

Publication Report



Primary 1 Body Mass Index (BMI) Statistics

School Year 2011/12

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Introduction

There is continued concern over the levels of overweight and 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 certain cancers, low self-esteem and depression. Underweight in childhood can also be a cause for concern, indicating poor nutritional intake and/or underlying medical problems. Both over- and underweight develop as a result of an imbalance between energy consumption and energy expenditure.

This publication provides annual statistics on high, low and healthy body mass index (BMI) for Primary 1 school children, and includes data to school year 2011/12. The statistics are derived from height and weight measurements recorded at Primary 1 health reviews. Statistics are presented by: NHS Board, Council area, Community Health Partnership (CHP), gender and Scottish Index of Multiple Deprivation (SIMD) quintile. The data for 2011/12 covers all CHP/Council areas in Scotland for the first time. 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.

In previous years, this publication only presented information based on the epidemiological thresholds for classifying children into over- and underweight categories (see section on [measuring obesity in children](#)). This year changes to the information presented have been made as follows:

- The tables based on epidemiological thresholds have been enhanced and now include figures on the proportion of children classified as healthy weight. The categories have also been relabelled for clarity.
- New tables presenting figures based on the clinical thresholds for classifying children into categories of over- and underweight are included in the publication for the first time. The inclusion of this information is to support planning and delivery of clinical services, such as child healthy weight programmes in NHS Boards.

Although the report includes brief commentary on the proportion of children in each clinical category, the main focus of the report commentary is the proportion of children in each epidemiological category. The reason is for comparability with previous years' publications and for ease of reference with published data in the rest of the UK, for example, the annual report on the [National Child Measurement Programme in England](#).

There has been a minor change to the methodology for allocating children into over- and underweight categories in this publication (this relates to the rounding of figures used in calculations). This change has been applied to data for all years presented resulting in minor revisions to some of the previously published figures for school years 2000/01 to 2010/11. The differences are mainly in the range -0.1 to +0.1 percentage points. Some Boards/CHP/council areas/SIMD quintiles may see slightly larger differences in some years. This revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Further information can be found in [Appendix A2](#).

Measuring obesity in children

Body Mass Index (BMI) is one of the most widely used methods for assessing body composition in children aged two years or older and adults. BMI is calculated by dividing an individual's weight (in kilograms) by their height squared (in metres²) and gives an indication of whether weight is in proportion to height. Whilst BMI generally gives a good indication of body composition, it can occasionally misclassify individuals with heavy musculature as being overweight or obese.

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 standards.

Growth reference standards are derived from population based surveys of children's height and weight undertaken at a particular time. They therefore show the distribution of BMI within the child population that pertained in the location and at the time point that the surveys were conducted. The UK 1990 growth reference standards have been used for the purposes of this publication. These standards were published in 1995 and replaced the Tanner-Whitehouse reference standards that had been used since the 1960s. The reference data used to construct the UK 1990 standards 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 at that time.

The growth reference standards are used to provide the thresholds or cut-off points in the BMI distribution that specify categories such as underweight, obesity, etc. Two sets of thresholds have traditionally been used to assess children's growth as noted in the Scottish Intercollegiate Guidelines Network guideline on Management of Obesity (<http://www.sign.ac.uk/pdf/sign115.pdf>). Epidemiological thresholds are used to define children at risk of under- or overweight and are used primarily to assess the health of the whole child population and monitor the changes in the proportion of children at risk of unhealthy weight that have been seen in Scotland over recent years. Clinical thresholds are used to define children with a level of under- or overweight that may warrant clinical intervention, such as consideration of any underlying cause, advice on healthy eating and appropriate levels of physical activity, or referral to more intensive child healthy weight services. BMI measures would usually be only one of a variety of factors taken into consideration before any clinical diagnosis of obesity is made and, for example, other measures such as waist circumference may also be used. The epidemiological and clinical thresholds used to define the various categories of child (un)healthy weight are shown in the following tables.

Thresholds used to define epidemiological categories of child (un)healthy weight: predominantly used for population health monitoring purposes

Category	Definition (used in calculations for epidemiological thresholds)
At risk of underweight	BMI less than or equal to 2 nd centile
Healthy weight	BMI greater than 2 nd centile and less than 85 th centile
At risk of overweight	BMI greater than or equal to 85 th centile and less than 95 th centile
At risk of obesity	BMI greater than or equal to 95 th centile
At risk of overweight and obesity combined	BMI greater than or equal to 85 th centile

Thresholds used to define clinical categories of child (un)healthy weight: predominantly used in clinical practice

Category	Description/label in terms of rounded centile values	Definition: Standard Deviation (SD) score equivalent (used in calculations for clinical thresholds)
Underweight	BMI less than or equal to 0.4 th centile	BMI less than or equal to -2.67 SD score
Healthy weight	BMI greater than 0.4 th centile and less than 91 st centile	BMI greater than -2.67 and less than +1.33 SD score
Overweight	BMI greater than or equal to 91 st centile and less than 98 th centile	BMI greater than or equal to +1.33 and less than +2.00 SD score
Obesity	BMI greater than or equal to 98 th centile and less than 99.6 th centile	BMI greater than or equal to +2.00 and less than +2.67 SD score
Severely Obese	BMI greater than or equal to 99.6 th centile	BMI greater than or equal to +2.67 SD score
Overweight, obese and severely obese combined	BMI greater than or equal to 91 st centile	BMI greater than or equal to +1.33 SD score
Obese and severely obese combined	BMI greater than or equal to 98 th centile	BMI greater than or equal to +2.00 SD score

It can be seen from the tables above that the various thresholds/categories are described in terms of centiles. Centiles in the growth reference standards are derived by looking at the distribution of the BMIs of all children within a particular age and sex group that were included in the surveys that the reference standards are based on. The centile value then shows the proportion of children within that age and sex group with a BMI value below the centile value. For example, 2% of children included in the surveys used to derive the UK 1990 reference standards had a BMI less than or equal to the UK 1990 2nd centile value for their age and sex group. Similarly, 50% had a BMI \leq 50th centile and 95% had a BMI \leq 95th centile.

The clinical thresholds tend to be described and labelled, as they are in this report, in terms of centile values, for example, BMI on or over 98th centile is classified as obese and severely obese combined. However these descriptions/labels are rounded centile values and the clinical thresholds are actually defined in terms of their underlying Standard Deviation (SD) score. This means, for example, the actual clinical threshold for obese and severely obese combined is +2.00 SD score (which relates to the 97.7th centile, although it is described and labelled in terms of rounded centile i.e. the 98th centile). Therefore, for the clinical categories, the underlying BMI SD scores are the thresholds used to allocate children to categories of (un)healthy weight. For the epidemiological categories, the BMI centile values are the thresholds used to allocate children to categories of (un)healthy weight (as the 2nd, 85th and 95th centiles are exact centile values).

In previous years, this publication only presented information based on the epidemiological thresholds: this year information based on both the epidemiological and the clinical thresholds is included. To make the distinction between the two sets of figures clearer, the labels assigned to the epidemiological categories have been updated to those shown in the table above. These labels are in line with those recommended in a joint statement released by the Scientific Advisory Committee on Nutrition (SACN) and the Royal College of Paediatrics and Child Health (RCPCH) in April 2012 ([Consideration of issues around the use of BMI centile thresholds for defining underweight, overweight and obesity in children aged 2-18 years in the UK](#)). Previous publications included information on the proportion of children on or below the 5th centile. This threshold was not identified by SACN/RCPH as meaningful in terms of measuring rates of (un)healthy weight and is therefore no longer presented.

The current BMIs of Primary 1 children in Scotland are converted to SD scores/centiles in order to compare them to the growth reference standards and assign children to the various categories of (un)healthy weight. Each child's BMI is calculated then converted into SD scores/centiles, using the 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](#)). If the distribution of Primary 1 children's BMIs in Scotland were the same now as when the UK 1990 reference standards were produced, we would still expect to see 95% of children with a BMI \leq 95th centile (and conversely 5% of children with a BMI \geq 95th centile and hence included in the 'at risk of obesity' epidemiological category), and so on for the other categories. The upward shift in children's weight over recent years means that this is not the case. In general, fewer children than would be expected are seen in the underweight categories, and more children than would be expected are seen in the overweight and obese categories. For example, almost 10% of Primary 1 children now have a BMI that places them in the UK 1990 'at risk of obesity' epidemiological category compared to the 5% that would be expected if the BMI distribution of Primary 1 children was the same now as when the UK 1990 reference standards were produced.

