Publication Report

Primary 1 Body Mass Index (BMI) Statistics Scotland

School Year 2014/15

Publication date – 16 February 2016

A National Statistics Publication for Scotland

Contents

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. Being 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 for school years 2005/06 to 2014/15. The statistics are derived from height and weight measurements recorded at Primary 1 health reviews. Statistics are presented by: NHS Board, Local Authority, 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.

The publication presents information for both epidemiological and clinical thresholds for classifying children into over- and underweight categories (see section on measuring obesity in children). 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. Clinical thresholds have been included in order to support planning and delivery of clinical services, such as child healthy weight programmes in NHS Boards.

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 metres^2) 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 data.

Growth reference data 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 data have been used for the purposes of this publication. These were published in 1995 and replaced the Tanner-Whitehouse reference data that had been used since the 1960s. The data used to construct the UK 1990 reference data 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 UK 1990 reference data are used across Scotland to assess the growth of children aged 4 to 18 years inclusive (and hence are the appropriate reference to use for P1 children). For children aged up to 4 years the UK 1990 data have been replaced by growth standard data derived from the World Health Organisation multicentre growth reference study (http://www.who.int/childgrowth/en/). The two sets of growth reference data form the basis of the combined UK-WHO growth charts that are used across Scotland for children of all ages (http://www.rcpch.ac.uk/child-health/research-projects/uk-who-growth-charts/uk-who-growth-charts).

The growth reference data 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 Tables 2 and 3 which are located in Appendix 1 – Background Information.

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 Local Authorities 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 confidence intervals can be found in Appendix 1.

Key points

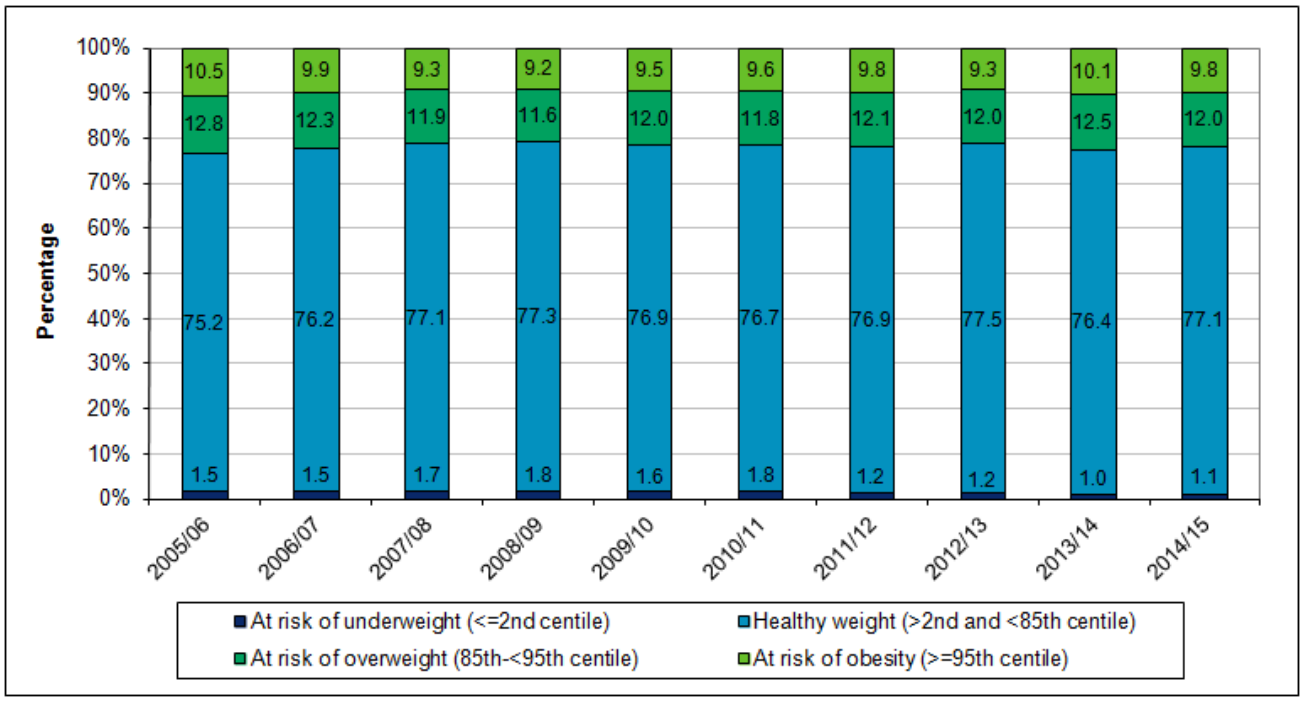
- In 2014/15, 77% of children in Primary 1 were classified as ‘healthy weight’.
- The prevalence of healthy weight amongst children in Primary 1 decreases as deprivation increases. In the least deprived areas 82% of children were classified as healthy weight while in the most deprived areas 74% were classified as ‘healthy weight’.
- The BMI distribution of children in Primary 1 has remained broadly similar over the period 2005/06 to 2014/15. In 2014/15, 22% of children in Primary 1 were at risk of overweight and obesity combined and 1% were at risk of underweight.
- The prevalence of healthy weight was slightly higher amongst girls than boys. In school year 2014/15, 78% of girls were classified as ‘healthy weight’ compared to 77% of boys.

Results and Commentary

BMI distribution of children in Primary 1 – epidemiological categories

Based on epidemiological thresholds used for population monitoring purposes, 77.1% of Primary 1 children in Scotland in school year 2014/15 were classified as healthy weight, a small increase from the 2013/14 figure of 76.4% (Figure 1). This small increase in the proportion of children classified as healthy weight is due to a slight decrease in both the percentage of children at risk of overweight (12.5% in 2013/14 compared to 12.0% in 2014/15) and the percentage of children at risk of obesity (10.1% in 2013/14 compared to 9.8% in 2014/15). The proportion of children at risk of underweight was 1.0% in 2013/14 compared to 1.1% in 2014/15.

Figure 1: BMI distribution of children in Primary 1, school years 2005/06 to 2014/15 (epidemiological categories), All participating NHS Boards/Scotland[1]

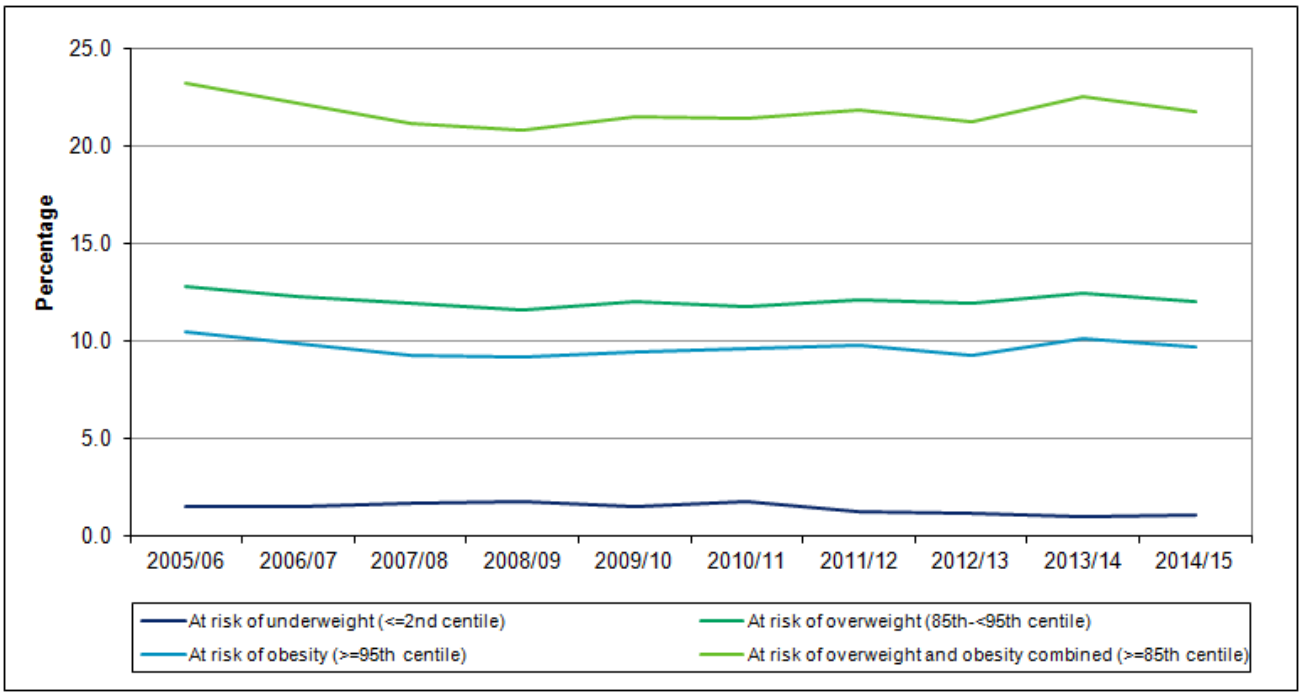


1. As the number of NHS Boards included in these statistics has increased over the last decade (from eight to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

