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National Obesity Observatory

NHS

National Child Measurement Programme

Changes in children's body mass index between 2006/07 and 2008/09

ASSOCIATION OF PUBLIC HEALTH OBSERVATORIES
APH
10 YEARS

National Child Measurement Programme

Changes in children's body mass index between 2006/07 and 2008/09

This report examines changes in prevalence of obesity and mean BMI (adjusted for age). Analysis is presented by age and sex group, as well as across the BMI distribution and by socioeconomic group and ethnic group.

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i. Abbreviations

BMI	Body mass index
HSE	Health Survey for England
IMD	Index of Multiple Deprivation
LSOA	Lower Super Output Area
NCMP	National Child Measurement Programme
NCOD	National Childhood Obesity Database
NHS IC	The National Health Service Information Centre for health and social care
NOO	National Obesity Observatory
PCT	Primary Care Trust
PHO	Public Health Observatory
SDS	Standard deviation score
SII	Slope index of inequality
UK90	British 1990 growth reference

ii. List of figures

iii. Key findings

This report presents analysis of the first three years of National Child Measurement Programme (NCMP) data, and highlights any statistically significant differences that can be detected across survey years in the body mass index (BMI) of English children aged 4–5 and 10–11 years.

The NCMP has now provided three years of good quality data. The size of the dataset, which includes approximately one million records in each of the last two years, means that some significant differences can be detected even over this short timescale.

Prevalence of obesity and mean BMI (adjusted for age) have been used to summarise the BMI of the child population by school year and sex. Analysis has also been conducted to examine change across the BMI distribution, by level of socioeconomic deprivation, and by ethnic group.

Changes in prevalence of obesity

Prevalence of obesity in the NCMP showed no significant change between 2007/08 and 2008/09 for boys or girls in Reception or Year 6. However, obesity prevalence for boys in Reception showed a significant decrease of 0.5% between 2006/07 and 2008/09.

Although there was a reported increase in obesity prevalence between 2006/07 and 2007/08 in Year 6, this may not represent an actual increase in prevalence of obesity within the underlying population. Previous NCMP analysis suggests much of this increase can be explained by improvements in NCMP data quality and participation.

These findings support the emerging evidence that the rate of increase in child obesity has, at the very least, slowed since the previous decade.

Changes in mean BMI for age

Although obesity prevalence remained constant, mean BMI (adjusted for age) of the children measured increased significantly between 2008/09 and previous years for both boys and girls in Reception and boys in Year 6.

On an individual basis the increase is small; it equates to the average child's BMI increasing by approximately 0.5 BMI centiles between 2007/08 and 2008/09. However, this finding may be important as we cannot rule out future health implications of such increases in BMI at population level.

Changes in the distribution of children's BMI

Examination of changes in the BMI distribution helps to explain the different trends observed in obesity prevalence and mean BMI between NCMP samples.

There was no significant increase in mean BMI (adjusted for age) among the most obese 5–10% of the child population between 2007/08 and 2008/09. Indeed, for children in Reception, the most obese 5% of girls and 25% of boys had lower BMI for age in 2008/09 than in 2007/08. This suggests prevalence of the more extreme forms of obesity among children of this age group may be falling.

Over the same time period, mean BMI for age increased among the 75% of children with the lowest BMI for all groups apart from girls in Year 6. This explains the observed rise in mean BMI. Therefore, the increases that have occurred in the mean BMI of the child population seem to be primarily among children whose BMI would currently be classed as healthy.

Changes in health inequalities

Child obesity prevalence is known to increase with greater socioeconomic deprivation. There is no evidence of changes in health inequalities over the three NCMP years for girls in both school years and boys in Year 6.

There is some indication of widening health inequalities for boys in Reception. This seems to have resulted from a reduction in obesity prevalence among the least deprived children, although prevalence remained constant for the most deprived boys in this age group.

Changes in obesity prevalence by ethnic group

The prevalence of obesity is lower among children of White British ethnicity than among most other ethnic groups. Obesity prevalence is highest among the Black African and Black Other ethnic groups for both boys and girls in Reception and girls in Year 6. Boys of Bangladeshi ethnicity have the highest prevalence of obesity in Year 6.

There was no evidence of change in obesity prevalence by ethnic group over the three years of NCMP measurement for all ethnic groups other than children of Bangladeshi ethnicity. Children of this ethnic group have experienced an increase in child obesity, and in 2008/09 show significantly higher prevalence of obesity compared to other Asian groups.

Important caveats

It should be noted that factors such as improvements to NCMP data quality and participation may influence the findings presented within this report.

The population surveillance approach taken by the NCMP enables measurements of very large numbers of children, but also means these factors cannot be as tightly controlled for as they are in some other studies. Therefore, the observed changes in children's BMI may not necessarily all reflect real changes in the population.

Some may reflect changes in data quality or participation that have changed between areas or population groups over time. Further analyses into the possible impact of changes in participation and data quality within the NCMP are being undertaken by the National Obesity Observatory (NOO). These may help to further explain some of the observed changes between years of NCMP analysis.

Conclusions

Much of the analysis presented in this report shows that there has been no significant change in child BMI between years of NCMP measurements. This is consistent with growing indications from the Health Survey for England (HSE) that the previous upward trend in child obesity is at least flattening out. However, it is still too early to say, from NCMP data alone, whether obesity prevalence has stopped rising among children of the age groups measured by the NCMP.

Although BMI does not appear to be increasing for obese individuals, there is evidence of increases in mean BMI among children whose BMI is considered healthy. If the BMI of these children continues to rise, they may become obese in future years. In addition, the potential future health impacts of such population-level increases in child BMI are currently unknown so this trend should be monitored closely to see if it persists.

Health inequalities do not appear to have widened significantly in the past three years, except for the small increase observed for boys in the Reception year which seems to result from decreases in obesity prevalence among the least deprived boys of this age. However, substantial health inequalities across socioeconomic groups still exist. NCMP data can provide a powerful tool with which to assess whether steps to reduce existing inequalities are successful.

The obesity prevalence figures presented in this report show the importance of analysing obesity prevalence by sex. The very high prevalence of obesity among boys of Bangladeshi ethnicity, especially in Year 6, is not obvious when prevalence figures are analysed for boys and girls combined.

The pattern of increasing prevalence of obesity among children of Bangladeshi ethnicity, in contrast to other ethnic groups which have shown no increase, is also of some concern. It may prove beneficial to conduct further NCMP analysis into this issue and to work with local areas where there are large Bangladeshi communities.

It is recommended that the techniques for monitoring trends in child BMI presented in this report are applied to future NCMP datasets. This will enable any changes in children's BMI, at population level or within sections of the child population, to be detected at the earliest possible opportunity.

iv. Summary of key findings

	Reception		Year 6	
	Boys	Girls	Boys	Girls
Changes in prevalence of obesity	Possible decrease	No change	No change	No change
Changes in mean BMI	Significant increase	Significant increase	Significant increase	No change
Changes in the BMI distribution	Significant decrease in mean BMI among the 25% of boys with highest BMI Significant increases for the remaining 75% of boys (largest for boys with the lowest BMI)	Significant decrease in mean BMI among the 5% of girls with highest BMI Significant increases for the remaining 95% of girls (largest for girls with the lowest BMI)	No change in BMI among the 20% of boys with highest BMI Significant increases for the remaining 80% of boys (largest for boys with the lowest BMI)	No change in mean BMI among the 70% of girls with highest BMI Significant increases for the remaining 30% of girls (largest for girls with the lowest BMI)
Changes in health inequalities	Possible widening of health inequalities, as a result of decreases in prevalence of obesity among the least deprived boys	No change	No change	No change
Changes in obesity prevalence by ethnic group	Possible increase for boys of Bangladeshi ethnicity	Possible increase for girls of Bangladeshi ethnicity	Possible increase for boys of Bangladeshi ethnicity	No change

1. Introduction

The National Child Measurement Programme (NCMP) records height and weight measurements annually of children in Reception (generally aged 4–5 years) and Year 6 (generally aged 10–11 years) attending state-maintained primary schools in England.

The 2008/09 NCMP dataset provides the third year of detailed child height and weight measurements collected across these two age groups. It consists of the largest sample of children's height and weight measurements in England and is an extremely useful dataset for the purposes of examining trends and enhancing understanding of the epidemiology of child obesity.

Headline figures are provided annually by The NHS Information Centre for health and social care (NHS IC). These cover prevalence of overweight and obesity at national, Local Authority and Primary Care Trust (PCT) level, as well as analysis of links between obesity prevalence and factors such as deprivation, ethnicity, and the rural/urban environment. This information is available from the NHS IC website, www.ic.nhs.uk/ncmp.

This report focuses on the body mass index (BMI) measurements recorded for children as part of the NCMP in the 2006/07, 2007/08, and 2008/09 academic years. It examines the trend in children's BMI at population level, highlighting those changes that can be detected over this relatively short time period.

Analysis has been presented by age and sex groups using mean BMI (adjusted for age), as well as the prevalence of obesity. The changes observed have also been broken down across the child BMI distribution, by socioeconomic group and by ethnic group, to provide a fuller picture of recent trends in child BMI.

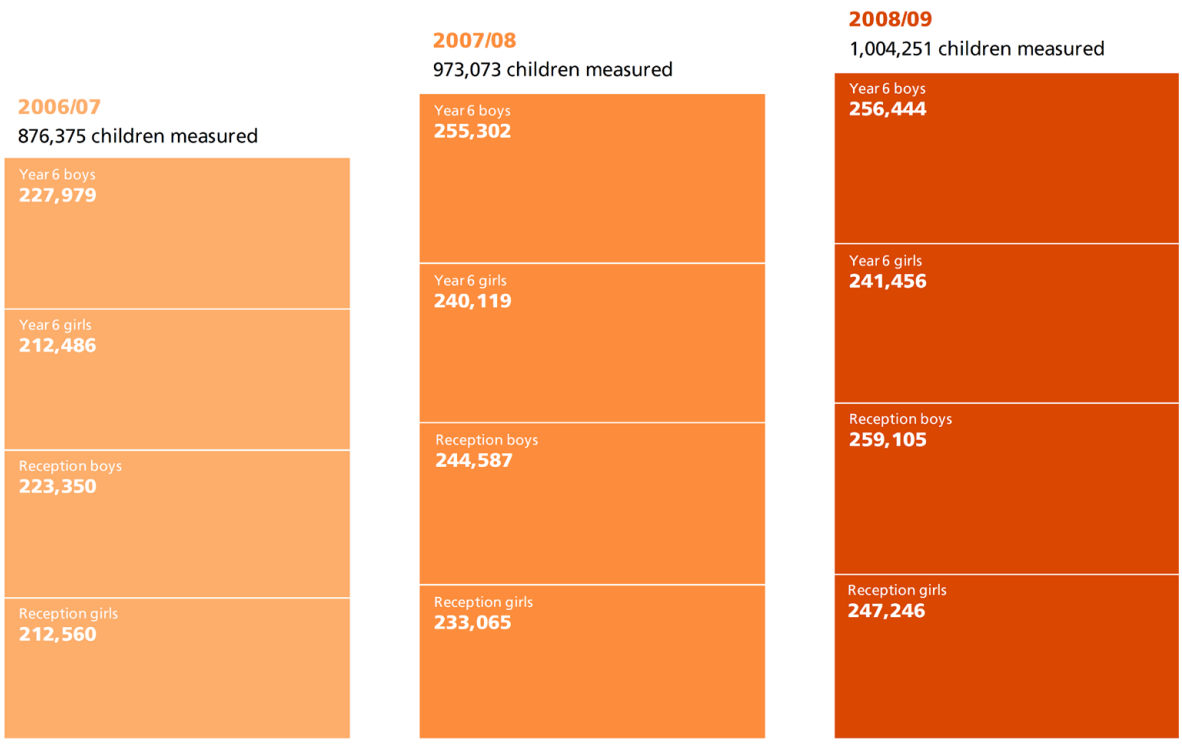
2. The National Child Measurement Programme dataset

A programme of national child measurements, collected by PCTs, began in 2005/06 with the National Childhood Obesity Database (NCOD). Over 500,000 child measurements were collected in that year, but the data fields that were collated centrally lacked the detail required for in-depth analysis.[1]

As a result the NCOD was revised; the new surveillance programme was renamed the National Child Measurement Programme and began in 2006/07. More information was collated within the central dataset than for the NCOD, revised guidance for PCTs was issued, and methods of data collection were improved. This has resulted in a more useful sample for epidemiological analysis.