Throughout this publication, the percentage of children included in each of the (un)healthy weight categories is provided along with a 95% confidence interval. A confidence interval gives an indication of the likely error around an estimate and should be considered when interpreting the 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 growth reference standards, the calculation of rates of (un)healthy weight and confidence intervals can be found in [Appendix A1 Background Information](#).

Data collection and coverage

NHS Scotland provides a universal health promotion programme to all children and their families known as the child health programme. The programme includes various elements such as formal screening for specific medical problems, routine childhood immunisations, and a structured programme of needs assessment, health promotion, and parenting support provided through regular scheduled contacts with health visitors, school nurses and other health professionals. The delivery of the child health programme to school aged children in Scotland is supported by the CHSP School system. The system facilitates the invitation of children for specific child health programme contacts as they reach the appropriate age and also allows recording of information obtained and/or care given during the contacts. 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 by NHS Boards. ISD receive data extracts from the system for the purpose of producing and publishing statistics.

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. In 2011/12, 50% of children were aged between 4.5 and 5.5 years at the time of measurement, and 48% were aged over 5.5 years up to 6.25 years (inclusive). There has been some variation in these rates over time with the percentage of children aged between 4.5 and 5.5 years ranging between around 40% and 50% over the period. However, as BMI centile results are adjusted for age, this variation, and the inclusion of a small percentage of children in Primary 1 over the age of 6.25 years, has negligible impact on the BMI distribution rates reported.

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 these statistics, from approximately 22% in 2000/01 to 92% in 2011/12. The data for 2011/12 covers all CHP/Council areas in Scotland for the first time. 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 twelve year period are similar to those for 'All participating NHS Boards'. Estimates of the proportion of Primary 1 children in Scotland included the statistics each year are shown in the following table.

Height and weight recording for Primary 1 School Children in Scotland Estimated Data Completeness, School Years 2000/01 - 2011/12

School year	Population of 5 year olds (NRS mid-year estimate)	Children in Primary 1 with valid height and weight measurements recorded	
		Number	Percentage
2000/01	59,175	12,966	21.9
2001/02	58,088	12,684	21.8
2002/03	58,624	15,864	27.1
2003/04	56,803	16,853	29.7
2004/05	55,929	23,014	41.1
2005/06	53,553	25,897	48.4
2006/07	52,843	25,207	47.7
2007/08	52,093	28,251	54.2
2008/09	53,135	34,463	64.9
2009/10	54,812	40,191	73.3
2010/11	55,763	41,191	73.9
2011/12	56,446	52,139	92.4

Source: CHSP School November 2012, ISD Scotland and mid-year population estimates from National Records of Scotland (NRS)

School year 2011/12 is the first year that all areas of NHS Greater Glasgow & Clyde (NHS GG&C) have recorded height and weight measurements for Primary 1 children on the CHSP School system. The NHS GG&C data available for previous years (2006/07 to 2010/11) are partial, with height and weight measurements recorded for only around 13% to 14% of all NHS GG&C children eligible for Primary 1. The partial data relates mainly to NHS GG&C children living in Renfrewshire CHP / Council area and are therefore not representative of the board area as a whole. The NHS GG&C figures based on partial data are likely to underestimate the true prevalence of unhealthy weight, and overestimate the prevalence of healthy weight. 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. Therefore the reported prevalence of (un)healthy weight for NHS GG&C for 2011/12 are not comparable with the rates for previous years.

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 2011/12 cover approximately 20% 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 school year 2011/12 a total of 52,139 valid height and weight measurements were recorded for children in Primary 1 in Scotland. This is approximately 92% of children in Primary 1. This is the first year that data are available for all council areas in Scotland.

Based on epidemiological thresholds used for population monitoring purposes:

- In 2011/12, 76.9% of children in Primary 1 were classified as healthy weight, a marginal increase on the 2010/11 figure of 76.7%.
- The BMI distribution of children in Primary 1 has remained broadly similar over the period 2000/01 to 2011/12 with around 21% to 23% of children (one in five) at risk of overweight and obesity combined and around 1.5% at risk of underweight. In 2011/12, 21.9% of children in Primary 1 were at risk of overweight and obesity combined and 1.2% at risk of underweight.
- The prevalence of healthy weight amongst children in Primary 1 decreases with deprivation. In the least deprived areas (SIMD quintile 5), 81.1% of children were classified as healthy weight while in the most deprived areas (SIMD quintile 1) 74.0% were classified as healthy weight.
- The prevalence of healthy weight is slightly higher amongst girls than boys. In school year 2011/12, 77.8% of girls were classified as healthy weight compared to 76.0% of boys.

Based on clinical thresholds for assessing children:

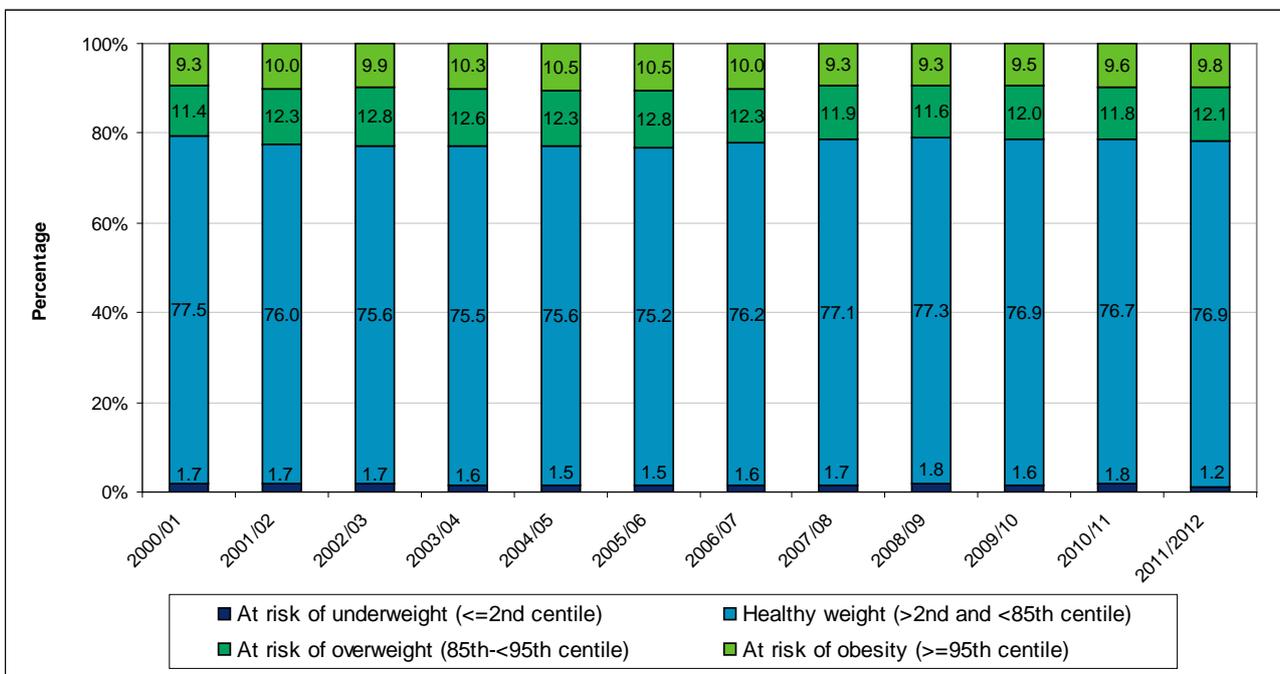
- In 2011/12, 84.6% of children in Primary 1 in Scotland were classified as healthy weight, a marginal decrease on the 2010/11 figure of 84.7%.
- The BMI distribution of children in Primary 1 has remained broadly similar over the period 2000/01 to 2011/12 with around 14% to 16% of children overweight, obese and severely obese combined and around 0.5% underweight. In 2011/12, 14.9% of children were classified as overweight, obese and severely obese combined and 0.4% underweight.
- The gender and deprivation patterns observed for the clinical thresholds are similar to those observed for the epidemiological thresholds.

Results and Commentary

BMI distribution of children in Primary 1 – epidemiological categories

Based on epidemiological thresholds used for population monitoring purposes, 76.9% of children in Primary 1 in Scotland in school year 2011/12 were classified as healthy weight, a marginal increase on the 2010/11 figure of 76.7% (Figure 1). This marginal increase in the proportion of children classified as healthy weight is due to a decrease in the percentage of children at risk of underweight from 1.8% in 2010/11 to 1.2% in 2011/12. The proportion of children at risk of overweight increased from 11.8% in 2010/11 to 12.1% in 2011/12, and those at risk of obesity increased slightly from 9.6% in 2010/11 to 9.8% in 2011/12.