Source: ISD Scotland, CHSP School November 2015

The BMI distribution of children in Primary 1 has remained broadly similar over the period 2005/06 to 2014/15 with between 21% to 23% of children at risk of overweight and obesity combined and between 1-2% at risk of underweight (Figure 2). As shown in Figure 2, a small downward trend in the proportion of children at risk of overweight and obesity combined is observed between 2005/06 and 2008/09, with the percentage at risk decreasing from 23.3% to 20.9%. The percentage at risk has since increased to 21.8% in 2014/15. However, as the number of NHS Boards included in these statistics has increased since 2005/06 from eight to fourteen Boards, the trend for 'all participating NHS Boards' should be interpreted with a degree of caution. The trends observed among the eight Boards participating in CHSP School throughout the ten year period are similar to those for 'All participating NHS Boards'.

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



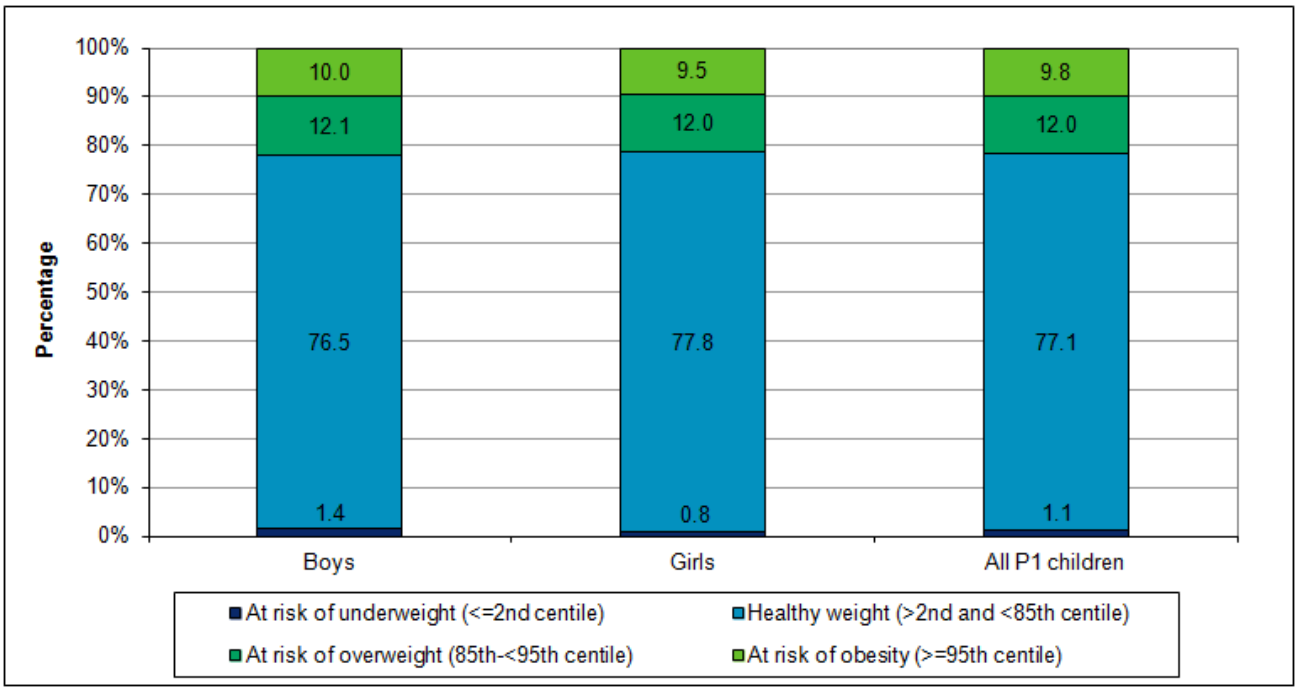
1. As the number of NHS Boards included in these statistics has increased over the last decade (from eight to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

Source: ISD Scotland, CHSP School November 2015

BMI distribution by gender – epidemiological categories

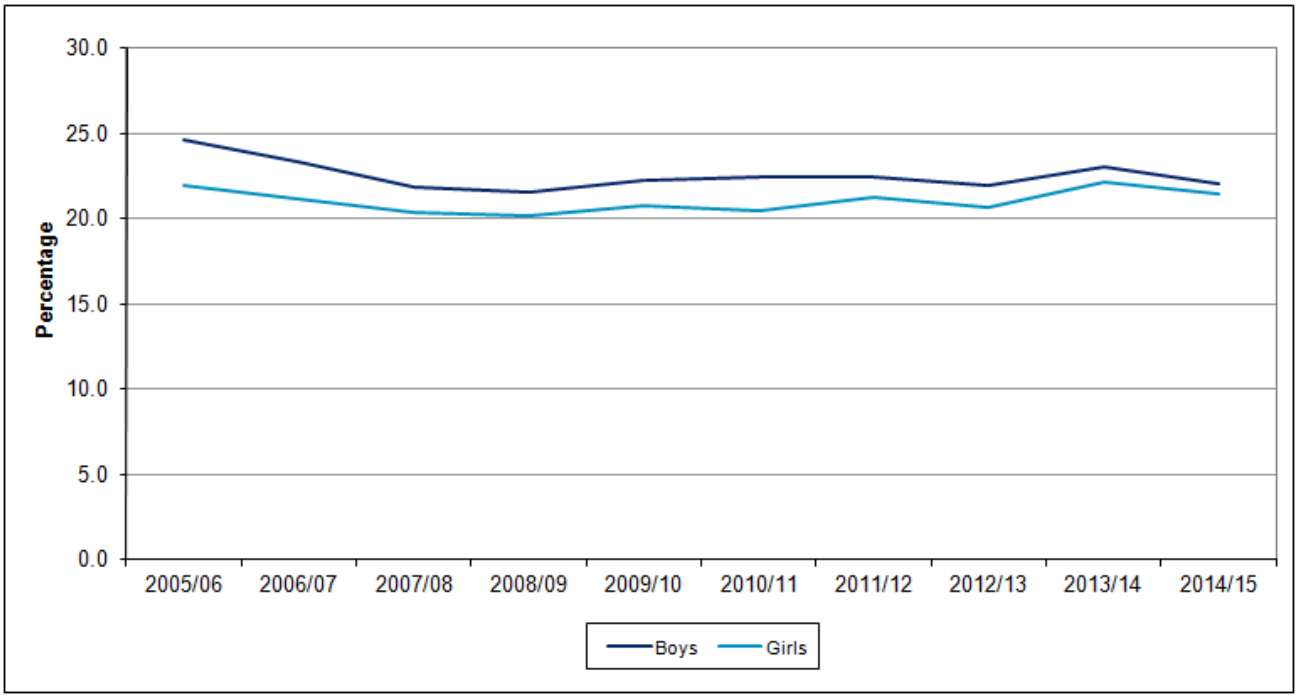
The prevalence of healthy weight is slightly higher amongst girls than boys. In school year 2014/15, 77.8% of girls were classified as healthy weight compared to 76.5% of boys (Figure 3). The prevalence of at risk of overweight and obesity combined and the prevalence of at risk of underweight are both slightly higher among boys than girls. In 2014/15, the percentage at risk of overweight and obesity combined was 22.1% of boys compared to 21.4% of girls. The gap between boys and girls has narrowed over time as can be seen in Figure 4, although it should be borne in mind that prior to 2011/12 not all boards submitted data, so this may account for some of the difference before this point. The percentage at risk of underweight was 1.4% of boys compared to 0.8% of girls.