Participation in the NCMP, both by PCTs and by individual children and parents, has improved over the three years in which measurements have been taken. The number of children with valid measurements that were measured in 2006/07, 2007/08, and 2008/09 is shown in Figure 1, broken down by school year and sex.

Figure 1: Number of children measured by year of measurement, school year, and sex



The number of children measured rose by nearly 100,000 between 2006/07[i] and 2007/08, corresponding to an increase from 80% of eligible children to 88%.

i The 2006/07 dataset used for analysis within this report is the same as used for the 2006/07 NOO NCMP report. This differs slightly from that used for the national analysis published for that year by the NHS IC and issued to Public Health Observatories (PHOs). This is due to additional data cleaning performed after the dataset was released and the addition of some records which were not included in the original national dataset.

In 2008/09 the NCMP dataset increased in size by a further 31,000 children (a 90% participation rate), resulting in a total sample of over one million child measurements for the first time.[ii]

The very large numbers of children sampled for the NCMP gives great potential for detailed analysis of the distribution of child BMI and allows the tracking of even small changes over time. Much smaller numbers of children are measured by other surveys such as the Health Survey for England (HSE), precluding detailed analysis and requiring many years of data before a reliable change over time can be detected.

ii The 2008/09 dataset used for this analysis contains 402 records more than that used for the NHS IC's published NCMP analysis for the same year. This is due to the inclusion of data for some state-maintained schools previously wrongly coded as independent schools. This dataset is the same as that released by the NHS IC to PHOs in January 2010.

3. Methods

This report is based on the NCMP datasets for the three years 2006/07, 2007/08, and 2008/09.

Only data for pupils attending state-maintained schools have been included in the analysis, as only a very small proportion of independent and special schools are covered in the NCMP datasets. In addition, pupils at independent and special schools were not included in the 2006/07 dataset distributed to regional Public Health Observatories (PHOs). For consistency over time and between areas, these records have been excluded from the analysis for this report.

The number of valid records remaining after data cleaning by the NHS IC[2] for the three years of measurement is shown in Figure 1, broken down by school year and sex. The whole sample for each survey year has been used for the analyses presented, unless specified otherwise in the text.

In this analysis children with a BMI greater than or equal to the 95th centile of the British 1990 growth reference (UK90) BMI distribution[3] have been classified as obese. This definition is the most commonly used for child obesity prevalence figures in England, for example in most published HSE and NCMP analysis.

Any differences observed between population groups or between years of NCMP measurement have been tested to a 95% significance level using the techniques recommended by Altman et al.[4]

All analyses were conducted using Microsoft Access and Excel. The slope index of inequality, and associated confidence limits (Figure 7), were calculated using weighted linear regression within PASW Statistics 18 (SPSS).

4. Changes in children's BMI at population level

- **Child obesity prevalence shows no significant change between 2007/08 and 2008/09, suggesting that the historic rise in prevalence has slowed.**

- **There is some evidence of a slight decrease in obesity prevalence over the past three years of NCMP measurements for boys in the Reception year.**

- **However, mean BMI (adjusted for age) shows an increase between 2007/08 and 2008/09 for boys and girls in Reception and boys in Year 6. Analysis of the BMI distribution suggests this has been driven by increases in BMI among children at a healthy weight for height.**

This section of the report examines the trend in child obesity prevalence over the three NCMP years. Changes observed in mean BMI (adjusted for age) are also presented in order to examine whether other types of change can be observed in the BMI of the child population.

4.1 Changes in obesity prevalence

In recent years the HSE has provided the most robust source of trend data on child obesity. Between 1995 and 2004, HSE data reported a steady rise in obesity prevalence for children aged 2–15 years of over 0.5% per year. Since 2005 the rate of increase has slowed, suggesting that the upward trend in child obesity prevalence is flattening out.[5]

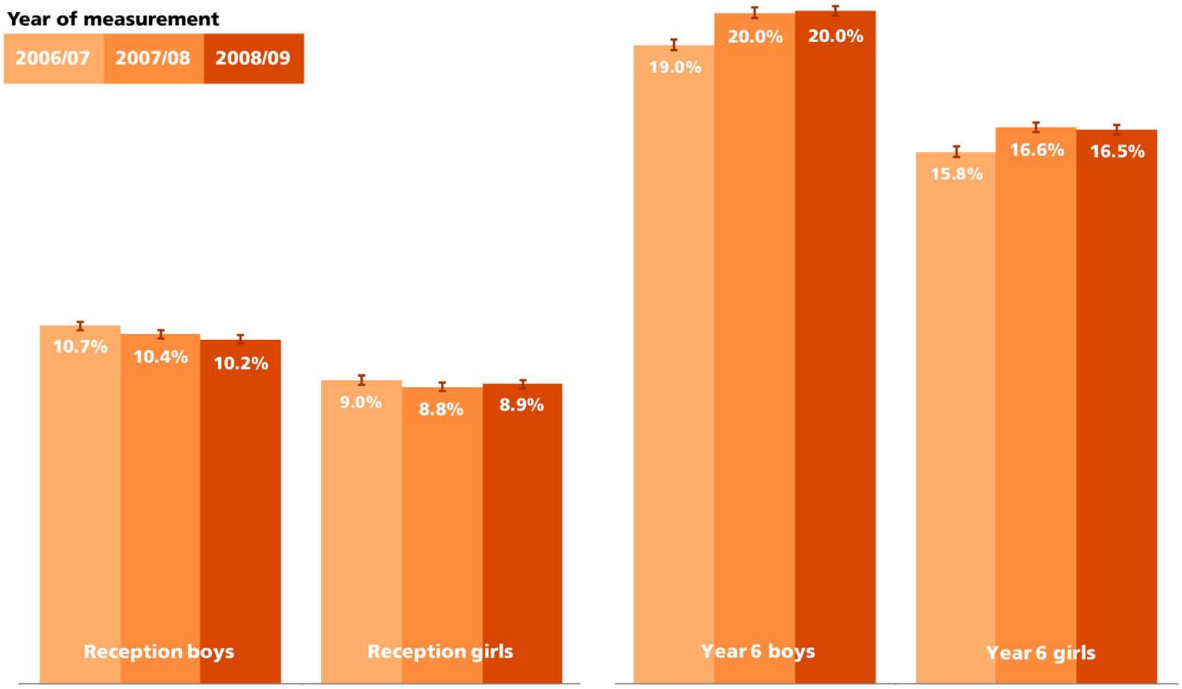
The NHS IC analysis of the NCMP also supports this observation, at least for the age groups covered by the NCMP. As Figure 6 in the 2008/09 NHS IC NCMP report shows,[6] no statistically significant changes in obesity prevalence are evident between 2007/08 and 2008/09 when compared by school year.

Figure 2 below shows the obesity prevalence figures for the three NCMP samples split by school year, and also by sex.

A significant increase in reported obesity prevalence occurred between 2006/07 and 2007/08 for both boys and girls in Year 6. However, as discussed in the 2007/08 NHS IC NCMP report,[7] this apparent increase in prevalence may be explained by the increase in NCMP participation that occurred over the same time period.

Between 2007/08 and 2008/09 there were no significant increases in child obesity prevalence for boys and girls in Year 6 and girls in Reception. In addition, there was a significant decrease in obesity prevalence for boys in Reception in both the 2007/08 and 2008/09 samples compared with 2006/07.

Figure 2: Prevalence of obesity (with 95% confidence limits) by year of measurement, school year, and sex



The lack of any significant increase in obesity prevalence between 2007/08 and 2008/09, and the significant decrease observed for boys in Reception between 2006/07 and later years, supports the pattern observed with HSE data. This suggests that the rate of increase in child obesity has slowed compared to the increases observed between 1995 and 2004.[5] The large size of the NCMP dataset means this levelling off can be reported with greater confidence. If increases were still occurring at a rate of approximately 0.5% per year, these would be detectable between NCMP datasets from adjacent years.

4.2 Changes in mean BMI for age

Analysis of obesity prevalence alone cannot detect all possible changes in BMI across the child population. This is because obesity prevalence figures are based on the proportion of individuals whose BMI exceeds a defined threshold. Any changes in the BMI of children who are under this threshold will therefore not be reflected in these figures.

In order to capture such changes, alternative population measures of children's BMI can be used. Mean BMI is an accepted summary measure of a population's BMI that takes account of the BMI of all individuals and is routinely published based on HSE data.

However, the BMI of children is known to vary with age and sex, and so the mean BMI of the NCMP sample would change if the average age of the children measured differed between survey years.

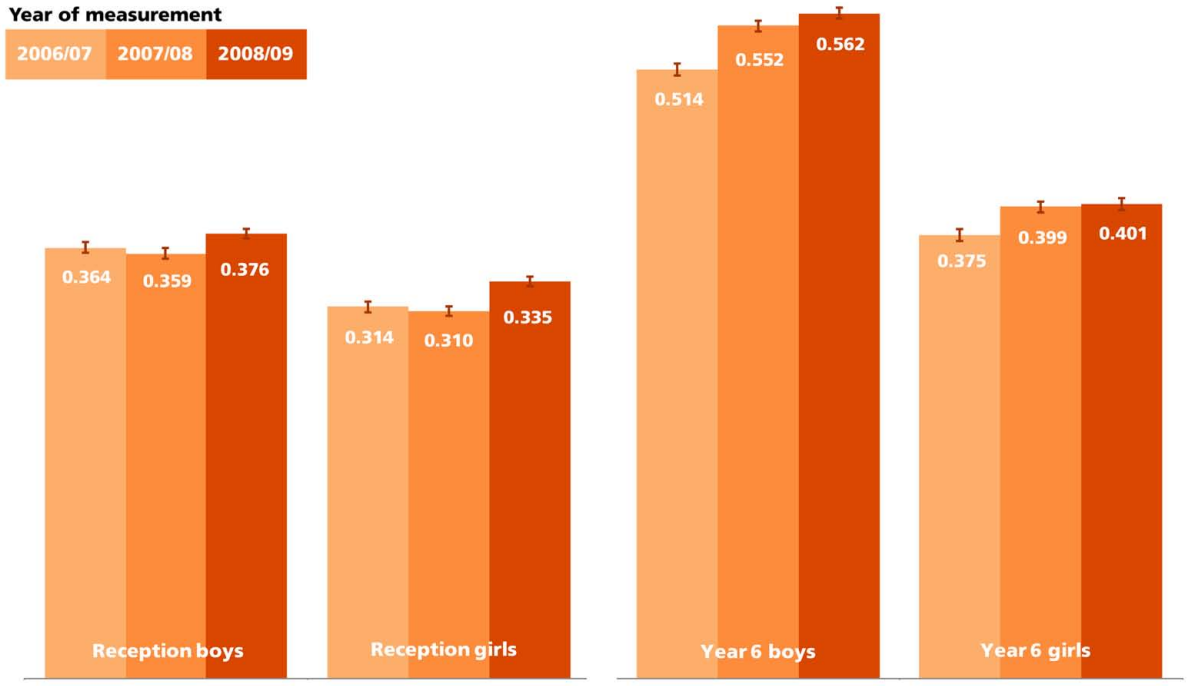
Analysis of NCMP data across the three years shows that the average age of children measured has increased by approximately 1.5 months between 2006/07 and 2008/09. Therefore any observed changes in mean BMI could result from sampling differences between years rather than actual changes in the BMI distribution of the child population.

