the percentage of Primary 1 children classified as obese in NHS Board 'Y' is statistically significantly lower than the average percentage for all participating Boards. However, the percentage for NHS Board 'X' is not significantly lower.

### **Accuracy and reliability**

Data are compared to previous year's figures and to expected trends. The proportion of children with 'extreme' BMI values recorded (indicating possible error) is monitored to help assess where systematic error may have occurred.

BMI measurements with a standard deviation score outside the range -3 to +4 are unlikely to occur. The final dataset has fewer than 0.7% of records outside this range. BMI measurements with a standard deviation score outside the range -7 to +7 are 'extreme' values and are excluded from final dataset (fewer than 0.1% of records).

Only measurements for children in the range four to seven years of age (inclusive) are included in the final dataset. There are a small number of Primary 1 measurements for children out-with this age range recorded on CHSP School.

It is important to consider how variation in the coverage of the BMI statistics between areas, and within an area from year to year, may affect reported rates. Confidence intervals should be considered when interpreting results.

## A2 – Publication Metadata (including revisions details)

Metadata Indicator	Description
Publication title	Primary 1 Body Mass Index (BMI) Statistics
Description	Annual statistics on high and low body mass index (BMI) for Primary 1 school children. Statistics are presented by: NHS Board, Council Area, Community Health Partnership, gender and Scottish Index of Multiple Deprivation (SIMD) quintile.
Theme	Health and Social Care
Topic	Child Health
Format	PDF document and Excel workbooks
Data source(s)	Child Health Systems Programme School (CHSP School)
Date that data are acquired	14 November 2011
Release date	24 April 2012
Frequency	Annual
Timeframe of data and timeliness	Data to school year 2010/11. No delays between data availability and processing of data for publication.
Continuity of data	As the number of NHS Boards included in these statistics has increased since 2000/01 (from four to all fourteen Boards in Scotland), the trend for 'all participating NHS Boards' should be interpreted with some caution.
Revisions statement	The publication is produced from the latest data extract from CHSP S which is a dynamic system, with ongoing updating of records. Data for the previous school year are updated in the next release though any updates are expected to be minor. Data for earlier school years may be updated where the publication includes a new presentation of the data as a time-series or includes updated geographical reference data (for example a new geographical breakdown). This is to ensure there is consistency in the totals (for example the denominator number of reviews) presented for each year across the publication. Any changes are expected to be negligible.
Revisions relevant to this publication	A change to the criteria for identifying likely errors in the recorded height and/or weight measurements (and hence derived BMI) and an improved method of deriving the Council Area, Community Health Partnership (CHP) and Scottish Index of Multiple Deprivation (SIMD) has been implemented. This has been applied to data for all years presented resulting in revisions to previously published figures for school years 2000/01 to 2009/10. See <a href="#">Appendix A1</a> for full details.
Concepts and definitions	See <a href="#">Measuring obesity in children</a> and <a href="#">Appendix A1</a>
Relevance and key uses of the statistics	Making information publicly available for planning, epidemiology, provision of services and providing comparative information.
Accuracy	Data are compared to previous year's figures and to expected trends. The final dataset has less than 0.7% of records with BMI standard deviation scores outside the

	range -3 to 4. The proportion of eligible Primary 1 children included in the statistics in each area and year will also impact on the accuracy of the reported rates.
Completeness	Estimated data completeness tables are available (see section on <a href="#">Data Collection and Coverage</a> )
Comparability	The NHS Information Centre has published <a href="#">New Guidance on Producing UK level Child Obesity Statistics</a> which outlines the available data sources for child obesity statistics for England, Northern Ireland, Scotland and Wales and the differences in collection and analysis methods. See also the <a href="#">Further Information</a> section.
Accessibility	It is the policy of ISD Scotland to make its web sites and products accessible according to <a href="#">published guidelines</a> .
Coherence and clarity	Tables and charts are accessible via the <a href="#">ISD website</a> .
Value type and unit of measurement	Numbers and percentages
Disclosure	The <a href="#">ISD protocol on Statistical Disclosure Protocol</a> is followed.
Official Statistics designation	National Statistics
UK Statistics Authority Assessment	Awaiting assessment by UK Statistics Authority
Last published	14 December 2010
Next published	December 2012
Date of first publication	Due to phased implementation of the CHSP School system, data for different NHS Boards are available for different school years. For the first NHS Boards to implement the CHSP School system, data are available back to school year 2000/01.
Help email	<a href="mailto:NSS.isdchildhealth@nhs.net">NSS.isdchildhealth@nhs.net</a>
Date form completed	April 2012

## **A3 – Early Access details (including Pre-Release Access)**

### **Pre-Release Access**

Under terms of the "Pre-Release Access to Official Statistics (Scotland) Order 2008", ISD are obliged to publish information on those receiving Pre-Release Access ("Pre-Release Access" refers to statistics in their final form prior to publication). The standard maximum Pre-Release Access is five working days. Shown below are details of those receiving standard Pre-Release Access and, separately, those receiving extended Pre-Release Access.

#### **Standard Pre-Release Access:**

- Scottish Government Health Department
- NHS Board Chief Executives
- NHS Board Communication leads

#### **Extended Pre-Release Access**

Extended Pre-Release Access of 8 working days is given to a small number of named individuals in the Scottish Government Health Department (Analytical Services Division). This Pre-Release Access is for the sole purpose of enabling that department to gain an understanding of the statistics prior to briefing others in Scottish Government (during the period of standard Pre-Release Access).

- Scottish Government Health Department (Analytical Services Division)

#### **Early Access for Management Information**

These statistics will also have been made available to those who needed access to 'management information', i.e. as part of the delivery of health and care:

- NHS Board Directors of Public Health