Figure 3: BMI distribution of children in Primary 1 in Scotland, by gender, school year 2014/15 (epidemiological categories)



Source: ISD Scotland, CHSP School November 2015

Figure 4: Percentage of children in Primary 1 at risk of: overweight and obesity in Scotland, by gender, school years 2005/06 to 2014/15 (epidemiological categories)

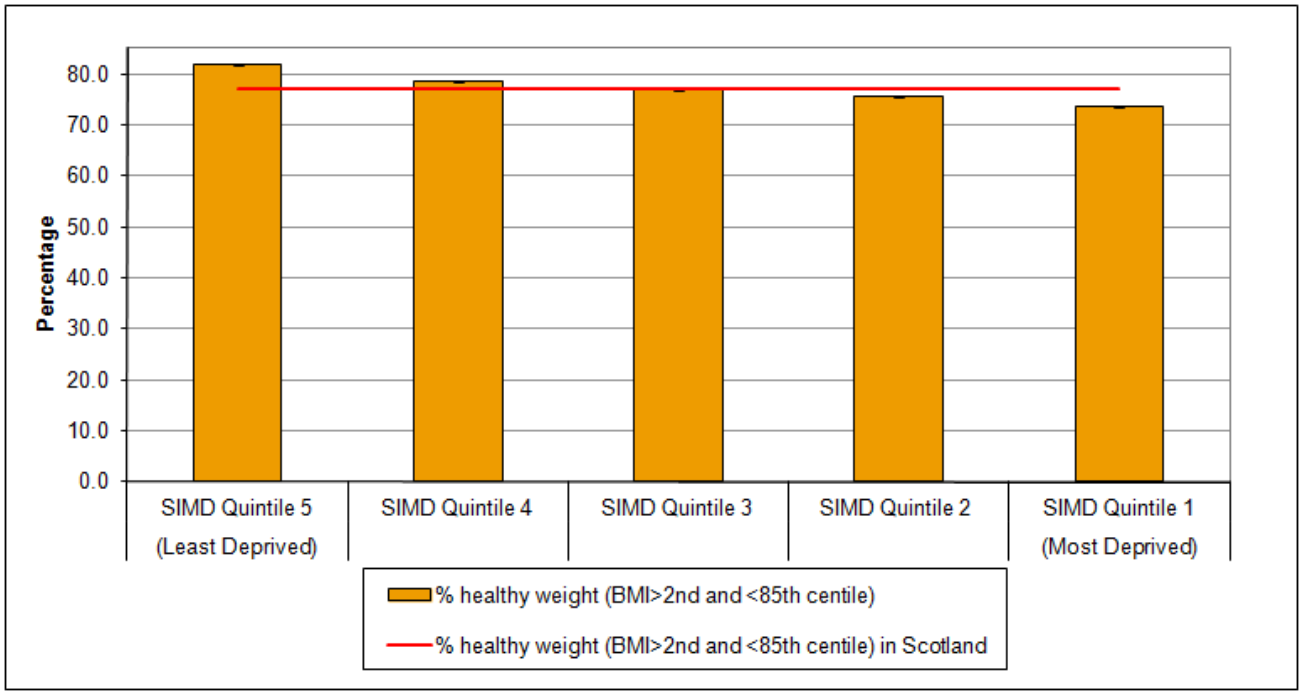


Source: ISD Scotland, CHSP School November 2015

BMI distribution by deprivation – epidemiological categories

Data for 2014/15 show that the prevalence of healthy weight amongst children in Primary 1 decreases as deprivation increases (Figure 5). In the least deprived areas (SIMD quintile 5), 81.8% of children were classified as healthy weight while in the most deprived areas (SIMD quintile 1) 73.7% 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.

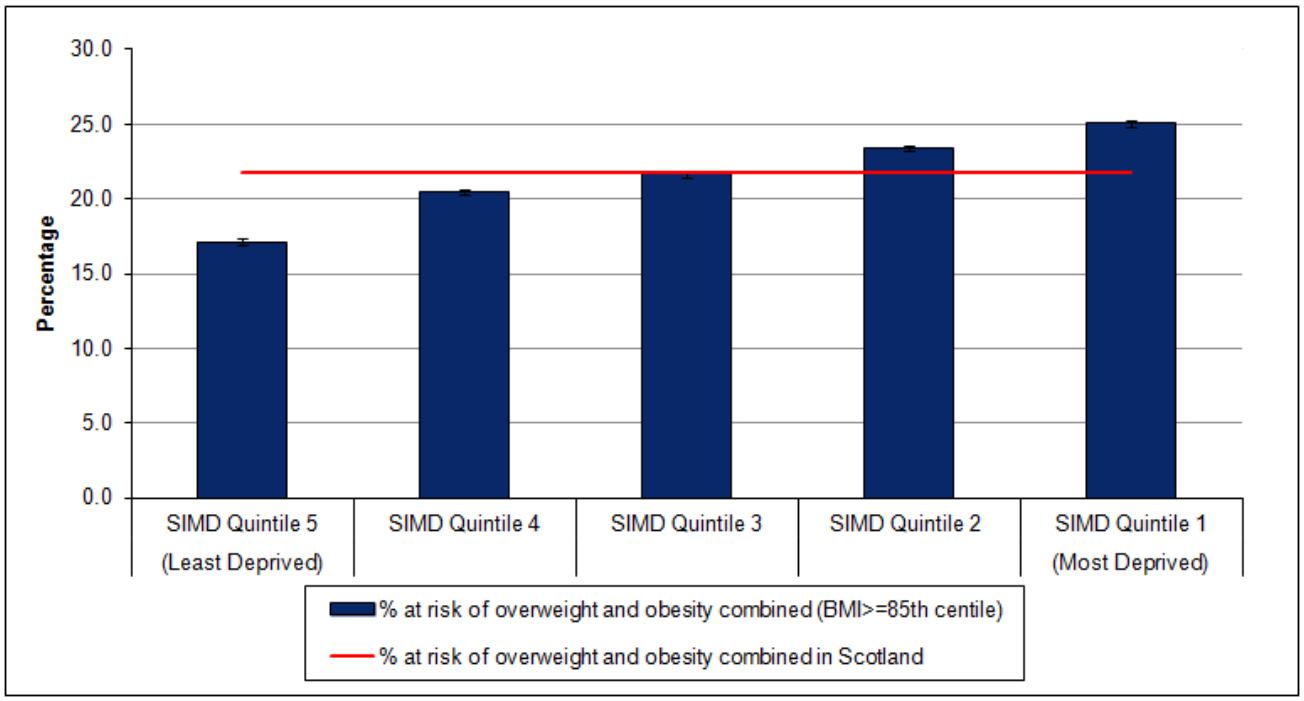
Figure 5: Percentage of children in Primary 1 in Scotland categorised as healthy weight, by Scottish Index of Multiple Deprivation (SIMD) Quintile, school year 2014/15 (epidemiological categories)



Source: ISD Scotland, CHSP School November 2015

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 2014/15 in the least deprived areas (SIMD quintile 5), 17.1% of children were classified as at risk of overweight and obesity combined compared to 25.1% in the most deprived areas (SIMD quintile 1).