To adjust for such variation in the age of children sampled, the BMI of individual children can be adjusted for age by using the UK90 BMI reference. Using this approach, a standard deviation score (SDS) for the BMI of each individual child can be calculated. This represents the number of standard deviations that child is from the expected BMI for age in the 1990 baseline population, and is known as the BMI z score. These can then be averaged to produce a mean z score, which provides a single measure for the population that takes account of both the BMI and the age of each child measured.

Mean BMI z score is a useful summary measure of the child population[8] and has been used in the analysis of child BMI status within a number of academic papers.[9,10]

Figure 3 shows the mean BMI z score for each year of NCMP measurement.

Figure 3: Mean BMI z score (with 95% confidence limits) by year of measurement, school year, and sex



Mean BMI z score shows a significant increase between 2006/07 and 2007/08 for both boys and girls in Year 6. As with the increase observed for obesity prevalence between these years in Year 6, this may be attributable to the substantial improvements in NCMP participation that occurred over this time.

There were also significant increases in mean BMI z score between 2007/08 and 2008/09 for boys and girls in Reception and boys in Year 6. These changes are unexpected given that obesity prevalence did not increase in these groups over this time.

In terms of UK90 centiles, the mean BMI z score of boys in Reception measured for the NCMP increased by 0.6 centiles (from the 64th centile to the 64.6th centile) between 2007/08 and 2008/09. For girls of this age the increase was 0.9 centiles (62.2nd to 63.1st). For boys in Year 6 the increase in mean BMI z score equates to 0.4 centiles (70.9th to 71.3rd).

Although such changes represent a small shift in BMI for an individual, such increases, taking place at population level over just a twelve month period, may be cause for concern. We cannot rule out future health implications of such increases in BMI at population level.

For some population groups the two measures appear to show contrasting patterns; obesity prevalence among boys in Reception was significantly lower in 2008/09 than in 2006/07, whereas mean BMI z score showed a significant increase between these years. However, these findings are not necessarily contradictory; they may be a reflection of changes in the distribution of BMI within the child population. This is explored in more detail in the following section.

4.3 Changes in child BMI distribution, analysed by twentile

In order to check for differences in the BMI z score distribution between years of the NCMP, the child population in each sample year and for each age and sex group has been divided into twenty groups or 'twentiles'.[iii]

The first twentile relates to the 5% of children with the lowest BMI for age, and the final twentile to the 5% of children with the highest BMI for age. The mean BMI z score for each group has then been calculated.

In this analysis the mean BMI z score for each group has been presented as the absolute change since the 1990 baseline and is shown in Figures 4a–d.

Confidence limits around the mean BMI z score for each twentile are very small (on average +/- 0.0025 SDS) and so have not been shown in the figures. However, where changes in mean BMI z score are visible on these charts they will be significant at the 95% significance level.

iii This technique groups children with similar BMI, and so the standard deviation (and confidence limits) of the twentile estimates is very small. This enables more groups to be utilised in this form of analysis (e.g. twentiles rather than deciles), which in turn allows for more detailed examination of patterns of trends.

Figure 4a: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement: Reception, boys

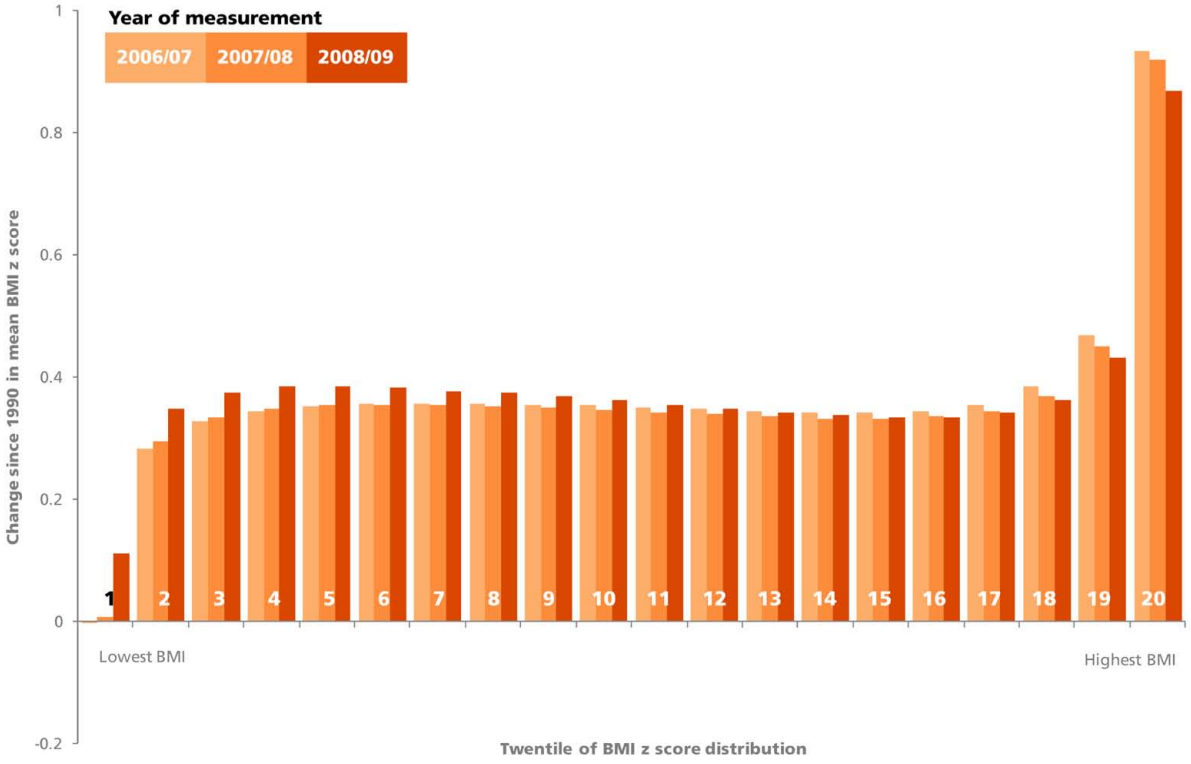


Figure 4b: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement: Reception, girls

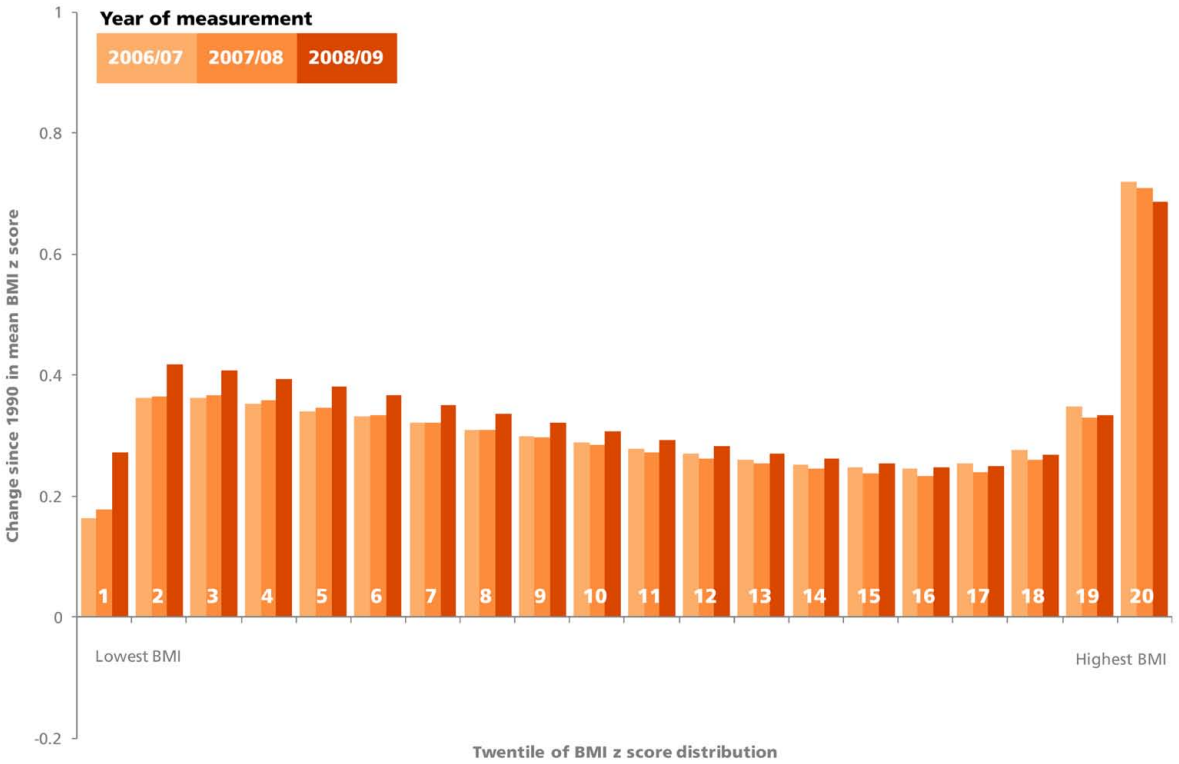


Figure 4c: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement: Year 6, boys