Figure 1: BMI distribution of children in Primary 1, school years 2000/01 to 2011/12 (epidemiological categories), All participating NHS Boards/Scotland¹



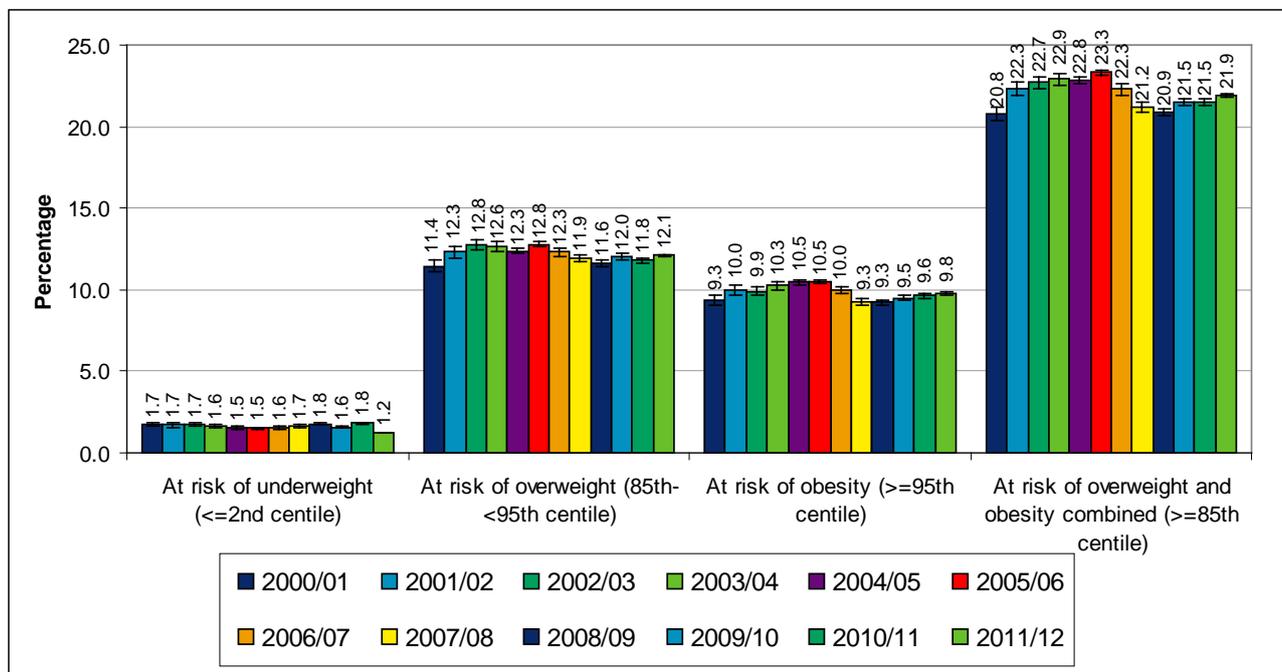
1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

Source: ISD Scotland, CHSP-S November 2012

The BMI distribution of children in Primary 1 has remained broadly similar over the period 2000/01 to 2011/12 with around 21% to 23% of children (one in five) at risk of overweight and obesity combined and around 1.5% at risk of underweight (Figure 2). As shown in Figure 2, a small upward trend in the proportion of children at risk of overweight and obesity combined is observed between 2000/01 and 2005/06, with rates increasing from 20.8% to 23.3%. Rates subsequently decreased to 20.9% in 2008/09 and then increased to 21.9% in 2011/12. However, as the number of NHS Boards included in these statistics has increased since 2000/01 from four to fourteen Boards, the trend for 'all participating NHS Boards' should be interpreted with a degree of caution. The trends observed among the four Boards participating in CHSP School throughout the twelve year period are similar to those for 'All participating NHS Boards'.

Although school year 2011/12 is the first year that data are available for all areas of NHS Greater Glasgow & Clyde, the largest NHS board in Scotland, this has a negligible impact on the 'All participating NHS Boards/Scotland' figures for 2011/12 and the comparison to rates in 2010/11. This is because the BMI distribution of children in NHS Greater Glasgow & Clyde in 2011/12 is similar to the overall BMI distribution of children in the rest of Scotland. If the 'new' data for NHS Greater Glasgow & Clyde hadn't been available for 2011/12, the percentages of children classified as at risk of (un)healthy weight in 'All participating NHS Boards/Scotland' would have been almost the same as those reported here for 2011/12 (the largest difference would have 0.1 percentage points when rounded to one decimal place).

Figure 2: Percentage of children in Primary 1 at risk of: underweight, overweight and obesity, by school year (epidemiological categories), All participating NHS Boards/Scotland¹



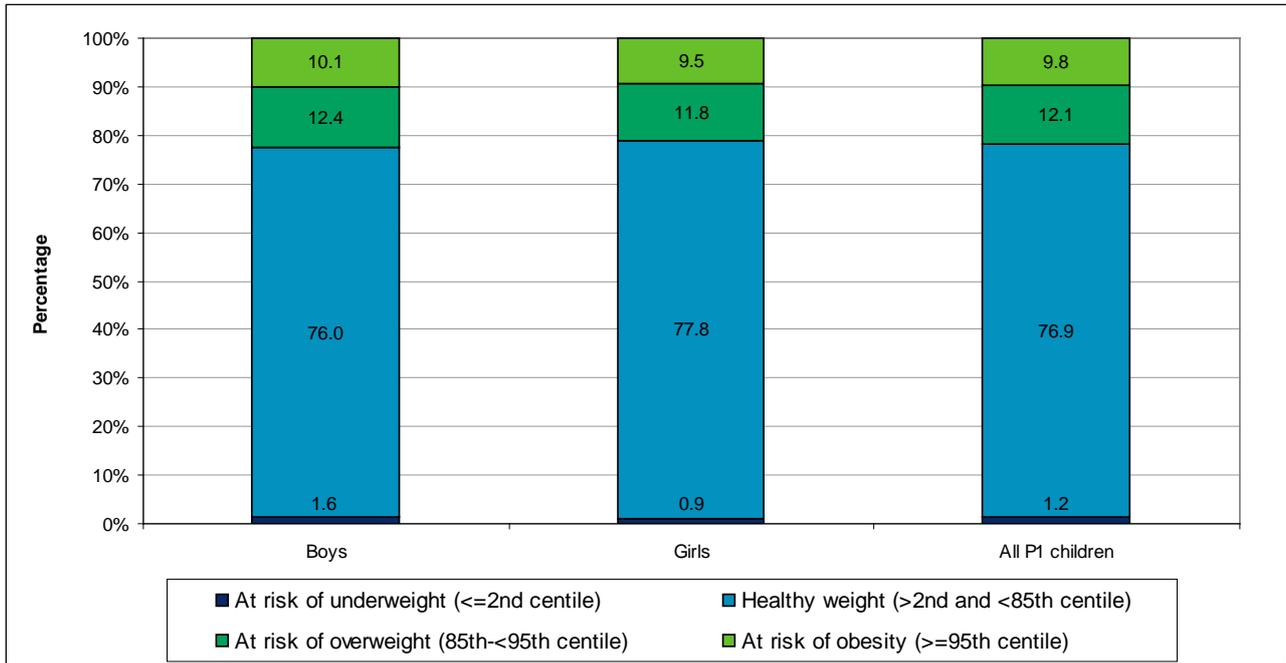
1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