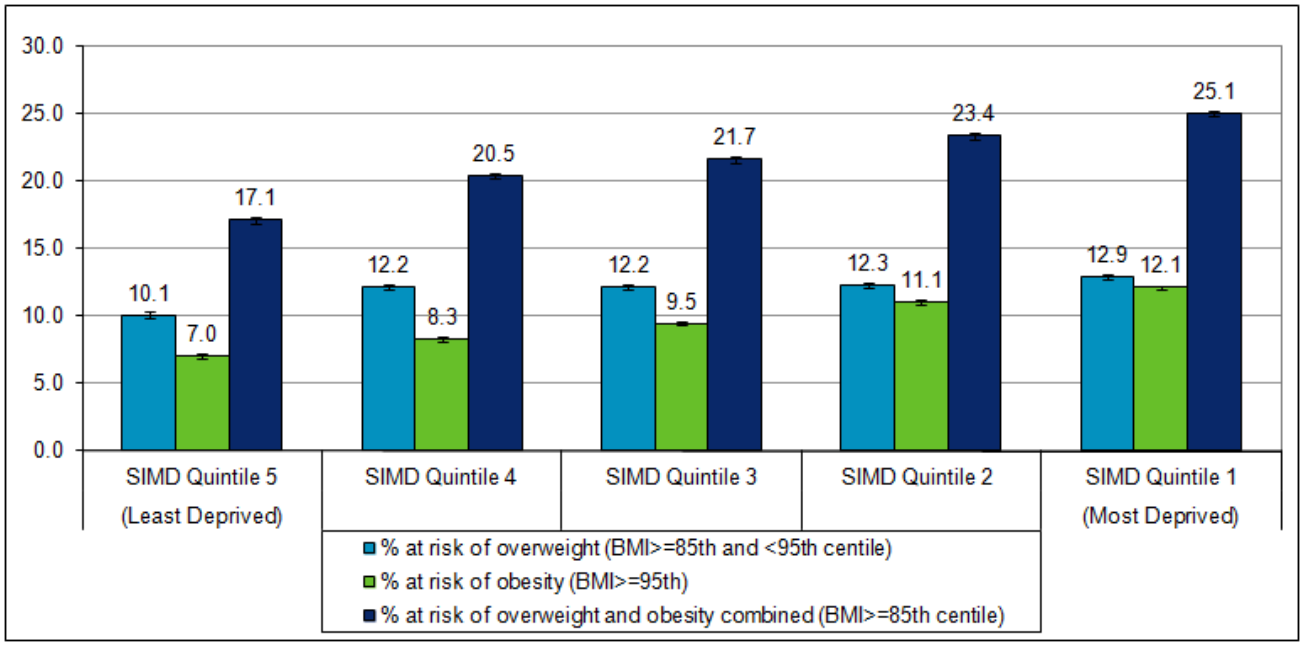
Figure 6: Percentage of children in Primary 1 in Scotland at risk of overweight and obesity combined, by Scottish Index of Multiple Deprivation (SIMD) Quintile, school year 2014/15 (epidemiological categories)



Source: ISD Scotland, CHSP School November 2015

The level of inequalities observed are greater for children at risk of obesity compared to children at risk of overweight (Figure 7). In 2014/15 in the least deprived areas (SIMD quintile 5), 7.0% of children were classified as at risk of obesity compared to 12.1% in the most deprived areas (SIMD quintile 1). In the least deprived areas (SIMD quintile 5), 10.1% of children were classified as at risk of overweight compared to 12.9% in the most deprived areas (SIMD quintile 1).

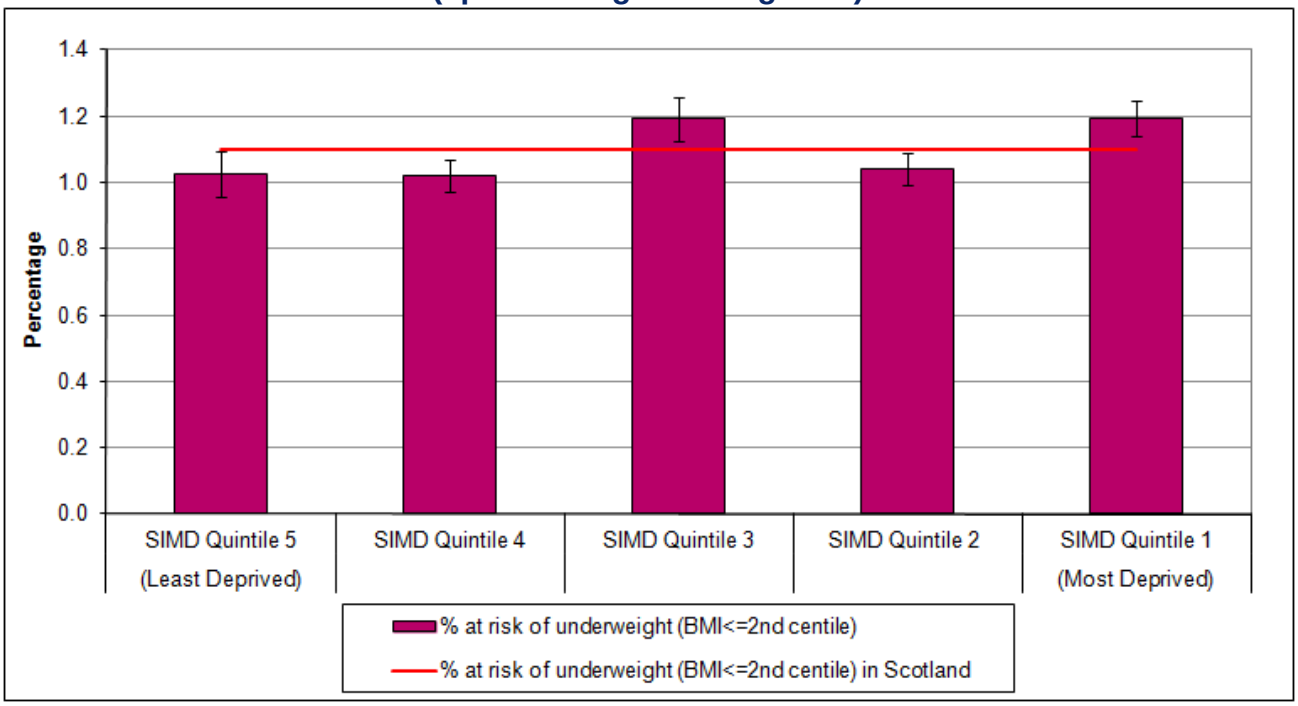
Figure 7: Percentage of children in Primary 1 in Scotland at risk of: overweight, obesity, and overweight and obesity combined, by Scottish Index of Multiple Deprivation (SIMD) Quintile, school year 2014/15 (epidemiological categories)



Source: ISD Scotland, CHSP School November 2015

The relationship between deprivation and the proportion of children in Primary 1 at risk of underweight is less clear. In 2014/15, no clear relationship between underweight and deprivation was evident (Figure 8).

Figure 8: Percentage of children in Primary 1 in Scotland at risk of underweight by Scottish Index of Multiple Deprivation (SIMD) Quintile, school year 2014/15 (epidemiological categories)



Source: ISD Scotland, CHSP School November 2015

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 2014/15 the percentage of children in mainland Boards classified as healthy weight ranged from 73.9% in NHS Dumfries & Galloway to 78.5% in NHS Forth Valley (Figure 9). Boards across the central belt had the highest percentage of children classed as healthy weight.