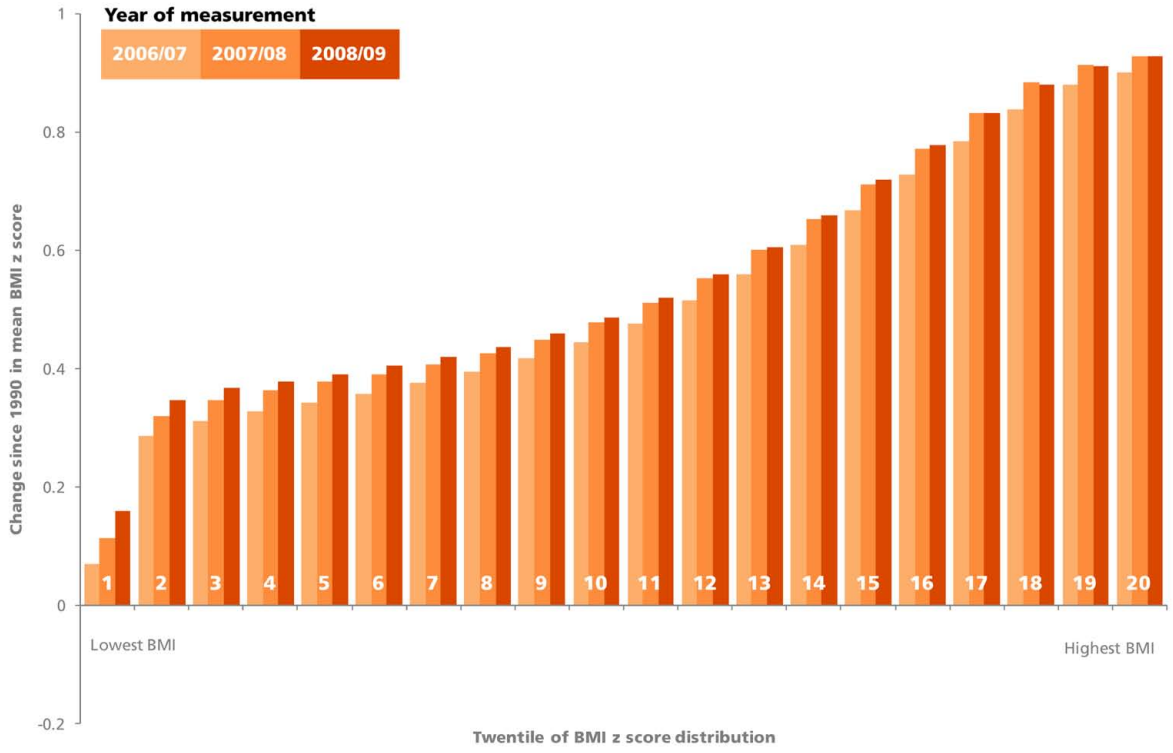
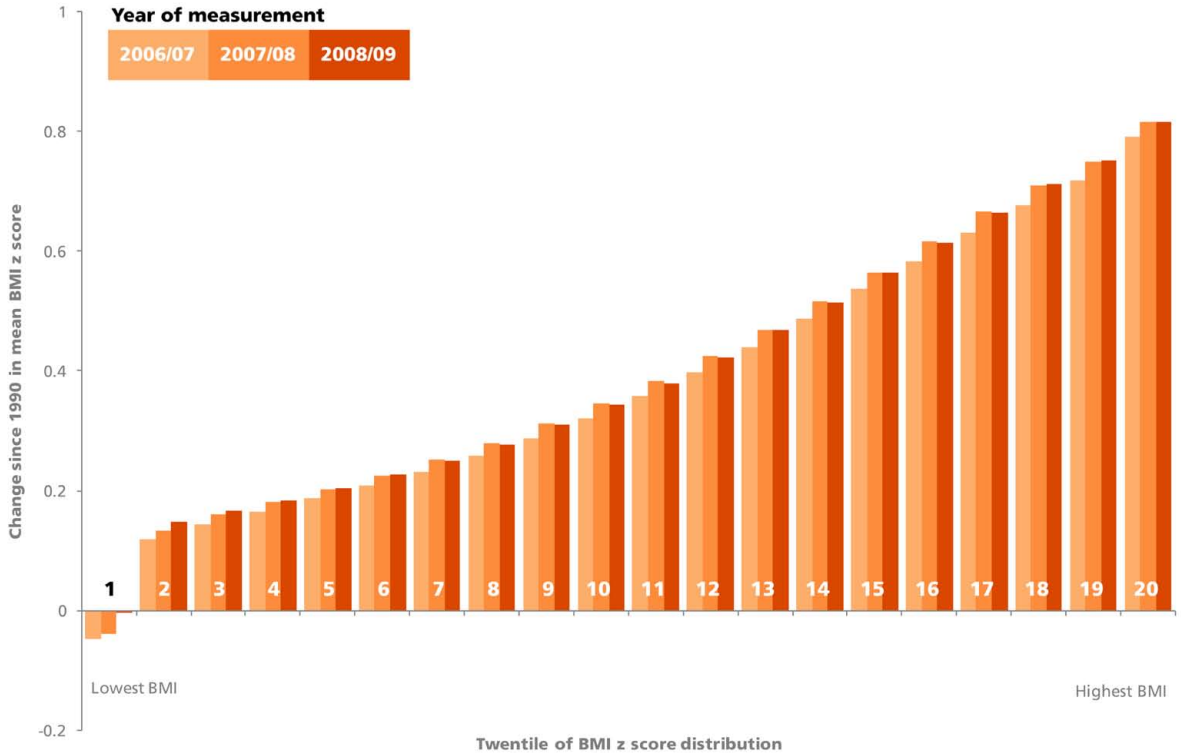


Figure 4d: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement: Year 6, girls



The distribution of BMI z scores shows a similar pattern of change since the 1990 baseline across all years of NCMP measurements. With the exception of the 5% of Year 6 girls with the lowest BMI for age, all the changes observed since the 1990 baseline are positive – i.e. showing that mean BMI has increased across the whole child population.

The change since the baseline differs substantially between children in Reception and Year 6. This pattern is similar to that observed with the 2007/08 data, as illustrated in Figure 17 of the 2007/08 NOO NCMP report.[11]

However, some significant differences in the BMI z score distribution are evident between years of NCMP measurements in Figures 4a–d. Once again the pattern of these changes differs by age group and sex.

In Reception, mean BMI z score changed little between 2006/07 and 2007/08. Some small increases in mean BMI z score can be seen at the bottom of the BMI distribution, whereas the top of the distribution shows slight decreases. In Year 6, there have been consistent increases in mean BMI z score across the whole distribution between these years.

Changes in mean BMI z score between 2007/08 and 2008/09 are more likely to reflect actual changes in the underlying population, as data quality and NCMP participation changed less between these years than between 2006/07 and 2007/08.

In Reception, there was a significant decrease in BMI z score between 2007/08 and 2008/09 among the 5% of girls and 25% of boys with the highest BMI for age. However, at the bottom end of the BMI distribution, there has been an increase in mean BMI z score over this time for boys in the lower 75% of the distribution and for girls in the lower 95% of the distribution.

In Year 6, there is no evidence of any change in mean BMI z score between 2007/08 and 2008/09 at the top of the BMI distribution. Mean BMI has not increased significantly among the 20% of boys and 70% of girls in Year 6 with the highest levels of obesity. However, between 2007/08 and 2008/09, there is evidence of an increase in mean BMI z score in the lower 80% of the BMI distribution for boys and in the lower 30% for girls.

4.4 Discussion

This analysis of the NCMP dataset supports recent findings from the HSE and elsewhere that the rise in child obesity has slowed. This is apparent in the analysis of obesity prevalence figures, and is confirmed by more detailed analysis looking at twentiles of the BMI distribution, assessed by school year and sex.

For children in Reception, especially boys, there has been a small decrease in mean BMI for age among the most obese children between the 2007/08 NCMP sample and the 2008/09 NCMP sample. In Year 6 the NCMP data show that the mean BMI of children at the top of the BMI distribution has not changed between 2007/08 and 2008/09.

Data quality issues are unlikely to have resulted in the reported stabilisation of obesity prevalence and mean BMI among the most obese children. Both data quality and participation have improved with each year, and such improvements would be expected to increase – not decrease – reported prevalence or mean BMI for age. However it is not known whether, for example, an increase in

the selective opt-out of the most obese children (which cannot be easily measured or quantified) occurred at the same time as improvements in factors which can be measured, such as overall NCMP participation or data quality. Further analysis of the NCMP dataset, including analysis of the opt-out information supplied by PCTs, may help to understand whether this is indeed the case. NOO is currently conducting such analysis, which will be published in peer-reviewed journals.

The observed increase in BMI z score across the whole population raises interesting questions. The increases observed in mean BMI for age at population level between 2007/08 and 2008/09 have come about mainly due to increases in the bottom half of the BMI distribution – i.e. among children whose BMI would be classified as healthy.

Weight gain for such individuals is not necessarily unhealthy. Indeed, for those in the bottom 20% of the BMI distribution, where individuals are closer to being classed as underweight than overweight, weight gain might be considered a healthy change.

However, for those children closer to the threshold for overweight, the increases in mean BMI may represent an increase in risk of future obesity-related ill health. If seen to continue, this may result in more children being classified as overweight or obese in future years.

In addition, such increases in mean BMI for age, could be more important at population level. Because the relationship between childhood BMI and both current and future obesity-related ill health is not yet well understood, we cannot be certain that the observed increases in child BMI at population level will have no detrimental impact on the future health of the current child population.

It is important that future monitoring of the entire child BMI distribution continues, making use of NCMP data, so the observed population-level changes can be monitored more closely. In addition, the relationship between data quality and participation in the NCMP, using both obesity prevalence and mean BMI for age, should be examined further to determine whether any of the observed changes in population-level BMI can be explained by these indicators.

5. Changes in health inequalities within child obesity

- **There is no evidence of changes in the existing health inequalities in child obesity over time, with the exception of boys in Reception.**

- **Health inequalities appear to be widening for boys in the Reception year. If so, this is a result of reductions in obesity prevalence among the least deprived boys of this age.**

Previous analysis by the NHS IC and NOO has highlighted the very strong relationship between obesity prevalence and socioeconomic deprivation, as measured by indices such as the Index of Multiple Deprivation (IMD) 2007. In both Reception and Year 6, the prevalence of obesity is known to increase with greater socioeconomic deprivation.

The large number of children sampled for the NCMP allows the links between obesity prevalence and deprivation to be examined in some detail, including analysis to detect any changes over the three years of NCMP measurements.

5.1 The relationship between obesity prevalence and deprivation

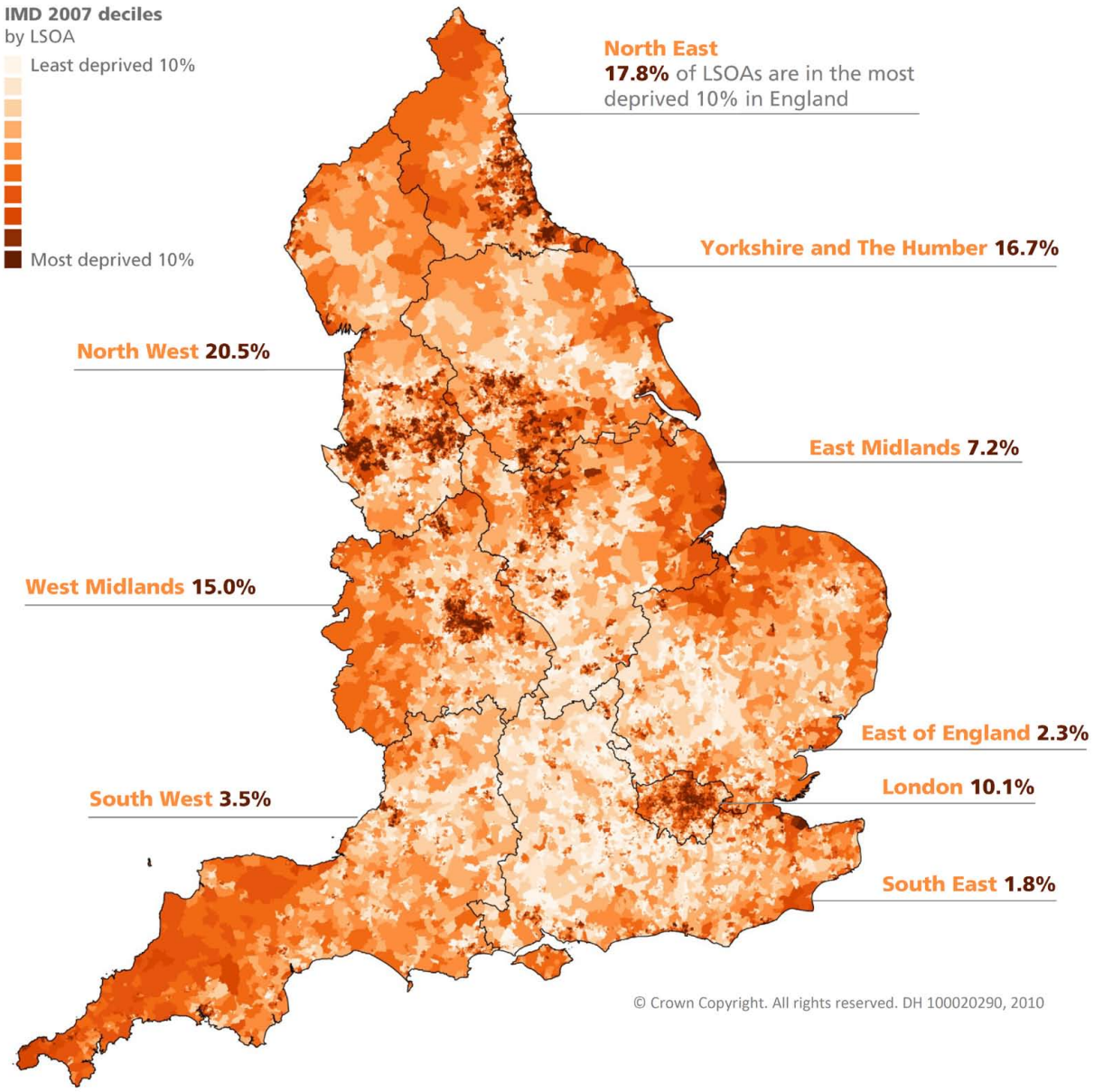
In order to analyse changes in child BMI by socioeconomic group, the NCMP sample was stratified into deciles of deprivation using the Lower Super Output Area (LSOA) of residence of all individual children in the NCMP sample with valid LSOA coding. Children were then assigned to one of ten IMD deciles, with decile 1 containing the least deprived 10% of LSOAs in the country, and decile 10 containing the most deprived 10% of LSOAs.[iv]