Source: ISD Scotland, CHSP-S November 2012

BMI distribution by gender – epidemiological categories

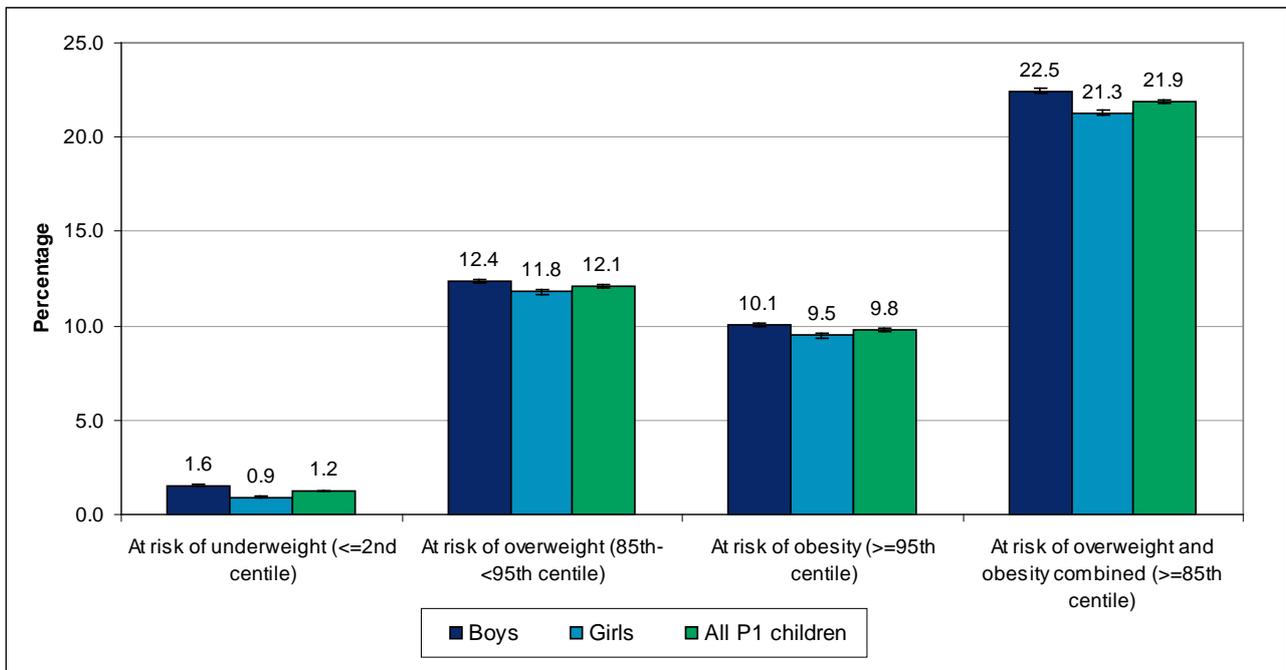
The prevalence of healthy weight is slightly higher amongst girls than boys. In school year 2011/12, 77.8% of girls were classified as healthy weight compared to 76.0% of boys (Figure 3). The prevalence of at risk of overweight and obesity combined and the prevalence of at risk of underweight are both slightly higher among boys than girls. In 2011/12, the percentage at risk of overweight and obesity combined was 22.5% of boys compared to 21.3% of girls (Figure 4). The percentage at risk of underweight was 1.6% of boys compared to 0.9% of girls. These gender differences are observed across all years.

Figure 3: BMI distribution of children in Primary 1 in Scotland, by sex, school year 2011/12 (epidemiological categories)



Source: ISD Scotland, CHSP-S November 2012

Figure 4: Percentage of children in Primary 1 at risk of: underweight, overweight and obesity in Scotland, by gender, school year 2011/12 (epidemiological categories)

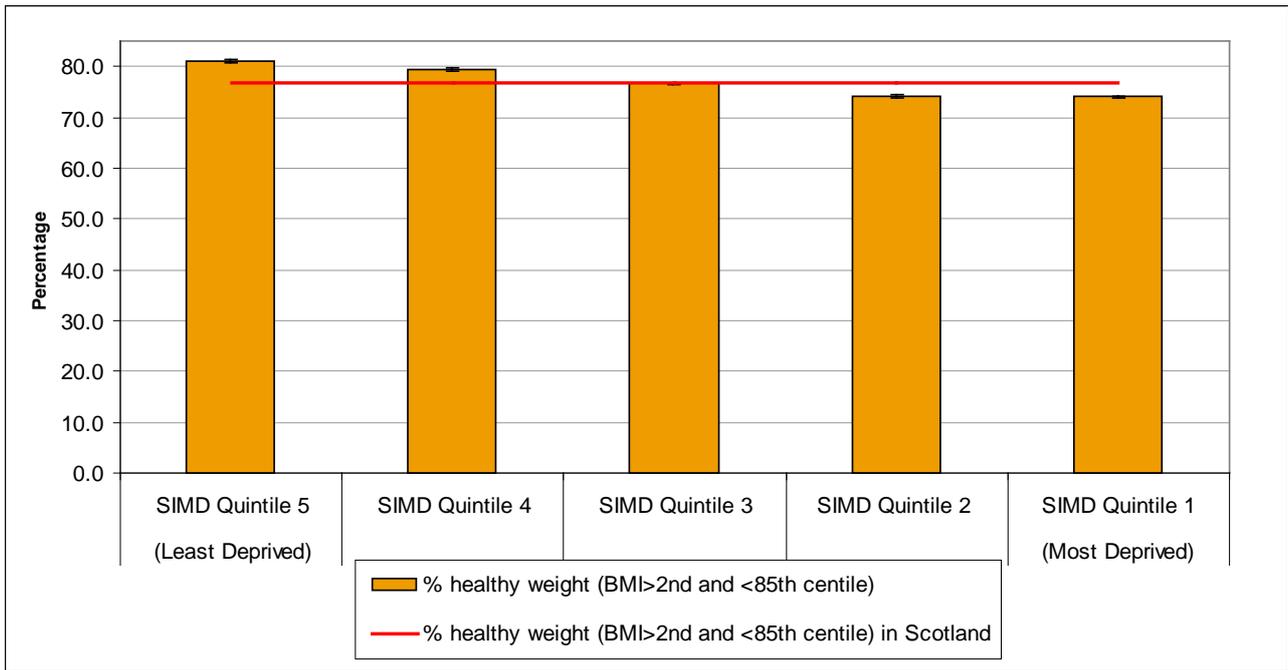


Source: ISD Scotland, CHSP-S November 2012

BMI distribution by deprivation – epidemiological categories

Data for 2011/12 show that the prevalence of healthy weight amongst children in Primary 1 decreases with deprivation (Figure 5). In the least deprived areas (SIMD quintile 5), 81.1% of children were classified as healthy weight while in the most deprived areas (SIMD quintile 1) 74.0% were classified as healthy weight. In the two most deprived quintiles the proportion of children classified as healthy weight is significantly lower than the Scotland average.

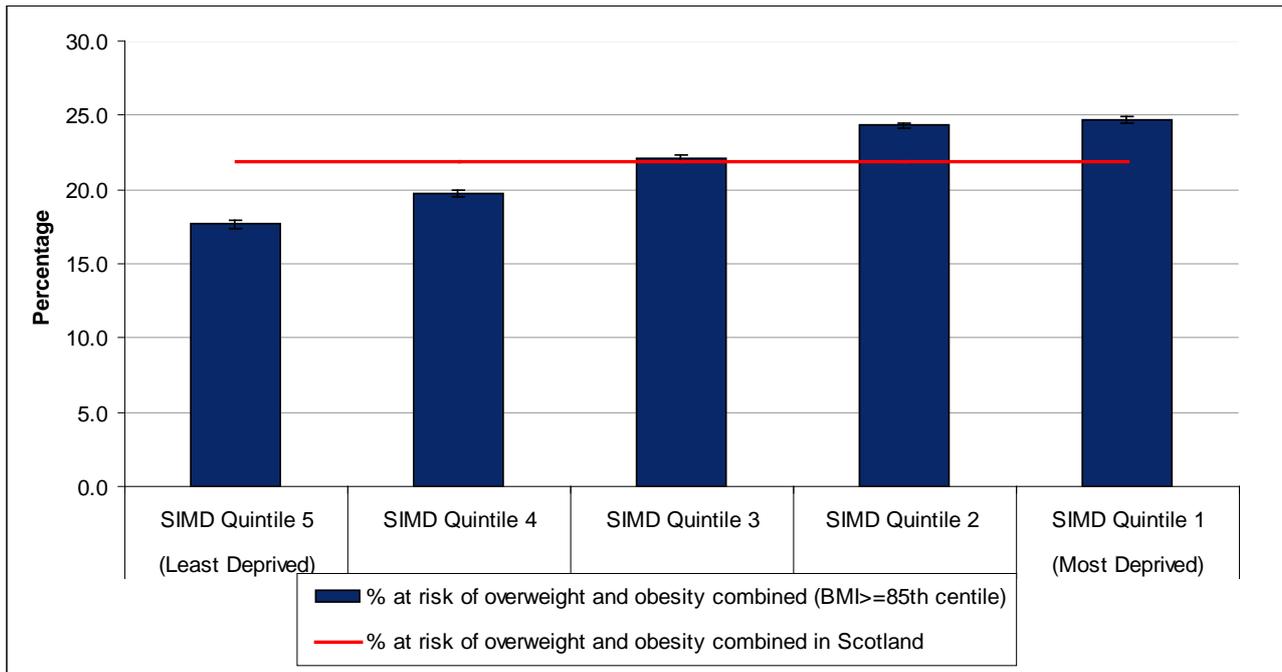
Figure 5: Percentage of children in Primary 1 in Scotland categorised as healthy weight, by Scottish Index of Multiple Deprivation (SIMD) 2012 Quintile, school year 2011/12 (epidemiological categories)



Source: ISD Scotland, CHSP-S November 2012

A strong positive relationship exists between deprivation and the proportion of children in Primary 1 at risk of overweight and obesity combined (Figure 6). In 2011/12 in the least deprived areas (SIMD quintile 5), 17.7% of children were classified as at risk of overweight and obesity combined compared to 24.7% in the most deprived areas (SIMD quintile 1).