Figure 9. Percentage of Children in Primary 1 in Scotland categorised as healthy weight, by NHS Board of Examination, School year 2014/15 (epidemiological categories)

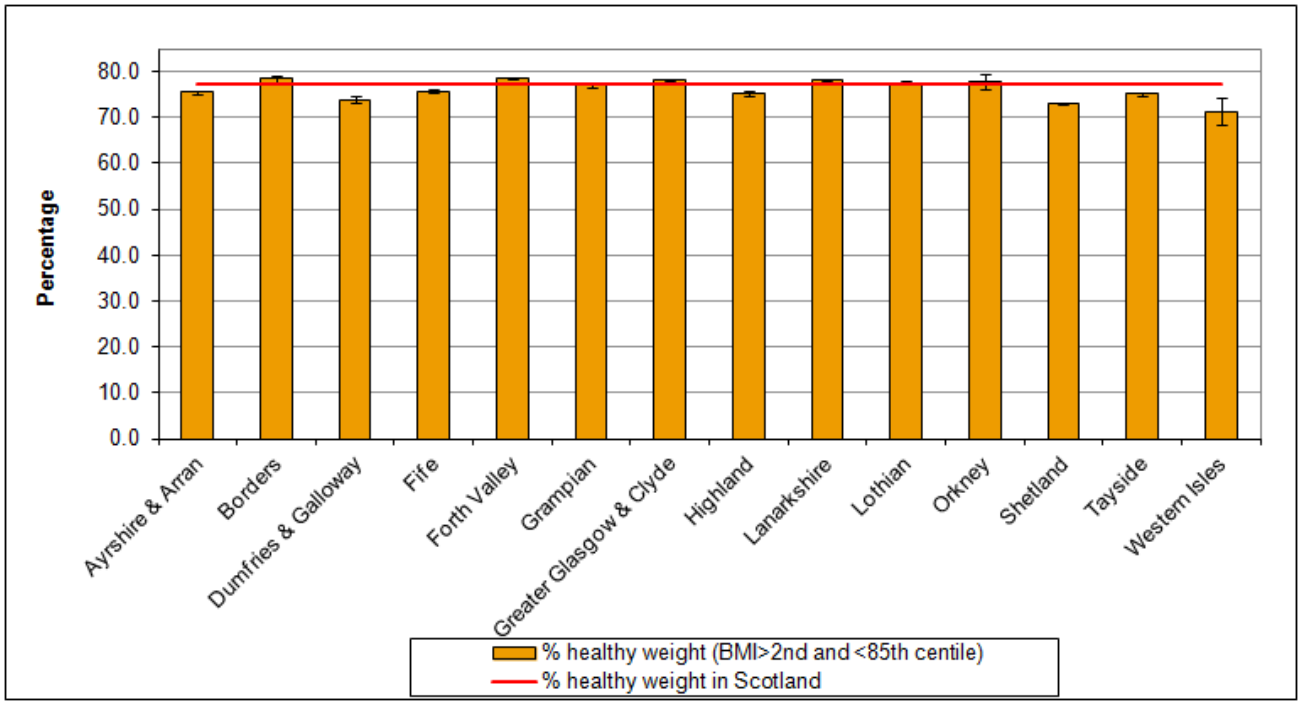


Figure 10 shows the percentages of children at risk of overweight and obesity combined by NHS Board. In mainland boards this ranges from 19.9% in NHS Lanarkshire to 26.0% in NHS Dumfries & Galloway. Figure 11 shows the percentages at risk of underweight by NHS Board. In mainland boards this ranges from 0.1% in NHS Dumfries & Galloway to 1.8% in NHS Lanarkshire. 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 10. Percentage of Children in Primary 1 in Scotland at risk of overweight and obesity combined, by NHS Board of Examination, School year 2014/15 (epidemiological categories)

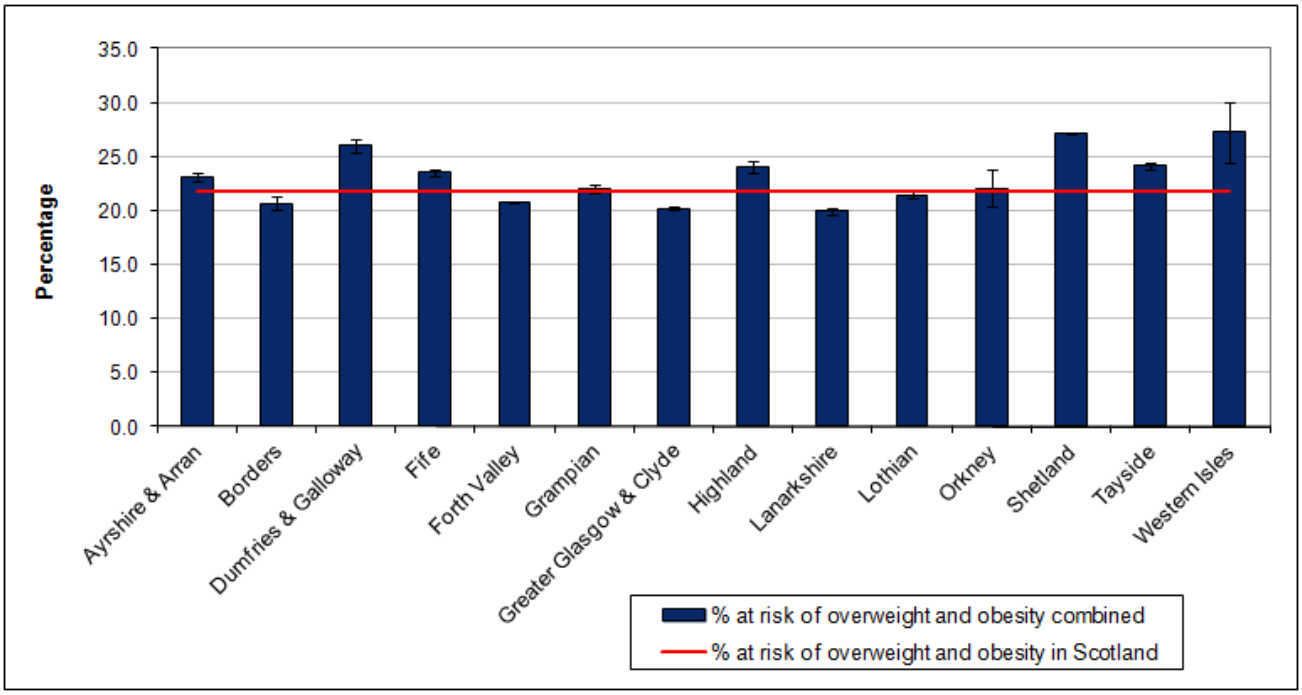


Figure 11. Percentage of Children in Primary 1 in Scotland at risk of underweight by NHS Board of Examination, School year 2014/15 (epidemiological categories)