Figure 5 shows the spread of these deciles across England and shows the proportion of LSOAs in each region that are classified as being in the most deprived 10% nationally.

The map shows that the most deprived LSOAs are predominantly found in the North West, North East, Yorkshire and The Humber, West Midlands, and London. However, all regions of the country have some LSOAs that are classed as being among the most deprived 10% in England.

iv Over the three NCMP years there has been an increase in the number of records that have valid coding for LSOA of residence. This information is required to assign child records accurately to these deprivation deciles. As a result the analysis presented in this section does not use all the child records within each year's NCMP dataset. Approximately 58% of records had valid LSOA coding in 2006/07, 95% in 2007/08, and 98% in 2008/09.

Figure 5: Index of Multiple Deprivation decile of LSOAs in England



Figures 6a–d present the prevalence of obesity by year of measurement, school year, and sex for each of the ten IMD deciles shown in Figure 5.

The gradient of the 'line of best fit' across the ten deciles (calculated by linear regression) is shown by dotted lines for each study year. The steeper the gradient of these lines the greater the increase in obesity prevalence between the deciles of deprivation. Therefore, the steeper the gradient the greater the gap in health inequalities between more deprived and less deprived areas.

Figure 6a: Prevalence of obesity (with 95% confidence limits) by IMD decile and year of measurement: Reception, boys

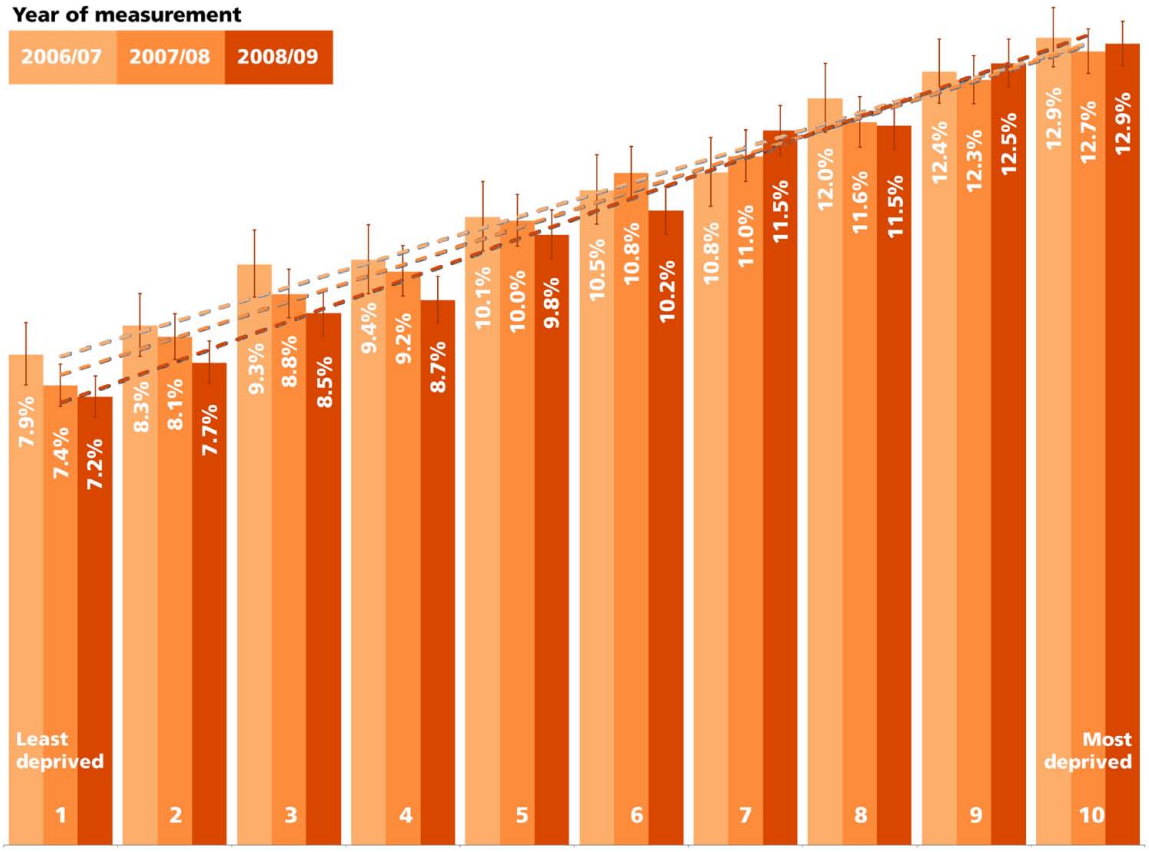


Figure 6b: Prevalence of obesity (with 95% confidence limits) by IMD decile and year of measurement: Reception, girls

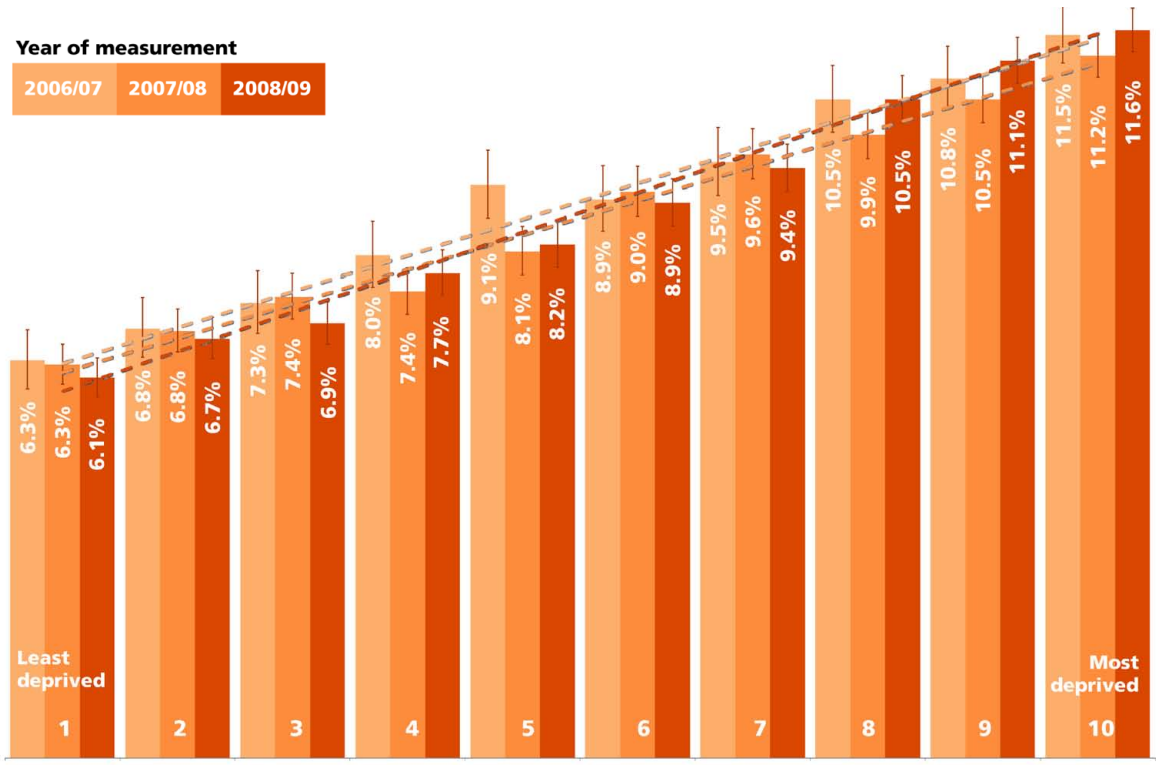


Figure 6c: Prevalence of obesity (with 95% confidence limits) by IMD decile and year of measurement: Year 6, boys