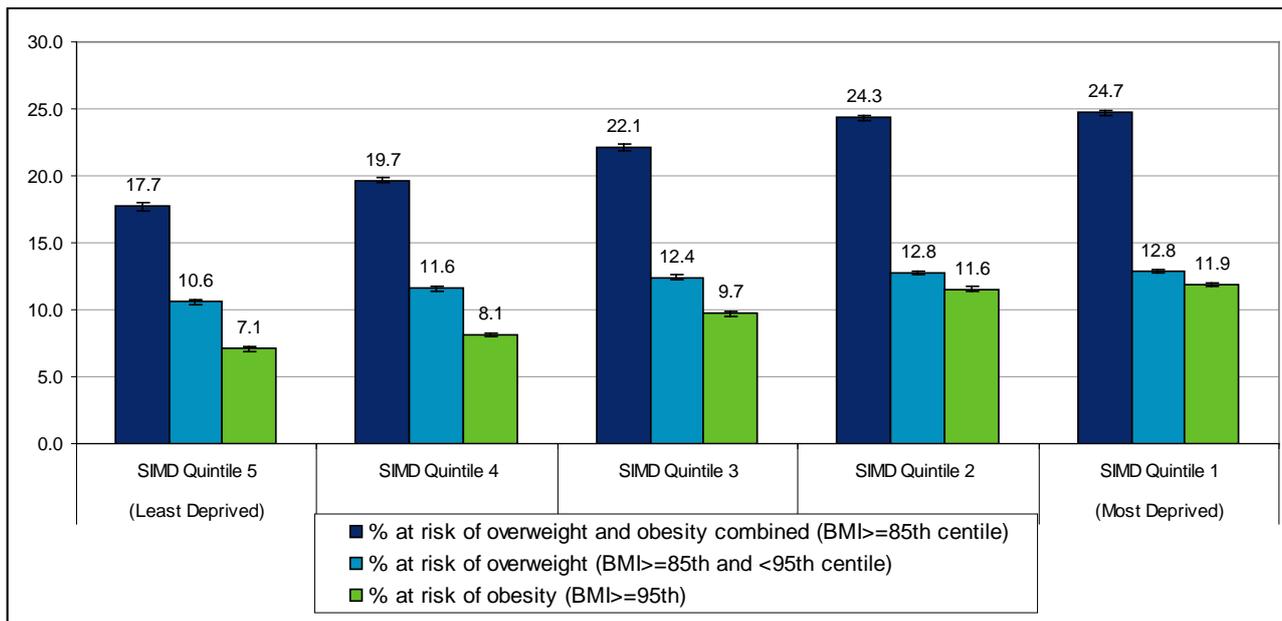
Figure 6: Percentage of children in Primary 1 in Scotland at risk of overweight and obesity combined, by Scottish Index of Multiple Deprivation (SIMD) 2012 Quintile, school year 2011/12 (epidemiological categories)



Source: ISD Scotland, CHSP-S November 2012

The level of inequalities observed are greater for children at risk of obesity compared to children at risk of overweight (Figure 7). In 2011/12 in the least deprived areas (SIMD quintile 5), 7.1% of children were classified as at risk of obesity compared to 11.9% in the most deprived areas (SIMD quintile 1). In the least deprived areas (SIMD quintile 5), 10.6% of children were classified as at risk of overweight compared to 12.8% in the most deprived areas (SIMD quintile 1).

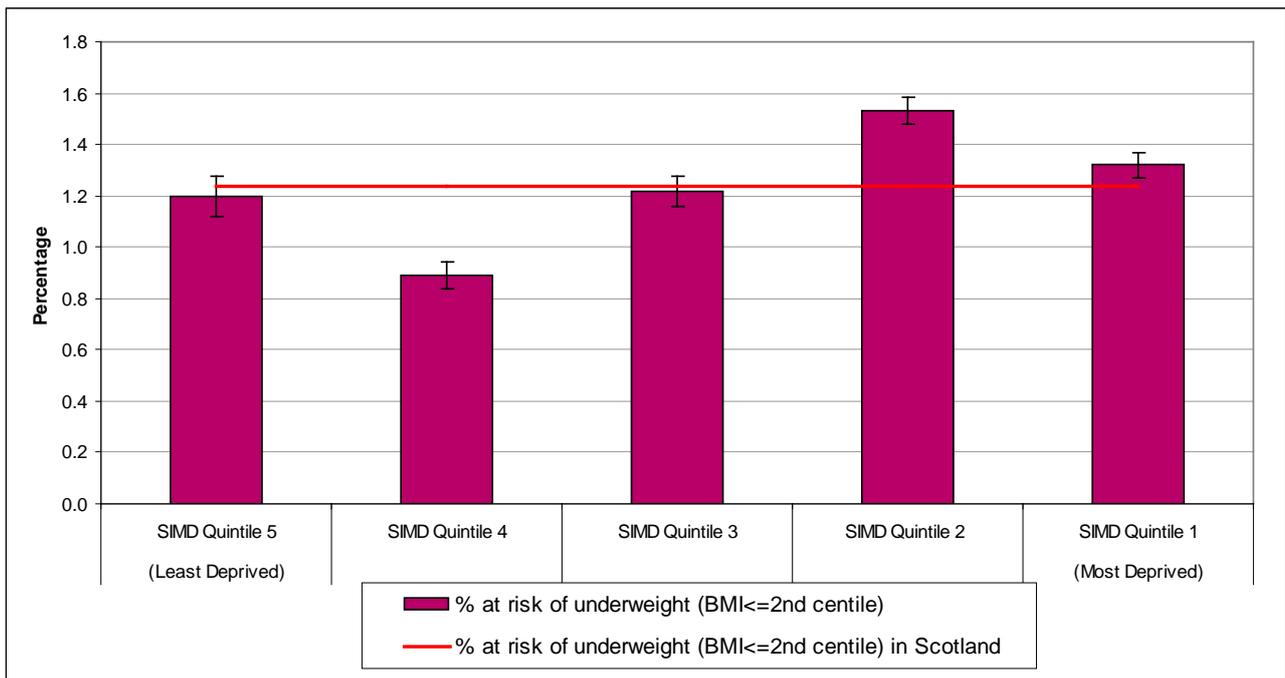
Figure 7: Percentage of children in Primary 1 in Scotland at risk of: overweight, obesity, and overweight and obesity combined, by Scottish Index of Multiple Deprivation (SIMD) 2012 Quintile, school year 2011/12 (epidemiological categories)



Source: ISD Scotland, CHSP-S November 2012

The relationship between deprivation and the proportion of children in Primary 1 at risk of underweight is less clear. Figures over the last decade show that the prevalence of underweight tends to be higher in the most deprived areas (SIMD quintile 1), although this pattern is not observed every year. In 2011/12 the proportion of children at risk of underweight in the two most deprived quintiles is significantly higher than the Scotland average (Figure 8).