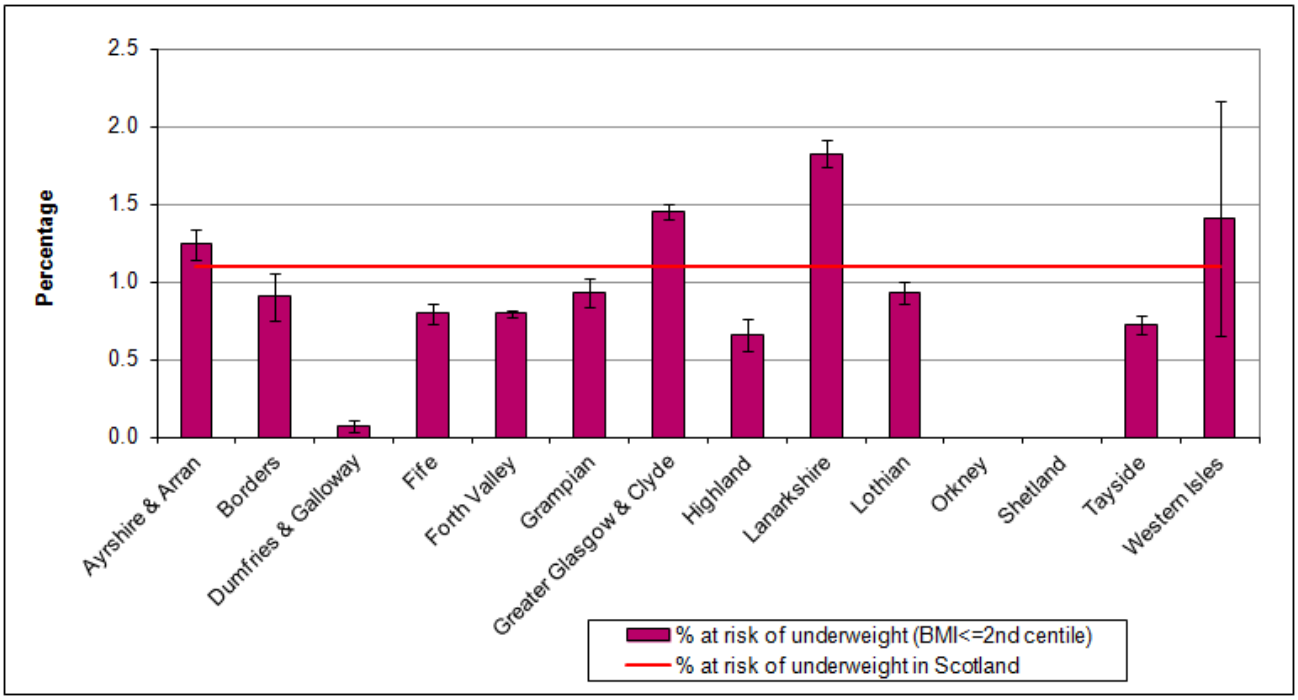
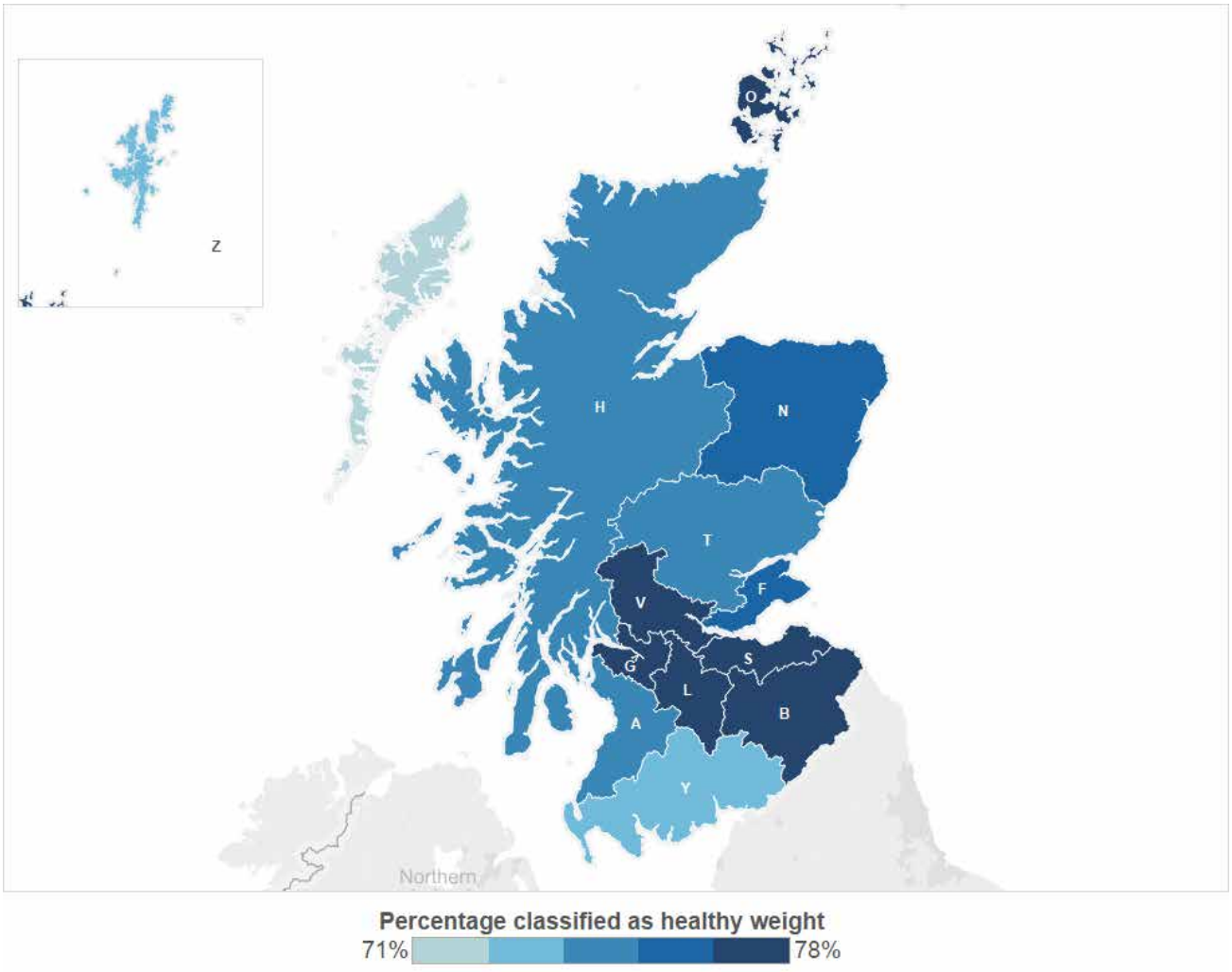


Figure 12. Percentage of Children in Primary 1 in Scotland classified as Healthy Weight, by NHS Board of Examination, School year 2014/15 (epidemiological categories)



NHS Boards

A Ayrshire & Arran
B Borders
V Forth Valley
N Grampian
L Lanarkshire
S Lothian
T Tayside
W Western Isles
Y Dumfries & Galloway
G Greater Glasgow & Clyde
O Orkney
F Fife
H Highland
Z Shetland

Figure 12 shows the percentage of children classified as healthy weight by NHS Board of examination in 2014/15. It can be seen that, of the mainland boards, those across central Scotland (NHS Greater Glasgow & Clyde, NHS Lanarkshire, NHS Forth Valley, NHS Lothian), and NHS Borders had the highest percentage of children within the healthy weight category. As discussed earlier, the rates for island boards are based on small numbers of children so can be highly variable.

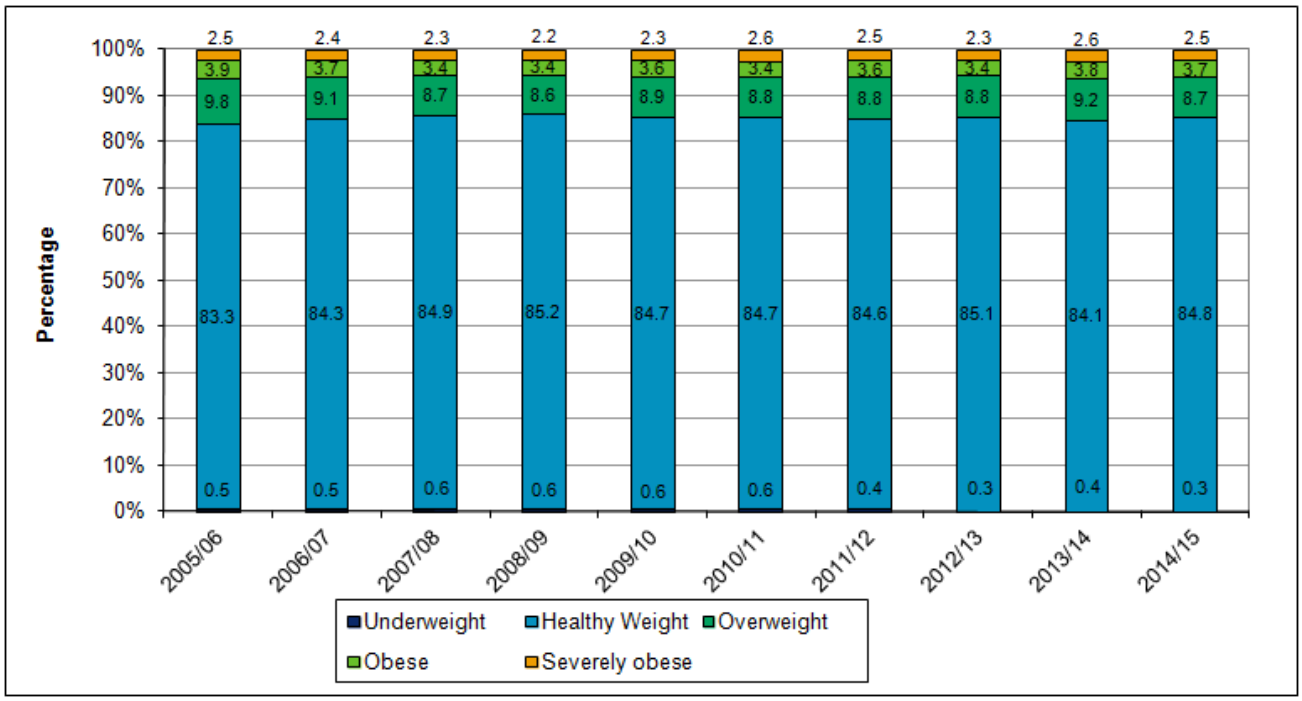
Rates of (un)healthy weight based on the epidemiological thresholds are also available by Local Authority. Local Authority's are derived from child's home postcode. To view the full range of detailed information on the prevalence of (un)healthy weight for children in Primary 1 based on the epidemiological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

Previous Primary1 Body Mass Index Statistics publications also presented information by Community Health Partnership (CHP). CHPs ceased to exist as of 1 April 2015 therefore this breakdown is no longer provided. See Appendix A1 for more information.