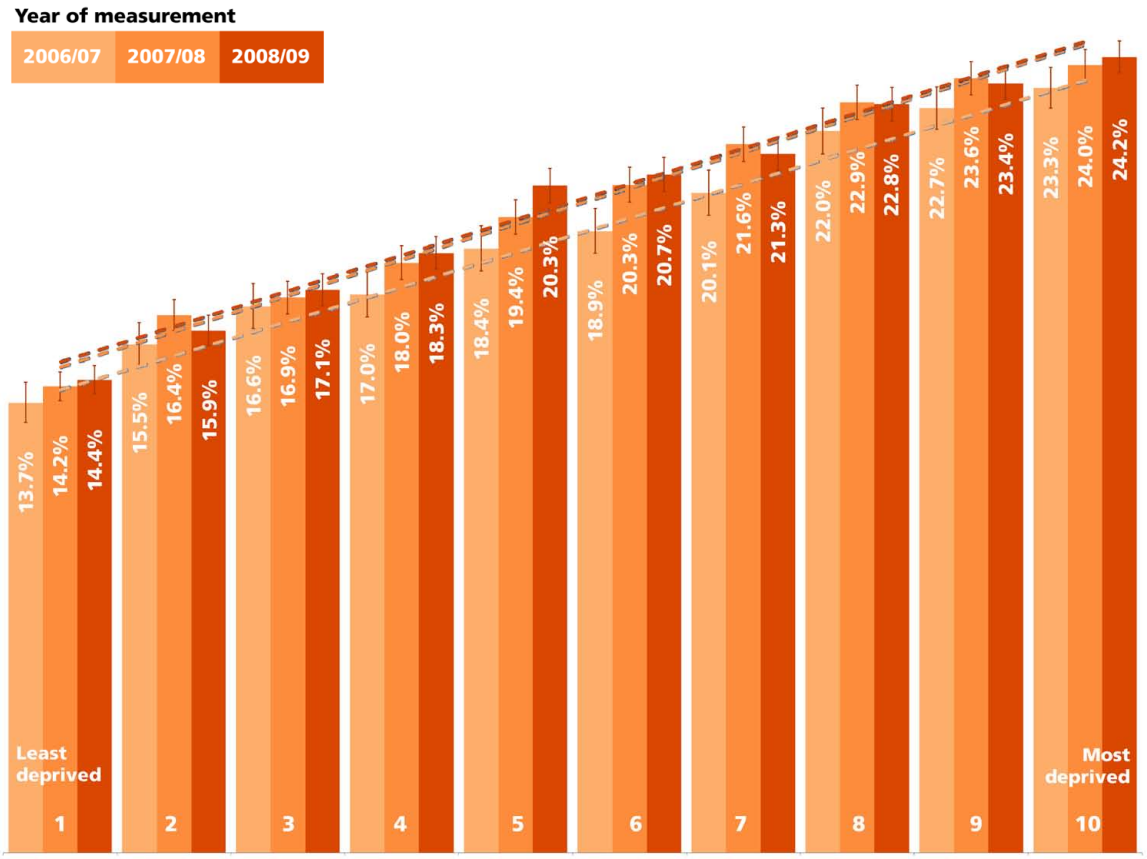
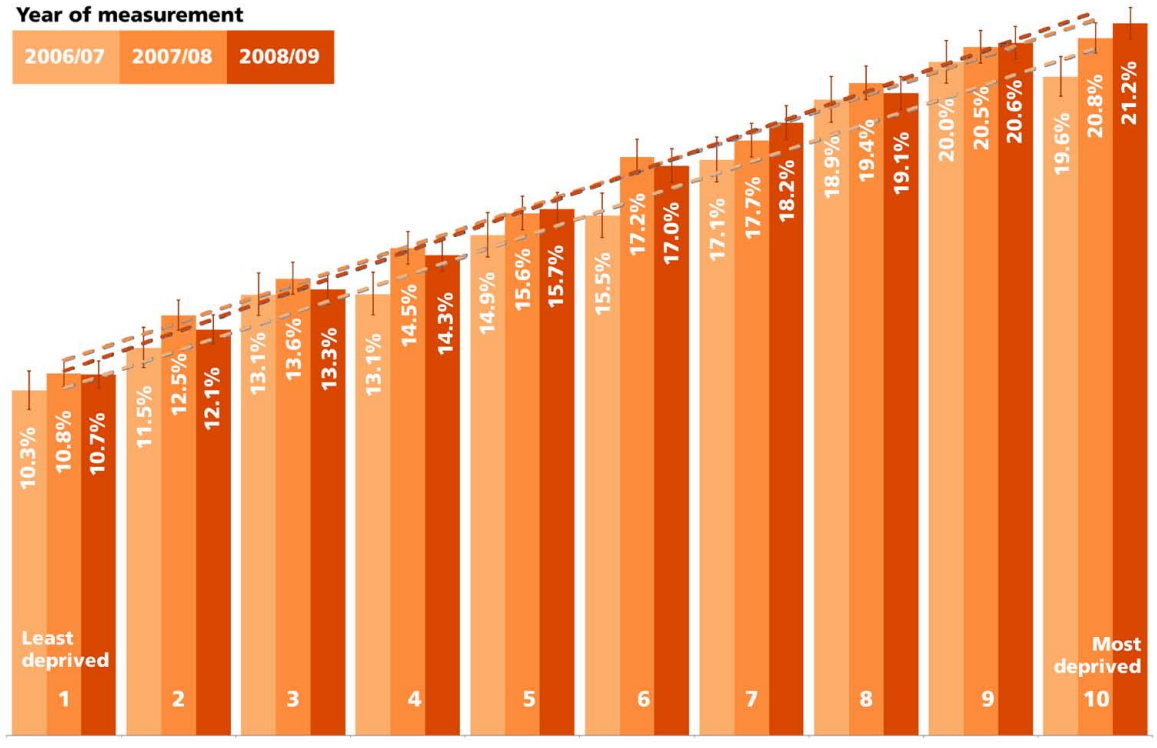


Figure 6d: Prevalence of obesity (with 95% confidence limits) by IMD decile and year of measurement: Year 6, girls



As reported in previous years, and shown in Figures 6a–d, the prevalence of obesity increases in a near linear fashion from the least to the most deprived IMD decile for both sexes and for both school years in all three years of NCMP measurement.

The gradient of the increase in prevalence with deprivation differs by school year, but is similar for both boys and girls of the same age. In Reception, the prevalence of obesity increases by around 0.6% per decile of deprivation. In Year 6, the gradient of this increase is around 1.1% per decile.

5.2 Trends in health inequalities within child obesity prevalence

Recent analysis using HSE data has suggested that health inequalities within child obesity prevalence widened for English children between 1995 and 2007.[12] It is possible to use NCMP data to test whether a similar pattern is observed between 2006/07 and 2008/09.

Some significant differences in obesity prevalence are evident between deciles across the three years of NCMP samples, as shown in Figures 6a–d. Although there was an apparent decrease in obesity prevalence within IMD decile 5 for girls in Reception between 2006/07 and later years, this result is likely to be a statistical anomaly as no similar pattern is seen for surrounding deciles. Significant differences also occur between the 2006/07 and 2008/09 obesity prevalence figures for Year 6 which, as already discussed, may be explained by improvements in NCMP participation and data quality.

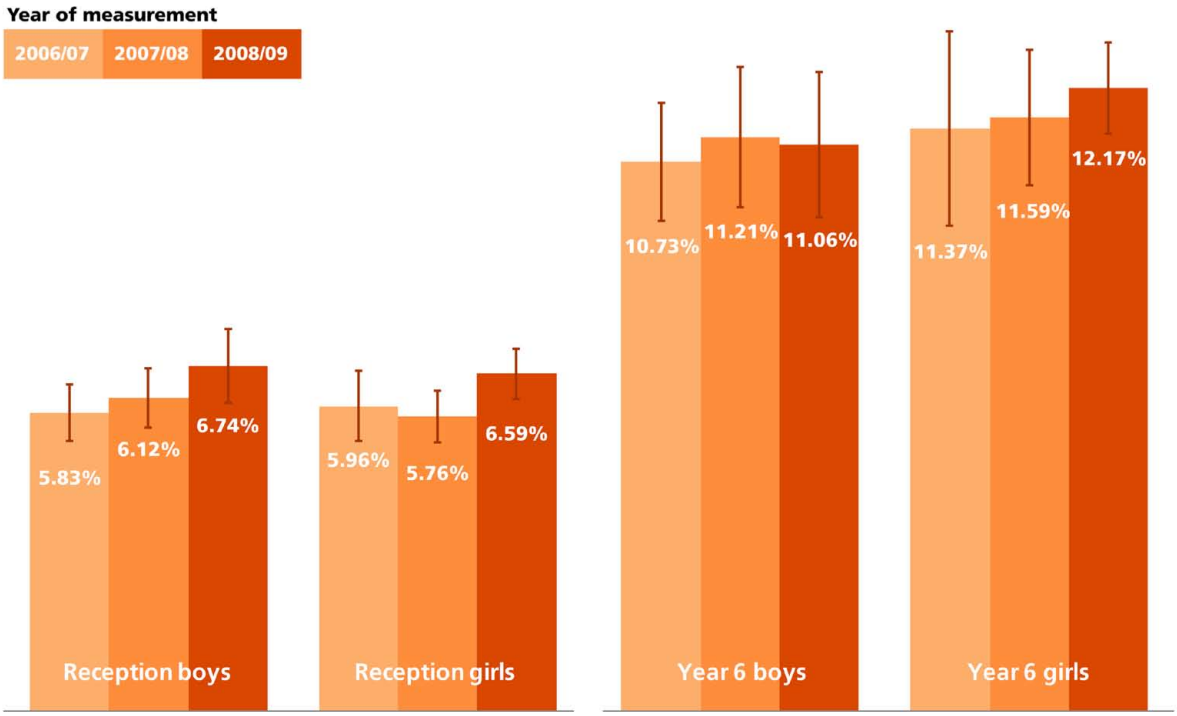
Rather than look for year on year changes between deprivation deciles to test for changing levels of health inequalities within child obesity prevalence, the slope index of inequality (SII) can be used. This estimates the size of the difference in obesity between the most and least deprived children in England and is frequently used by health professionals to examine health inequalities.[13] If the index shows a significant increase between NCMP years this suggests a widening of health inequalities.

The SII for child obesity and deprivation does show variation between NCMP years. Figure 7 shows the inequalities gap in obesity prevalence by school year, sex, and year of measurement.

The 2008/09 data show the greatest inequality with deprivation for both boys and girls in Reception, and girls in Year 6. However, only the change between 2006/07 and 2008/09 for boys in Reception is significant at the 95% significance level.[v] For this population group, obesity prevalence was around 5.8% higher in the most deprived children compared to the least deprived in 2006/07. In 2008/09 this difference had increased to 6.7%. This equates to an increase in the inequalities gap of nearly 1% in obesity prevalence for this age group over two years of NCMP measurement.

v Although the confidence limits on Figure 7 appear to overlap, there is a significant difference at the 95% level, when the combined variance of the 2006/07 and 2008/09 data is considered.

Figure 7: Change in the slope index of inequality for obesity and deprivation (with 95% confidence limits) by year of measurement, school year, and sex



This suggests that health inequalities for boys in Reception may be widening. No conclusions can yet be drawn about other age/sex groups covered by the NCMP.

The observed widening of health inequalities among boys in Reception seems to be a result of a decrease in obesity prevalence among the least deprived sections of the child population. Obesity prevalence has remained constant in the most deprived sections of the population. This can be seen in Figure 6a.

5.3 Discussion

In each of the NCMP years there is evidence of a substantial increase in obesity prevalence with greater socioeconomic deprivation. However, the trend in obesity prevalence has remained fairly constant between NCMP years except for boys in Reception. For this group an apparent widening of health inequalities between NCMP years can be seen, most likely as a result of decreases in obesity prevalence among the least deprived sections of the child population.

These findings differ slightly from those observed in the recent study (referred to in section 5.2) that used HSE data. In this study health inequalities were shown to have widened for boys and girls aged 2–10 years and boys aged 11–18 years, between 1995 and 2007.[12] The different findings are likely to be a result of the different time periods examined, age groups covered, and methods used to assign sociodemographic status.

More years of NCMP measurement are needed to confirm such trends in health inequalities and further analysis would be required to assess whether data quality and participation in the NCMP might be affecting the patterns observed.

6 Changes in child obesity prevalence by ethnic group

- **When prevalence of obesity is examined by ethnic group, some differences are apparent between boys and girls. In particular, obesity prevalence for boys from the Bangladeshi ethnic group is much higher than other groups, especially in Year 6.**

- **Prevalence of obesity shows no significant change over time when analysed by ethnic group with the exception of children of Bangladeshi ethnicity.**

- **Among children of Bangladeshi ethnicity, obesity prevalence for boys in both age groups, and girls in Reception, has increased across the three NCMP samples.**

The NCMP dataset records the ethnicity of the children measured and this information has been used to produce robust obesity prevalence figures by ethnic group. This could not have been done easily prior to the NCMP because the number of children sampled by surveys such as the HSE is too small to produce ethnicity-specific prevalence figures without combining data from a number of years.

6.1 Patterns of prevalence by ethnic group

Previous analysis, using NCMP and HSE data, has shown that child obesity prevalence varies substantially between ethnic groups. In general, such analysis shows children from most ethnic groups appear to have a higher prevalence of obesity than children of White British ethnicity.