Figure 8: Percentage of children in Primary 1 in Scotland at risk of underweight by Scottish Index of Multiple Deprivation (SIMD) 2012 Quintile, school year 2011/12 (epidemiological categories)



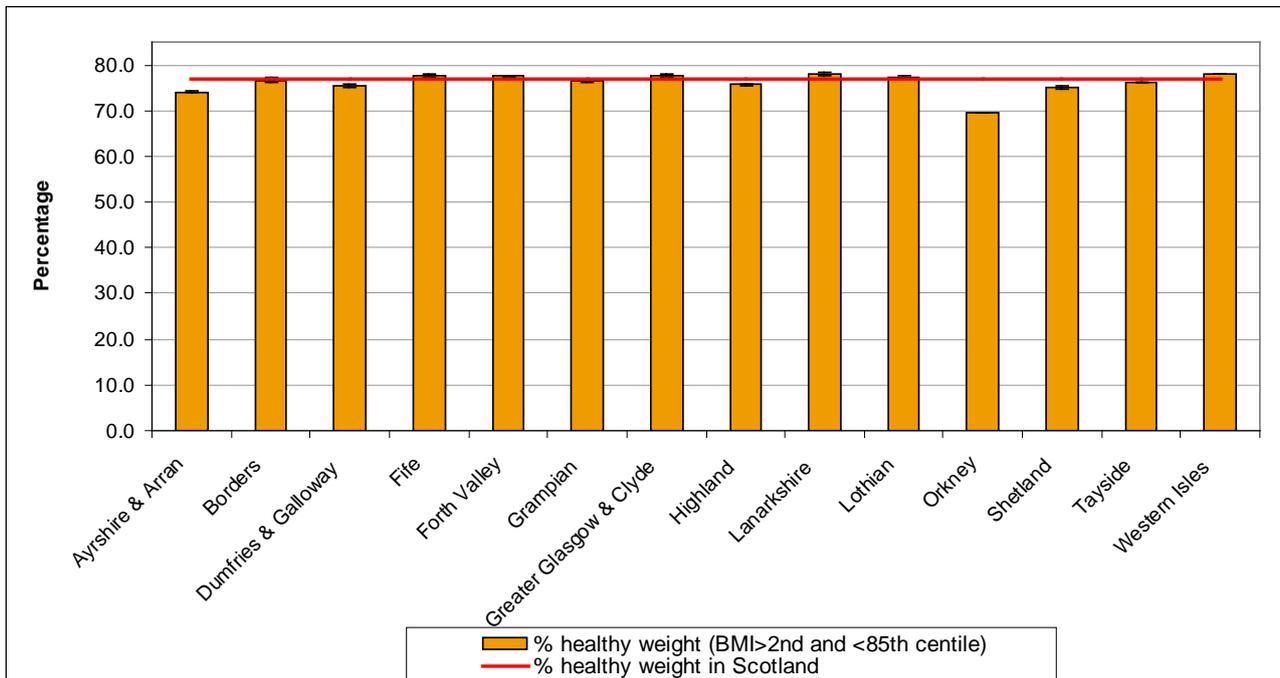
Source: ISD Scotland, CHSP-S November 2012

BMI distribution by NHS Boards – epidemiological categories

There is some variation in rates of (un)healthy weight among children in Primary 1 between NHS Board areas. NHS Board figures relate to the area where the child attends school (NHS board of examination). Children may attend school outside the NHS board area where they live.

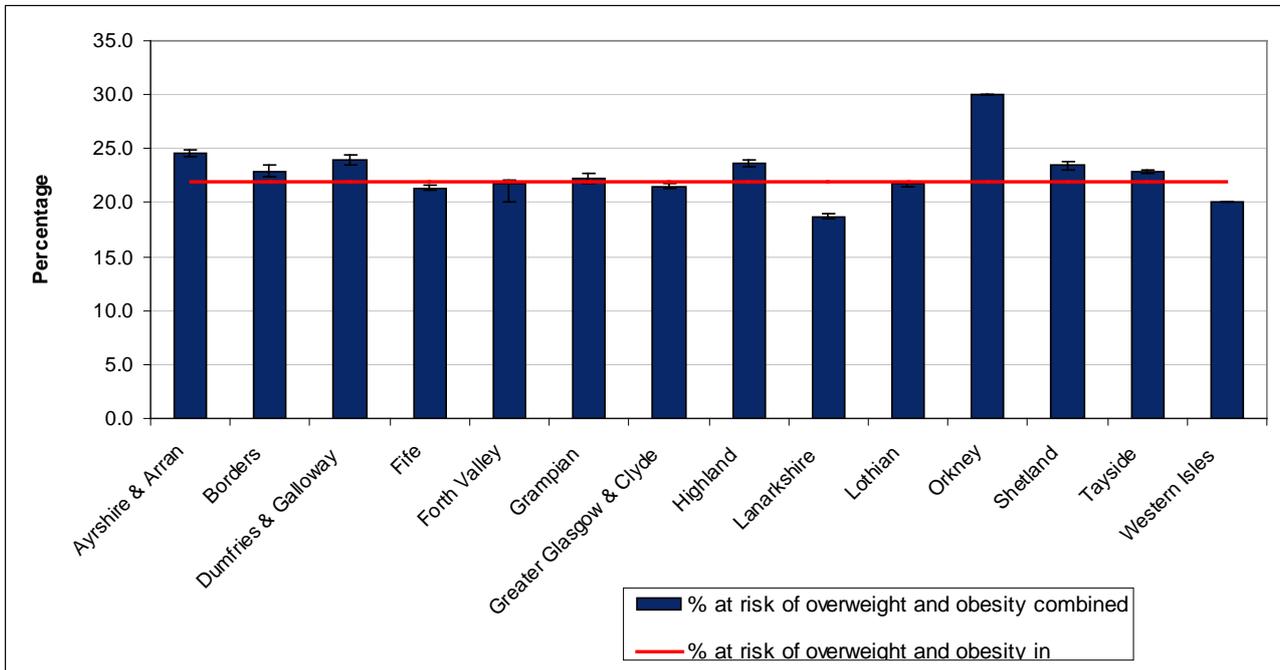
In 2011/12 the percentage of children classified as healthy weight ranges from 69.5% in NHS Orkney to 78.1% in NHS Western Isles (Figure 9). Figure 10 shows the percentages of children at risk of overweight and obesity combined by NHS Board and Figure 11 shows the percentages at risk of underweight by NHS Board. Rates in a particular area can often fluctuate year on year. It is not unusual for areas with (un)healthy 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. Rates for Island Boards (Orkney, Shetland and Western Isles) are based on small numbers of children and are therefore more likely to fluctuate from year to year, even when there is no meaningful difference.

Figure 9: Percentage of children in Primary 1 in Scotland categorised as healthy weight, by NHS Board of Examination, school year 2011/12 (epidemiological categories)



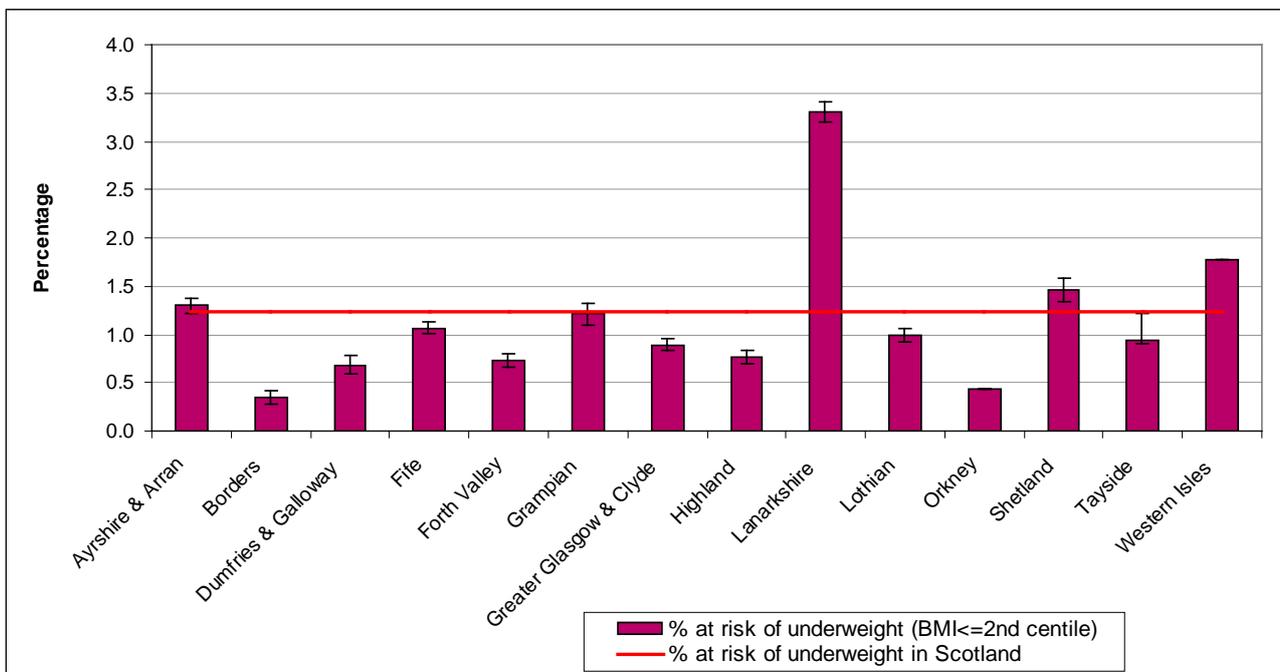
Source: ISD Scotland, CHSP-S November 2012