BMI distribution of children in Primary 1 – clinical categories

Based on clinical thresholds, 84.8% of children in Primary 1 in Scotland in school year 2014/15 were classified as healthy weight, a small increase from the 2013/14 figure of 84.1% (Figure 13). In 2014/15, 0.3% of children were underweight, 8.7% overweight, 3.7% obese and 2.5% severely obese. This compares to 0.4% of children underweight, 9.2% overweight, 3.8% obese and 2.6% severely obese in 2013/14.

Figure 13: BMI distribution of children in Primary 1, school years 2005/06 to 2014/15 (clinical categories), All participating NHS Boards/Scotland[1]

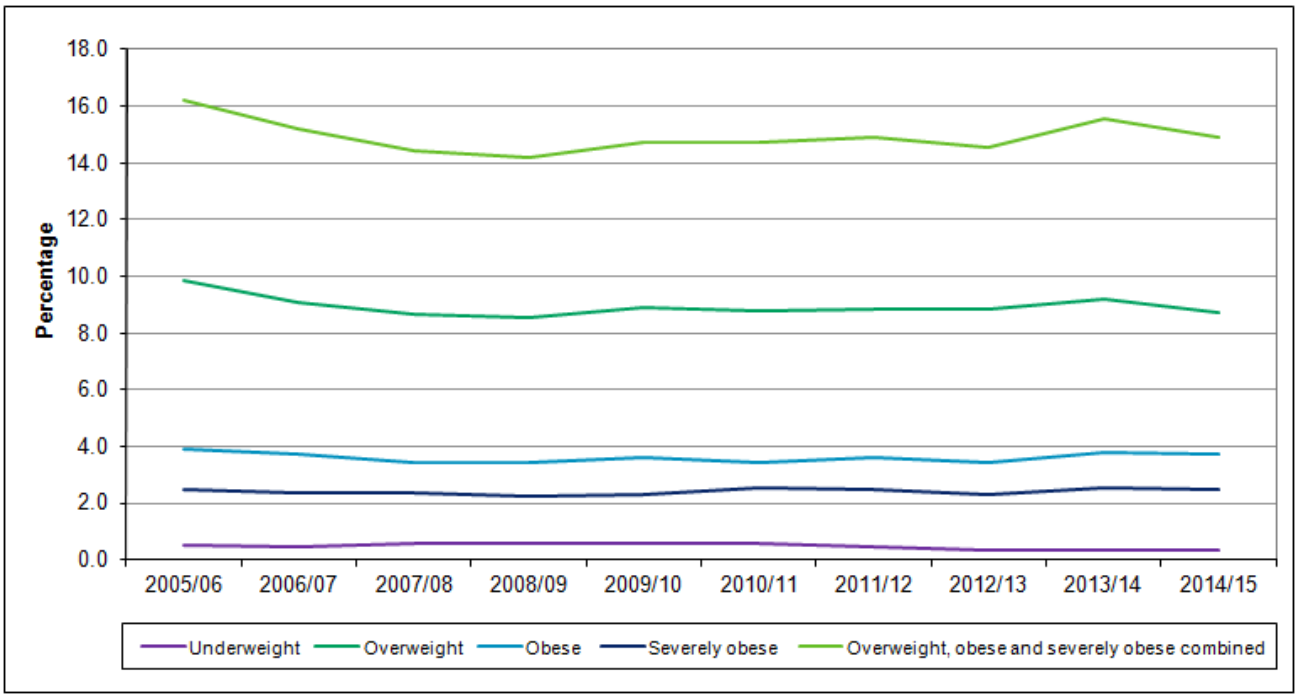


1. As the number of NHS Boards included in these statistics has increased over the last decade (from eight to fourteen Boards), the trend for 'all participating NHS Boards' should be interpreted with some caution.

Source: ISD Scotland, CHSP School November 2015

The BMI distribution of children in Primary 1 has remained broadly similar over the period 2005/06 to 2014/15 with around 14% to 16% of children overweight, obese and severely obese combined and between 0.3% and 0.6% underweight (Figure 14). 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 2005/06 from eight to fourteen Boards, the trend for 'all participating NHS Boards' should be interpreted with a degree of caution. However, the trends observed among the eight Boards participating in CHSP School throughout the ten year period are similar to those for 'All participating NHS Boards'.

Figure 14: Percentage of children in Primary 1 classified as underweight, overweight, obese and severely obese, by school year (clinical categories), All participating NHS Boards/Scotland[1]



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

Source: ISD Scotland, CHSP School November 2015

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 local authority 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 2015)

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

Information for other UK countries

The Health and Social Care Information Centre has published 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 2014/15 National Child Measurement Programme (NCMP) report.

Glossary

CHSP School	Child Health Surveillance Programme School
BMI	Body Mass Index [weight (in Kg) divided by height squared (in m^2)]
SD score	Standard deviation score
SIMD	Scottish Index of Multiple Deprivation
Confidence Interval	See Appendix A1

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 and Local Authority	School years 2005/06 to 2014/15	Excel [539kb]
B1 – B5	Primary 1 Statistics for BMI: Epidemiological Categories (includes data by NHS Board, Local Authority, gender and deprivation)	School years 2005/06 to 2014/15	Excel [3,948kb]
C1 – C5	Primary 1 Statistics for BMI: Clinical Categories (includes data by NHS Board, Local Authority, gender and deprivation)	School years 2005/06 to 2014/15	Excel [1,084kb]

Contact

Dr Rachael Wood

Consultant in Public Health Medicine

0131 275 7028

Susanne Brunton

Principal Information Analyst

0131 275 7646

Michael Nisbett

Senior Information Analyst

0141 282 2196

Email: NSS.isdchildhealth@nhs.net

Further Information

Further information is also available in the Child Weight and Growth section of the ISD website.

ISD Scotland publishes a wide range of information on Child Health including breastfeeding, immunisations, and 27-30 month assessment. Further information can be found in the Child Health section on the ISD website.

Rate this publication

Click here to provide feedback and rate this publication.

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 2014/15, 51% of children were aged between 4.5 and 5.5 years at the time of measurement, and 47% 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 a negligible impact on the BMI distribution rates reported.

The number of NHS Boards participating in CHSP School and recording reviews has increased since 2005/06 from eight 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 48% in 2005/06 to 92% in 2014/15. Therefore the trend for 'All participating NHS Boards' should be interpreted with a degree of caution. However, the trends observed among the eight Boards participating in CHSP School throughout the ten 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.

Table 1 - Height and weight recording for Primary 1 School Children in Scotland

Estimated Data Completeness, School Years 2005/06 - 2014/15

School year	Population of 5 year olds (NRS mid-year estimate)	Children in Primary 1 with valid height and weight measurements recorded	
		Number	Percentage
2005/06	54,317	25,879	47.6
2006/07	53,385	25,213	47.2
2007/08	52,188	28,284	54.2
2008/09	52,681	34,472	65.4
2009/10	54,398	40,209	73.9
2010/11	55,429	41,213	74.4
2011/12	55,769	52,545	94.2
2012/13	57,001	54,499	95.6
2013/14	59,457	54,944	92.4
2014/15	59,776	54,761	91.6

Source: CHSP School November 2015, ISD Scotland and mid-year population estimates from National Records of Scotland (NRS)

1. Population estimates from 2005/06 onwards are rebased using the 2011 census results

Estimates of the proportion of Primary 1 children measured are based on National Records of Scotland (NRS) rebased 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 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 / Local Authority (LA) area and attend school in a different area. As a result a few of the data completeness percentages at Board or LA level may be 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.