Figures 8a–d show the prevalence of obesity by ethnic group across the three NCMP survey years, split by school year and sex, to allow trends to be examined.[vi]

In order to maximise the number of children in each ethnic grouping, and therefore reduce the confidence limits around the estimates presented, some ethnic groups have been combined.[vii] The change in prevalence observed is not significantly different between the groups combined and so does not affect the interpretation of trends. It would not be possible to detect any change in prevalence over NCMP years for these ethnic groups if analysed separately, due to the small numbers measured from these groups.

When prevalence figures by ethnic group are broken down by sex, some patterns are evident which are not apparent when the figures are presented for all children by school year.

In Reception, the pattern of obesity prevalence by ethnic group is broadly similar for boys and girls, with raised prevalence for most non-White British ethnic groups. Obesity prevalence is especially high for children of both sexes from Black African and Black Other ethnic groups, and boys from the Bangladeshi ethnic group. However, the prevalence of obesity among children of Indian ethnicity is not significantly different from that for the White British ethnic group in Reception.

vi The number of records with valid ethnicity coding has increased over the three years of the NCMP, from 32% in 2006/07 to 67% in 2007/08 and 77% in 2008/09.

vii White Irish and any other White background have been combined into the group White Other. White and Black Caribbean, White and Black African, White and Asian, and any other Mixed background have been combined into the group Mixed. Black Caribbean and any other Black background have been combined into Black Other. Chinese and any other ethnic group have been combined into Any other ethnic group.

In Year 6, the pattern of prevalence by ethnic group varies considerably between boys and girls. For girls in Year 6, the pattern is broadly similar to that observed for girls in Reception. However, for boys in Year 6, all ethnic groups report significantly higher prevalence of obesity than the White British ethnic group. This includes boys of Indian ethnicity who are the only Indian age/sex group with significantly different obesity prevalence from White British children.

Prevalence of obesity among Year 6 boys in some Asian groups, particularly children of Bangladeshi, Asian Other, and Pakistani ethnicity, is as high, or higher, than that for the Black African and Black Other ethnic groups which are generally thought to have the highest obesity prevalence.

6.2 Trends in obesity prevalence by ethnic group

There have been no significant changes in obesity prevalence by ethnic group over the three NCMP years studied, at the 95% significance level, with the exception of obesity prevalence for boys of Bangladeshi ethnicity in Year 6, where prevalence increased significantly between the years 2006/07 and 2008/09.

As Figures 8a–d show, there is a clear trend of rising obesity prevalence for both boys and girls of Bangladeshi ethnicity. Although this has not led to significant differences between prevalence figures except for boys in Year 6, this pattern is observed for all age and sex groups examined, and is relatively consistent across the years 2006/07 to 2008/09.

In addition, in the 2006/07 data, obesity prevalence for children of Bangladeshi ethnicity was broadly in line with that for children from Pakistani and Asian Other ethnic groups. However, by the 2008/09 dataset, prevalence of obesity for Bangladeshi boys and girls in Reception, and boys in Year 6, was significantly higher than for Pakistani and Asian Other children.

This suggests the changes seen in obesity prevalence for children of Bangladeshi ethnicity represent a real change in underlying prevalence, and that this population group is showing a more rapid increase in prevalence of obesity than both the population as a whole and other Asian groups.

Figure 8a: **Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Reception, boys**

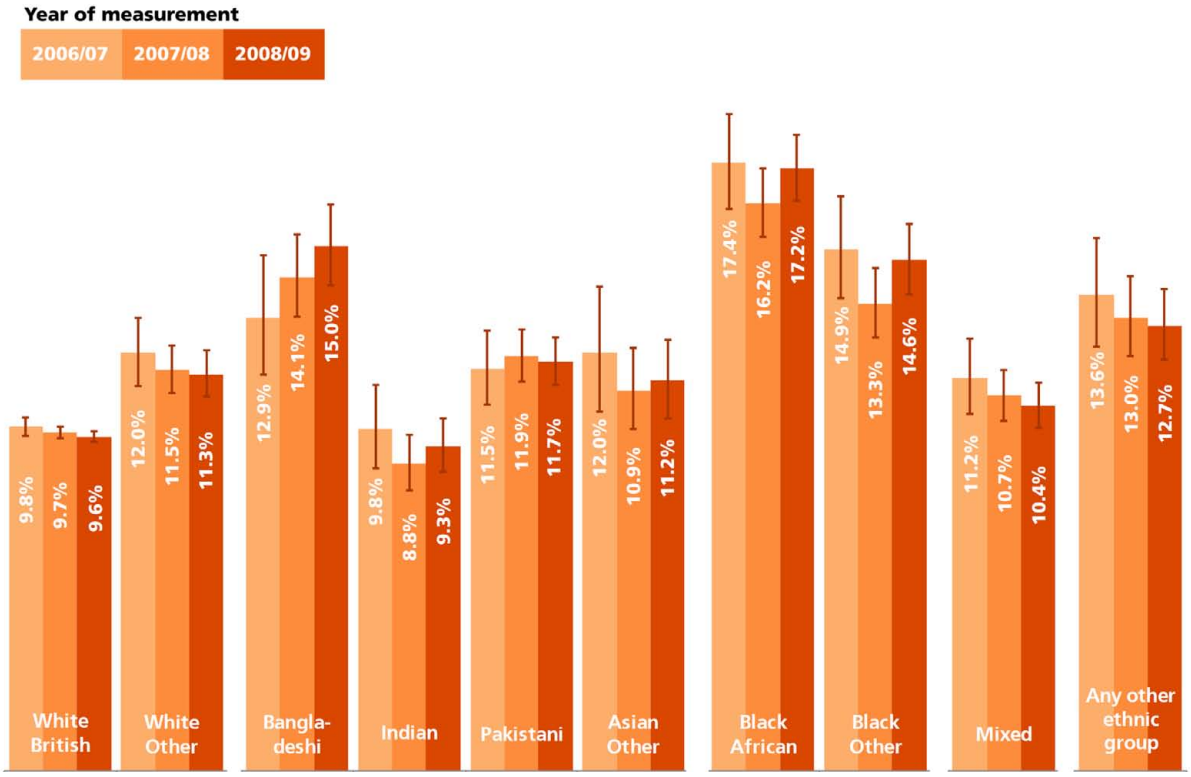


Figure 8b: **Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Reception, girls**