Figure 10: Percentage of children in Primary 1 in Scotland at risk of overweight and obesity combined, by NHS Board of examination, school year 2011/12 (epidemiological categories)



Source: ISD Scotland, CHSP-S November 2012

Figure 11: Percentage of children in Primary 1 in Scotland at risk of underweight, by NHS Board of examination, school year 2011/12 (epidemiological categories)



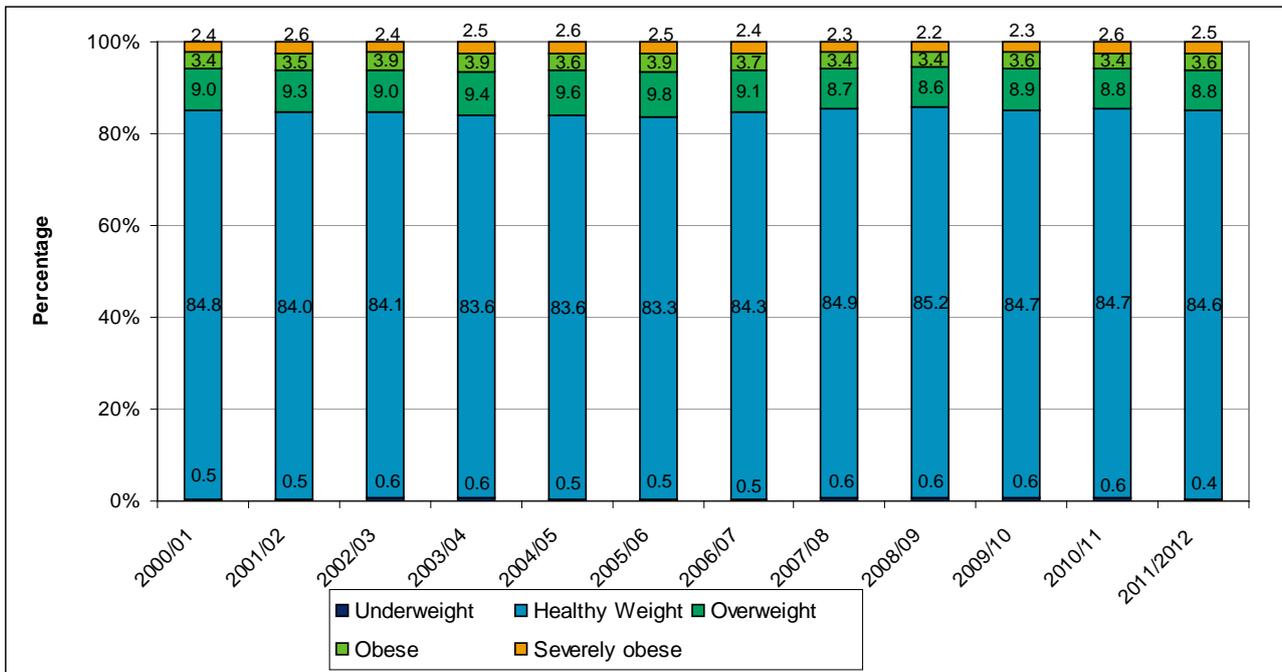
Source: ISD Scotland, CHSP-S November 2012

Rates of (un)healthy weight based on the epidemiological thresholds are also available by council and CHP areas. Council/CHP areas are derived from child’s home postcode. To view the full range of detailed information on the prevalence of (un)healthy weight for children in Primary 1 based on the epidemiological thresholds by gender, deprivation, NHS Board of examination, and council/CHP area of residence, see [List of Tables](#). The tables and charts should be read in conjunction with the Background and Explanatory notes which accompany them.

BMI distribution of children in Primary 1 – clinical categories

Based on clinical thresholds, 84.6% of children in Primary 1 in Scotland in school year 2011/12 were classified as healthy weight, a marginal decrease on the 2010/11 figure of 84.7% (Figure 12). In 2011/12, 0.4% of children were underweight, 8.8% overweight, 3.6% obese and 2.5% severely obese. This compares to 0.6% of children underweight, 8.8% overweight, 3.4% obese and 2.6% severely obese in 2010/11.

Figure 12: BMI distribution of children in Primary 1, school years 2000/01 to 2011/12 (clinical categories), All participating NHS Boards/Scotland¹



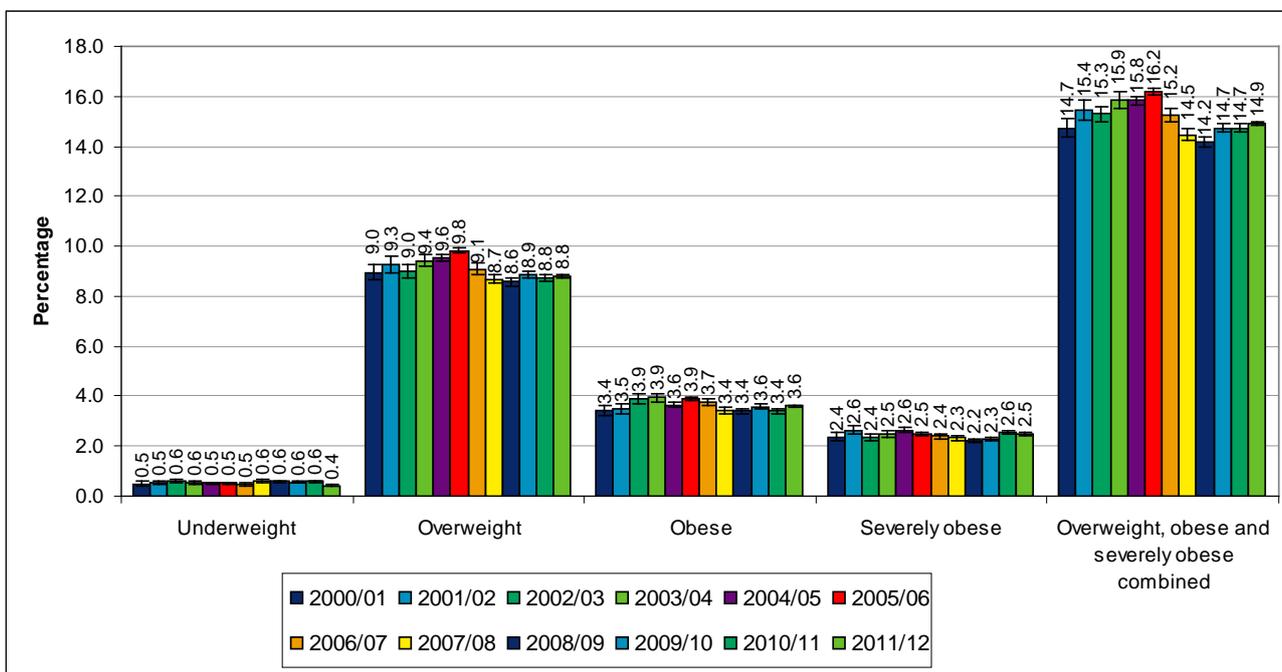
1. As the number of NHS Boards included in these statistics has increased over the last decade (from four to fourteen Boards), the trend for ‘all participating NHS Boards’ should be interpreted with some caution.

Source: ISD Scotland, CHSP-S November 2012

The BMI distribution of children in Primary 1 has remained broadly similar over the period 2000/01 to 2011/12 with around 14% to 16% of children overweight, obese and severely obese combined and around 0.5% underweight (Figure 13). The trends observed are similar to those described previously for the epidemiological categories. As the number of NHS Boards included in these statistics has increased since 2000/01 from four to fourteen Boards, 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 twelve year period are similar to those for ‘All participating NHS Boards’.