There was a small decrease in the number of valid height and weight measurements recorded between 2013/14 and 2014/15. There was an increase in the mid year population estimates of 5 year olds of approximately 300 over the same time period. The estimated data completeness for these statistics has dropped between 2013/14 and 2014/15 from 92.4% to 91.6%. Eight of the eleven mainland NHS Boards experienced a decrease in their estimated coverage between 2013/14 and 2014/15.

School year 2011/12 was the first year that all areas of NHS Greater Glasgow & Clyde (NHS GG&C) 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 14% to 16% of all NHS GG&C children eligible for Primary 1. The partial data relates mainly to NHS GG&C children living in Renfrewshire LA 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 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 LA. Therefore the reported prevalence of (un)healthy weight for NHS GG&C for 2011/12 onwards 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 2014/15 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.

For more information, please see: Estimated completeness of height and weight recording for Primary 1 School Children by NHS Board and Local Authority

Thresholds for epidemiological and clinical categories

The epidemiological and clinical thresholds used to define the various categories of child (un)healthy weight are shown in tables 2 and 3 below.

Table 2: 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 2nd centile
Healthy weight	BMI greater than 2nd centile and less than 85th centile
At risk of overweight	BMI greater than or equal to 85th centile and less than 95th centile
At risk of obesity	BMI greater than or equal to 95th centile
At risk of overweight and obesity combined	BMI greater than or equal to 85th centile

Table 3: 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 0.4th centile	BMI less than or equal to -2.67 SD score
Healthy weight	BMI greater than 0.4th centile and less than 91st centile	BMI greater than -2.67 and less than +1.33 SD score
Overweight	BMI greater than or equal to 91st centile and less than 98th centile	BMI greater than or equal to +1.33 and less than +2.00 SD score
Obesity	BMI greater than or equal to 98th centile and less than 99.6th centile	BMI greater than or equal to +2.00 and less than +2.67 SD score
Severely Obese	BMI greater than or equal to 99.6th centile	BMI greater than or equal to +2.67 SD score
Overweight, obese and severely obese combined	BMI greater than or equal to 91st centile	BMI greater than or equal to +1.33 SD score
Obese and severely obese combined	BMI greater than or equal to 98th centile	BMI greater than or equal to +2.00 SD score

It can be seen from tables 2 and 3 that the various thresholds/categories are described in terms of centiles. Centiles in the growth reference data 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 data 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 data 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 ≤50th centile and 95% had a BMI ≤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).

Information based on both the epidemiological and the clinical thresholds has been included in the Primary 1 BMI statistics publication since 2011/12. To make the distinction between the two sets of figures clear, the labels assigned to the epidemiological categories were updated in the 2011/12 publication to those shown in Table 2. 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).

The current BMIs of Primary 1 children in Scotland are converted to SD scores/centiles in order to compare them to the growth reference data 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 data were produced, we would still expect to see 95% of children with a BMI ≤95th centile (and conversely 5% of children with a BMI ≥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, 9.8% 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 data were produced.

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	50th 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:

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

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.

Local Authority and SIMD 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, height and weight measurements with a SD score outside the range -3 to +4 are unlikely to occur. The final dataset has fewer than 1% of records outside this range. BMI, height and weight 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 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 2011/12.

In the annual publication for school year 2011/12, released in April 2013, there was 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 was 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. This revision did not affect the overall interpretation or conclusions drawn from previously published data. Further information can be found in Appendix 1 of the publication for school year 2011/12.

In the annual publication for school year 2012/13, released in February 2014, Data from 2001/02 to 2011/12 was refreshed in order to incorporate new population estimates for NHS Boards and Council Areas. This resulted in some small changes to previously published information. The differences mainly affected the completeness results and resulted in differences mostly in the range -2 to +2 percentage points. The revision resulted in slight differences in the percentage of children recorded in the different BMI centile categories but the differences were mainly in the range of -0.1 to +0.1 percentage points. This revision did not affect the overall interpretation or conclusions to be drawn from previously published data. Further information can be found in the metadata and the data collection and coverage section of the publication for school year 2012/13.

A new Health Board configuration was introduced in Scotland as of 1st April 2014. In order to implement this and to allow trends to be illustrated the data has been refreshed for all years included in the 2013/14 publication. The changes mainly affect NHS Greater Glasgow & Clyde and NHS Lanarkshire. The new configuration meant that NHS Lanarkshire had roughly 800-900 extra eligible P1 children each year with NHS Greater Glasgow & Clyde having roughly the same number less. Between 2004/05 and 2010/11 the effect of this change is that the estimated coverage for NHS Lanarkshire drops by roughly 10% as NHS Greater Glasgow & Clyde were not contributing to the CHSP-School system at this time. The revision resulted in slight differences in the percentage of children recorded in the different BMI centile categories but the differences were mainly in the range of -0.1 to +0.1 percentage points. This revision does not affect the overall interpretation or conclusions to be drawn from previously published data. Further information can be found in the metadata and the data collection and coverage section of the publication for school year 2013/14.

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

Changes from previous publications

There have been SIMD releases in 2004, 2006, 2009 and 2012. Previous reports have used one SIMD release for all years being reported. This report uses the most appropriate SIMD for each year: the years 2004-2006 use SIMD 2006; years 2007-2009 use SIMD 2009V2; and years 2010 to 2014 use SIMD 2012. The latter method is more appropriate when trying to track whether the inequality between the most and least deprived categories has changed over time.

In the annual publication for school year 2013/14 the tables were presented by NHS Board, and Community Health Partnership (CHP). Tables showing data by CHP have been replaced by Local Authorities in the February 2016 publication as CHPs ceased to exist on 1 April 2015.

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, Local Authority, 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 Surveillance Programme School (CHSP School)
Date that data are acquired	9 November 2015
Release date	16 February 2016
Frequency	Annual
Timeframe of data and timeliness	Statistics to school year 2014/15.
Continuity of data	As the number of NHS Boards included in these statistics has increased since 2005/06 (from eight to all fourteen Boards in Scotland), the trend for 'all participating NHS Boards' should be interpreted with some caution. See Data collection and coverage. Data are available from financial year 2001/02. Information on the financial years not included in this update can be found in the February 2014 publication. It is worth noting that due to the changes in methodology and Health Board configuration (see revisions relevant to this publication section below for details) the data presented in the February 2014 publication are not directly comparable with the latest publication.
Revisions statement	The publication is produced from the latest data extract from CHSP School 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 have been SIMD releases in 2004, 2006, 2009 and 2012. Previous reports have used one SIMD release for all years being reported. This report uses the most appropriate SIMD for each year: the years 2004-2006 use SIMD 2006; years 2007-2009 use SIMD 2009V2; and years 2010 to 2014 use SIMD 2012. The latter method is more appropriate when trying to track whether the inequality between the most and least deprived categories has changed over time. In the annual publication for school year 2013/14 the tables were presented by NHS Board, and Community Health Partnership (CHP). Tables showing data by CHP have been replaced by Local Authorities. CHPs ceased to exist on 1 April 2015.
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 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	Assessment by UK Statistics Authority for National Statistics designation completed
Last published	17 February 2015
Next published	February 2017 (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 2001/02. Information on the financial years not included in this update can be found in the February 2014 publication.
Help email	NSS.isdchildhealth@nhs.net
Date form completed	25 January 2016

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.

Standard Pre-Release Access:

Scottish Government Health Department

NHS Board Chief Executives

NHS Board Communication leads

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.

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.

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics. Designation can be broadly interpreted to mean that the statistics:

- meet identified user needs;
- are well explained and readily accessible;
- are produced according to sound methods, and
- are managed impartially and objectively in the public interest.

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.