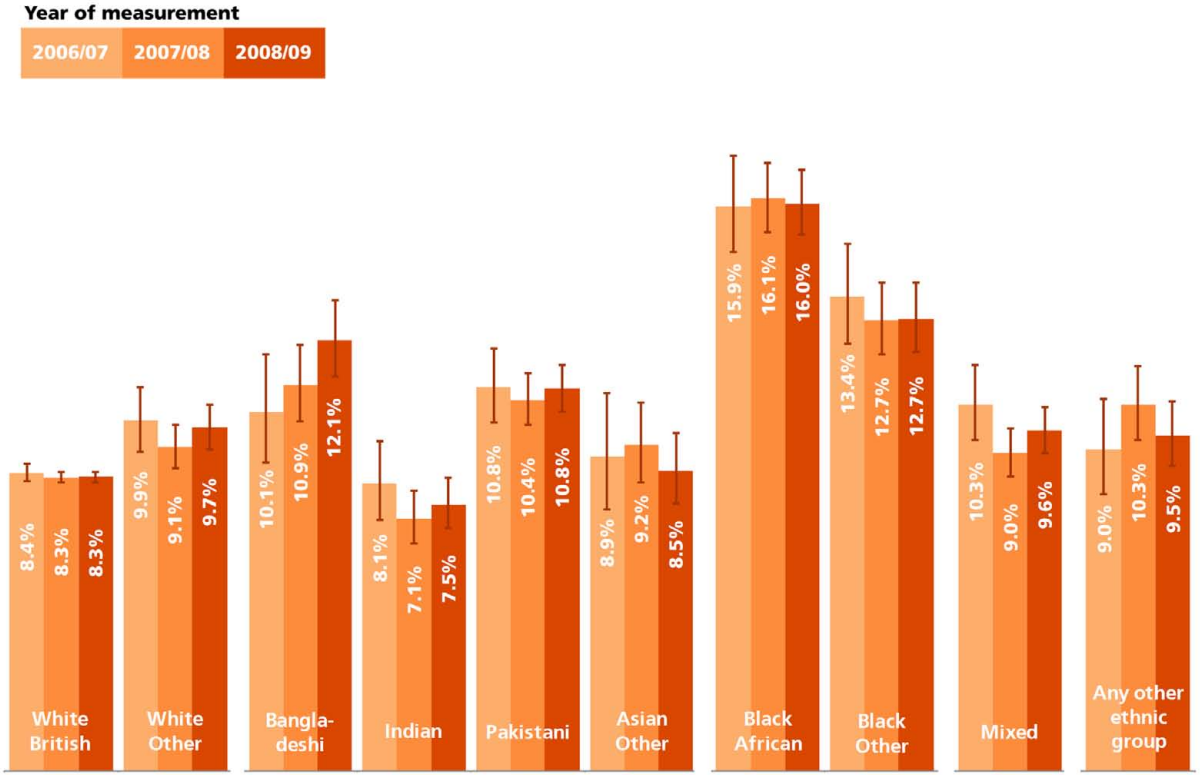


Figure 8c: Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Year 6, boys

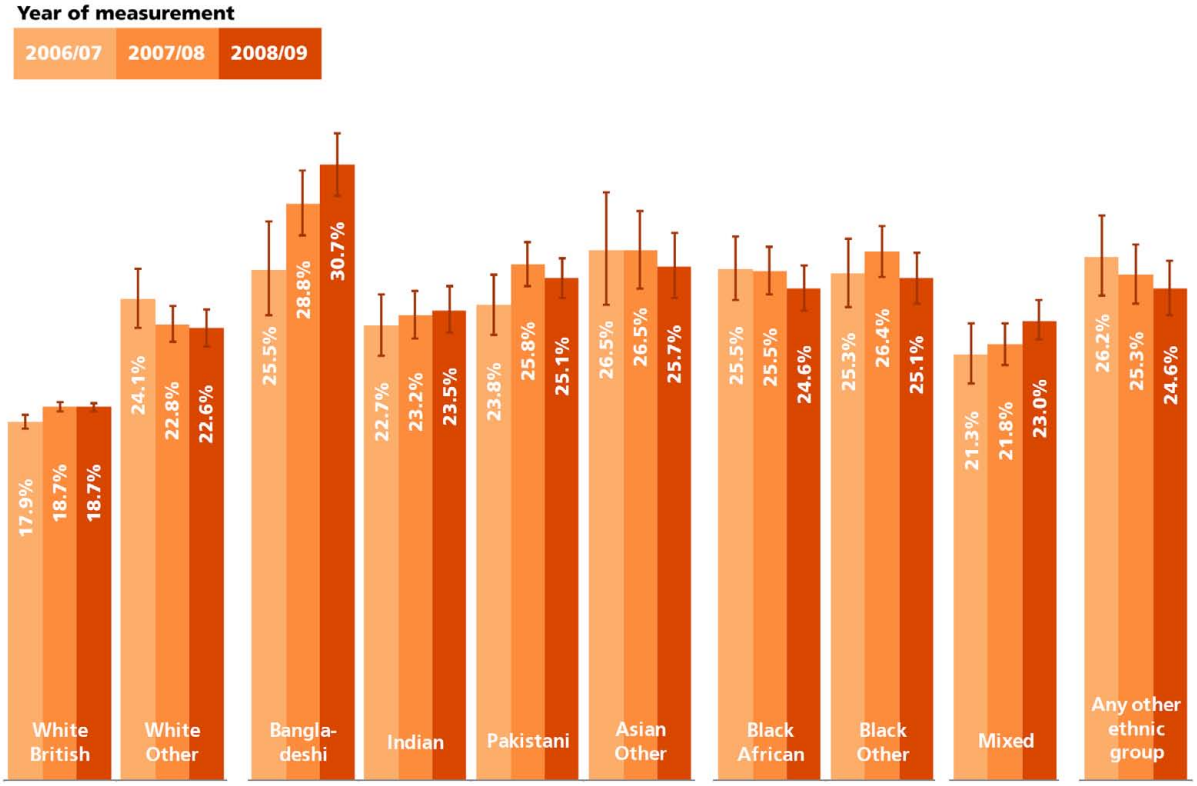
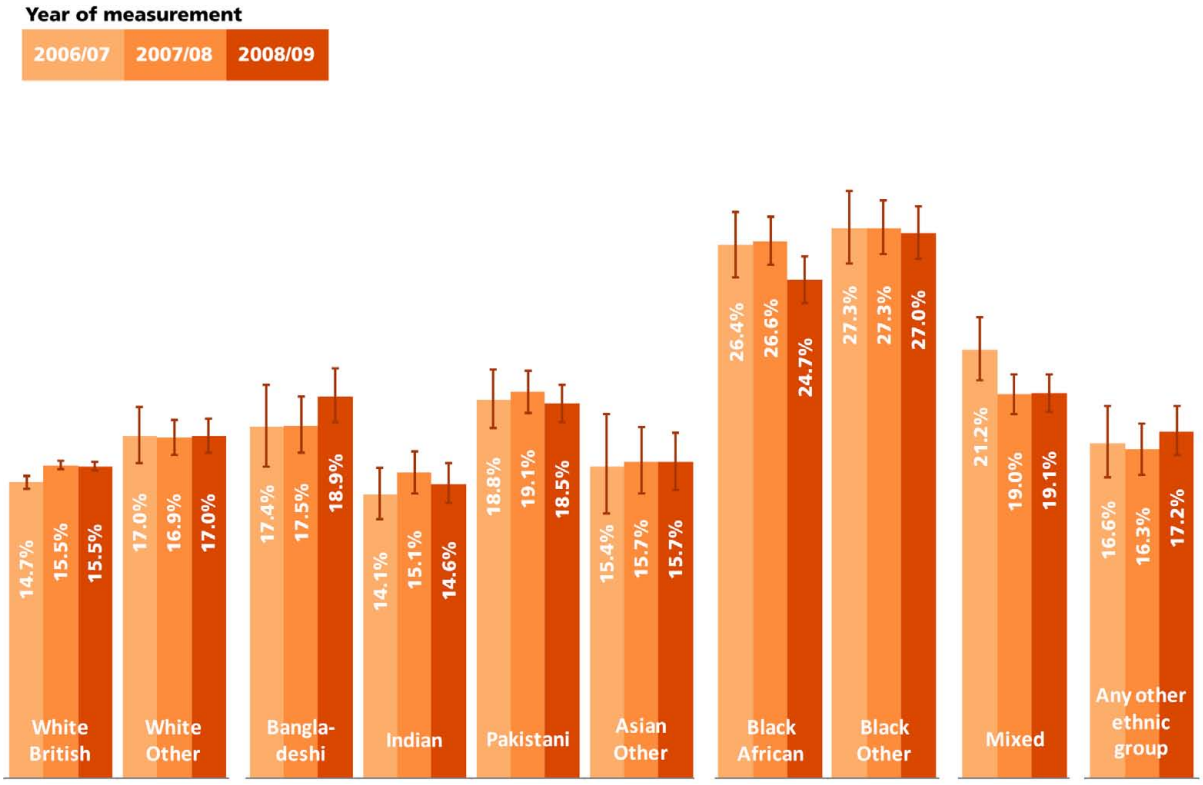


Figure 8d: Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Year 6, girls



6.3 Discussion

Prevalence of obesity is lower among children of White British ethnicity than among most other ethnic groups.

There is evidence that prevalence of obesity among children from the Bangladeshi ethnic group has increased between 2006/07 and 2008/09, especially for boys and girls in Reception and boys in Year 6. Bangladeshi children seem to be experiencing a more rapid increase in the prevalence of obesity than both the population as a whole and other Asian groups.

There is little evidence of year on year changes in obesity prevalence among any of the other ethnic groups over the NCMP study years.

As noted in previous NOO NCMP reports,[11,14] it is important to consider possible confounding effects. Factors such as deprivation and the urban environment may explain some of the higher prevalence of obesity observed in non-White British ethnic groups.

In addition, other factors such as an increased average height, or different build between ethnic groups, may also affect the likelihood that children from these population groups are classified as overweight or obese. NOO is currently conducting further NCMP analysis into differences between ethnic groups, which should shed further light on these issues.

7. Conclusions

The size of the NCMP dataset allows in-depth analyses of patterns in child BMI which greatly enhance the understanding of the epidemiology of child obesity. Even small changes can be detected without requiring data to be collected over a period of many years, and patterns can be examined by demographic and socioeconomic group.

It is already known that child obesity prevalence, as measured by the NCMP, seems to have remained constant between 2006/07 and 2008/09. This analysis, by NOO, provides some evidence that boys in Reception may be showing the first signs of a decrease in obesity prevalence. A decrease is also evident among the 25% most obese boys, and the 5% most obese girls when measured by mean BMI for age.

In contrast with these encouraging findings, the mean BMI for age for boys and girls in Reception and boys in Year 6 has increased, at least between 2007/08 and 2008/09. Although these increases have taken place among the 75% of children with lowest levels of obesity, such changes at the population level may still have a detrimental effect on public health in the longer term.

The data presented here also suggest that health inequalities may be widening for boys in Reception. The apparent reduction in obesity prevalence for this group appears to have taken place primarily among the least deprived children.

The prevalence of obesity is lower among children of White British ethnicity than among most other ethnic groups, and this pattern is consistent across all three years of NCMP measurement. Analysis of obesity prevalence by ethnic group and sex highlights the very high prevalence among boys of Bangladeshi ethnicity in Year 6. This is less evident when analysis is performed for boys and girls combined, as prevalence of obesity for Bangladeshi girls in Year 6 is only slightly elevated. However, it is possible that BMI does not provide an equally accurate assessment of levels of child obesity across all ethnic groups, so such differences should be treated with caution.

The reported prevalence of obesity for children of Bangladeshi ethnicity has increased across survey years. In 2006/07 the prevalence of obesity among children from the Bangladeshi ethnic group was no different than that for Pakistani or Asian Other groups, whereas in 2008/09 it is significantly higher. No other ethnic groups showed such a strong or consistent trend.

The size of the NCMP dataset enables this in-depth analysis. However the population surveillance approach which achieves these large numbers brings some disadvantages; it means that factors such as participation and data quality, including rounding of weight measurements at PCT level, cannot be as tightly controlled as they are in other studies which use a smaller sample size. Therefore it is possible that some of the patterns in obesity prevalence observed may actually result from changes in participation and data quality.

To understand better the observed changes in child BMI across the NCMP survey years, further analysis is recommended to look into the relationship between NCMP participation and data quality and child BMI. This should be assessed using both obesity prevalence and measures such as mean BMI z score, and should examine how this relationship has changed over time. NOO is currently working on such analysis and will publish findings at a later date.

8. References

1. Crowther R, Dinsdale H, Rutter H, Kyffin R. Analysis of the National Childhood Obesity Database 2005–06. London: Department of Health. December 2006. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_063565 (Accessed 27/05/10)
2. The NHS Information Centre for health and social care. National Child Measurement Programme: NHS Information Centre Validation Process for NCMP Data. London: NHS Information Centre. July 2009. http://www.ic.nhs.uk/webfiles/publications/ncmp/ncmp0809/Validation_Process_for_NCMP_data.pdf (Accessed 27/05/10)
3. Cole TJ, Freeman JV, Preece MA. Body mass index reference curves for the UK, 1990. Archives of Disease in Childhood 1995;73:25-9.
4. Altman DG, Machin D, Bryant TN, Gardner MJ. Statistics with Confidence, 2nd edition. London: BMJ Books. 2000.
5. The NHS Information Centre for health and social care. Health Survey for England 2008 Trends Tables. London: NHS Information Centre. December 2009. http://www.ic.nhs.uk/webfiles/publications/HSE/HSE08trends/Health_Survey_for_england_trend_tables_2008.pdf (Accessed 27/05/10)
6. The NHS Information Centre for health and social care. National Child Measurement Programme: England, 2008/09 School Year. London: NHS Information Centre. December 2009. http://www.ic.nhs.uk/webfiles/publications/ncmp/ncmp0809/NCMP_England_2008_09_school_year_report_2.pdf (Accessed 27/05/10)
7. The NHS Information Centre for health and social care. National Child Measurement Programme 2007/08 School Year Headline Results. London: NHS Information Centre. December 2008. http://www.ic.nhs.uk/webfiles/publications/ncmp/ncmp0708/NCMP%202007-08%20Report.pdf (Accessed 27/05/10)
8. Rudolf M, Levine R, Feltbower R, Connor A, Robinson M. The TRENDS Project: development of a methodology to reliably monitor the obesity epidemic in childhood. Archives of Disease in Childhood 2006;91:309-911.
9. McCarthy HD, Ellis SM, Cole TJ. Central overweight and obesity in British youth aged 11-16 years: cross sectional surveys of waist circumference. BMJ 2003:326.
10. Procter KL, Rudolf MC, Feltbower RG, Levine R, Connor A, Robinson M, Clarke GP. Measuring the school impact on child obesity. Social Science and Medicine 2008 Jul;67(2):341-9.
11. National Obesity Observatory. National Child Measurement Programme: Detailed Analysis of the 2007/08 National Dataset. Oxford: National Obesity Observatory. April 2009. http://www.noo.org.uk/uploads/doc168_2_noo_NCMPreport1_110509.pdf (Accessed 27/05/10)
12. Stamatakis E, Zaninotto P, Falaschetti E, Mindell J, Head J. Time trends in childhood and adolescent obesity in England from 1995 to 2007 and projections of prevalence to 2015. Journal of Epidemiology and Community Health 2010;64:167-74.
13. Association of Public Health Observatories. World Class Commissioning Assurance, Framework Health Inequalities Indicator, Guide to Interpretation. London: Association of Public Health Observatories. September 2009. http://www.apho.org.uk/resource/item.aspx?RID=75477 (Accessed 27/05/10)
14. National Obesity Observatory. National Child Measurement Programme: Detailed Analysis of the 2006/07 National Dataset. Oxford: National Obesity Observatory. June 2008. http://www.noo.org.uk/uploads/doc/vid_5265_NOO%200607%20NCMP%20report_150210.pdf (Accessed 27/05/10)

9. Reader information

Title	National Child Measurement Programme: Changes in children's body mass index between 2006/07 and 2008/09
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Publication date	June 2010
Target audience	Analysts, policy makers, academics and obesity leads in Central Government, Primary Care Trusts, Strategic Health Authorities, Public Health Observatories, Local Authorities, and Government Office Regions
Description	This report provides a detailed analysis of the body mass index (BMI) measurements recorded for children as part of the NCMP in the 2006/07, 2007/08, and 2008/09 academic years. It examines the trend in children's BMI at population level, highlighting those changes that can be detected over this relatively short time period.
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