Although school year 2011/12 is the first year that data are available for all areas of NHS Greater Glasgow & Clyde, the largest NHS board in Scotland, this has a negligible impact on the 'All participating NHS Boards/Scotland' figures for 2011/12 and the comparison to rates in 2010/11. This is because the BMI distribution of children in NHS Greater Glasgow & Clyde in 2011/12 is similar to the overall BMI distribution of children in the rest of Scotland. If the 'new' data for NHS Greater Glasgow & Clyde hadn't been available for 2011/12, the 'All participating NHS Boards/Scotland' figures would have been almost the same as those reported here for 2011/12 (the largest difference would have 0.1 percentage points when rounded to one decimal place).

Figure 13: Percentage of children in Primary 1 classified as underweight, overweight, obese and severely obese, by school year (clinical categories), All participating NHS Boards/Scotland¹



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.

Source: ISD Scotland, CHSP-S November 2012

The gender and deprivation patterns observed for the clinical thresholds are similar to those described in the previous section for the epidemiological thresholds. To view the full range of detailed information on the prevalence of (un)healthy weight for children in Primary 1 based on the clinical thresholds by gender, deprivation, NHS Board of examination, and council/CHP area of residence, see [List of Tables](#). The tables and charts should be read in conjunction with the Background and Explanatory notes which accompany them.

Other sources of information on child healthy weight in Scotland

The [Scottish Health Survey](#) presents BMI statistics for children aged 2-15 years (latest report published September 2012)

[Growing Up in Scotland: Overweight, obesity and activity](#) (published May 2012)

Information for other UK countries

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.

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 [2011/12 National Child Measurement Programme \(NCMP\)](#) report.

Glossary

CHSP School

Child Health Systems Programme - School

BMI

Body Mass Index [weight (in Kg) divided by height squared (in m²)]

SD score

Standard deviation score

List of Tables

Table No.	Name	Time period	File & size
A1 – A3	Estimated data completeness - height and weight recording for Primary 1 School Children by NHS Board, Council Area and CHP	School years 2000/01 to 2011/12	Excel [273kb]
B1 – B5	Primary 1 Statistics for BMI: Epidemiological Categories (includes data by NHS Board, Council Area, Community Health Partnership, gender and deprivation)	School years 2000/01 to 2011/12	Excel [826kb]
C1 – C5	Primary 1 Statistics for BMI: Clinical Categories (includes data by NHS Board, Council Area, Community Health Partnership, gender and deprivation)	School years 2000/01 to 2011/12	Excel [951kb]

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Further Information

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](#)

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Appendix

A1 – Background Information

Information on data sources, methods and definitions can be found in the main report.

Reference standards used to derive BMI statistics

As specified in the [‘Measuring obesity in children’](#) section, the figures presented in this report are based on comparison of children’s BMI against the 1990 UK growth reference standards.

New UK-WHO growth standards and 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 WHO growth reference data used in the new combined UK-WHO charts are based on data obtained from around 8,500 healthy, breastfed children from six different countries around the world (Brazil, Ghana, India, Norway, Oman and USA) as part of the Multicentre Growth Study. Further information is available from the World Health Organisation (<http://www.who.int/childgrowth/en/>) and the Royal College of Paediatrics and Child Health (<http://www.rcpch.ac.uk/child-health/research-projects/uk-who-growth-charts/uk-who-growth-charts>).

The UK 1990 growth reference standards will continue to be used in the UK for children over 4 years and hence are the appropriate reference for this publication as it only includes school aged children.

Calculation of rates (un)healthy weight

Cole’s LMS method ([Cole TJ, Freeman JV and Preece MA](#)) has been used to calculate the prevalence of (un)healthy weight. The table below describes what L, M and S are:

L	Skewness	A power value e.g. a value of 1 means not skewed i.e. normal
M	Median	50 th percentile
S	Coefficient of variation	SD divided by the mean

The main steps in this calculation can be summarised as:

1. BMI is calculated by dividing an individual's weight (in kilograms) by their height squared (in metres squared)
2. Look up the age and sex specific UK 1990 reference data and retrieve the appropriate values of L, M and S. Use interpolation to calculate values of L, M & S for the exact age of each child at measurement. Then use the following formula to calculate BMI SD score:

$$\text{BMI SD score} = \frac{\left(\frac{\text{BMI}}{M}\right)^L - 1}{L \times S}$$

3. For epidemiological thresholds only: convert the BMI SD score to BMI centile using standard normal distribution tables. Use BMI centile to allocate children to categories of (un)healthy weight e.g. children with a BMI centile greater than or equal to the 85th centile and less than the 95th centile will be allocated to the at risk of overweight (epidemiological) category. Count the number of children allocated to each epidemiological category.
4. For clinical thresholds only: use the BMI SD score to allocate children to categories of (un)healthy weight e.g. children with a BMI SD score greater than or equal to +1.33 and less than +2.00 are allocated to the overweight (clinical) category. Count the number of children allocated to each clinical category.
5. Calculate the percentage of children in each category, for example,

% at risk of overweight=

$$\frac{\text{Number of children at risk of overweight}}{\text{Total number of children measured}} \times 100$$

Note: only valid records are included in the calculation

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 independent samples from the same population, and confidence intervals were taken for each sample, 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.

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.

Geographical Information

NHS board figures relate to NHS board of examination (the area where the child attends school) as recorded on CHSP School. The exception is some of the data for GG&C and Highland NHS Boards. These boards have some records which relate to the areas of GG&C and Highland which were under the administration of NHS Argyll & Clyde. The former NHS Argyll & Clyde ceased to exist on 31st March 2006 and the administration was split between two sub-areas that now fall under the administration of NHS GG&C and NHS Highland respectively. Records for this area are still recorded on CHSP School with a NHS board of examination of NHS Argyll & Clyde. These records have been allocated to NHS GG&C or NHS Highland based on the child's postcode of residence. Children may attend school outside the NHS board area where they live.

Council area, CHP and SIMD 2012 quintile figures are based on the child's home postcode.

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 SD 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 SD 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.

Revisions history

In the annual publication for school year 2010/11, released April 2012, a new methodology was implemented to improve the accuracy of the statistics. This consisted of 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) quintile. The new methodology was applied to data for all years presented and did not affect the overall interpretation or conclusions to be drawn from previously published data. Further information can be found in Appendix 1 of the publication for [school year 2010/11](#).

Additional metadata can be found in the next section [A2 – Publication Metadata \(including revisions details\)](#)

A2 – Publication Metadata (including revisions details)

Metadata Indicator	Description
Publication title	Primary 1 Body Mass Index (BMI) Statistics
Description	Annual statistics on 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	12 November 2012
Release date	30 April 2013
Frequency	Annual
Timeframe of data and timeliness	Statistics to school year 2011/12. This publication was originally scheduled for December 2012 (to be based on data extracted from CHSP School as at mid- August 2012). The release was rescheduled to March 2013 to allow data quality assurance checks and this meant the statistics could be based on an updated data extract from CHSP School as at 12 November 2012. The publication was subsequently rescheduled from March to 30 April 2013 to accommodate the incorporation of expanded content and new tables in the release.
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. See Data collection and coverage .
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	There has been a minor change to the methodology for deriving BMI SD score. Previously all calculations were based on un-rounded figures. Following guidance from the Growth Charts Working Group of the Royal College of Paediatrics and Child Health , calculation of BMI SD score is now based on age in years expressed to two decimal places compared to the UK 1990 growth reference data. This change has been applied to data for all years presented resulting in minor revisions to some of the

	previously published figures for school years 2000/01 to 2010/11. The differences are mainly in the range -0.1 to +0.1 percentage points. Some Boards/CHP/council areas/SIMD quintiles may see slightly larger differences in some years. This revision does not affect the overall interpretation or conclusions to be drawn from previously published data.
Concepts and definitions	See Measuring obesity in children and Appendix A1
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.
Completeness	Estimated data completeness tables are available (see section on Data Collection and Coverage)
Comparability	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. See also the Further Information section.
Accessibility	It is the policy of ISD Scotland to make its web sites and products accessible according to published guidelines .
Coherence and clarity	Tables and charts are accessible via the ISD website .
Value type and unit of measurement	Numbers and percentages
Disclosure	The ISD protocol on Statistical Disclosure Protocol is followed.
Official Statistics designation	National Statistics
UK Statistics Authority Assessment	Awaiting assessment by UK Statistics Authority
Last published	30 April 2013
Next published	December 2014 (provisional)
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	NSS.isdchildhealth@nhs.net
Date form completed	16 April 2013

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', ie as part of the delivery of health and care: #

NHS Board Directors of Public Health

A4 – ISD and Official Statistics

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.

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- 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)
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- meet identified user needs;
- are well explained and readily accessible;
- are produced according to sound methods, and
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