

Delivered by NOO on behalf of the Public Health Observatories in England

Published: March 2012

Contents

i. Abbreviations.....	4
ii. List of figures.....	5
iii. Key findings.....	6
iv. Summary of key findings.....	9
1. Introduction.....	10
2. The National Child Measurement Programme dataset.....	10
3. Methods.....	12
4. Changes in children’s body mass index at population level.....	13
5. Changes in health inequalities in child obesity.....	22
6. Changes in child obesity prevalence by ethnic group.....	29
7. Conclusions, limitations and discussion.....	35
8. References.....	38
9. Reader information.....	39

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
HSCIC	The Health and Social Care Information Centre
NOO	National Obesity Observatory
SDS	Standard deviation score
SII	Slope index of inequality
UK90	British 1990 growth reference

ii. List of figures

Figure number	Figure description	Page number
Figure 1a	Number of children measured by year of measurement, school year, and sex	11
Figure 1b	Level of participation by year of measurement and school year	11
Figure 2	Prevalence of obesity by year of measurement, school year, and sex	15
Figure 3	Mean BMI z score by year of measurement, school year, and sex	16
Figures 4a–d	Change in mean BMI z score since 1990, by twentile of BMI distribution, year of measurement, school year, and sex	18–19
Figures 4e–f	Annual change in mean BMI z score within twentiles of the BMI distribution by school year, and sex	21
Figures 5a–d	Prevalence of obesity by Index of Multiple Deprivation 2010 decile, year of measurement, school year, and sex	24–25
Figure 6	Change in the slope index of inequality for obesity and deprivation by year of measurement, school year, and sex	26
Figure 7	Annual change in obesity prevalence within deprivation deciles by school year and sex	28
Figures 8a–d	Prevalence of obesity by ethnic group, year of measurement, school year, and sex	31–34

iii. Key findings

This report presents analysis of data from the first five years of National Child Measurement Programme (NCMP) and describes the changes that have taken place across survey years in the body mass index (BMI) of children aged 4–5 and 10–11 years attending state maintained schools in England.

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 changes across the BMI distribution, by level of socioeconomic deprivation, and by ethnic group.

This report provides an update on the analysis presented by the National Obesity Observatory (NOO) in 2011.¹

Changes in prevalence of obesity

Between 2009/10 and 2010/11 obesity prevalence as measured by the NCMP decreased for both boys and girls in Reception. Analysis of all years of NCMP measurements suggests that the decrease among boys in Reception may represent part of a longer term trend. However, there is less evidence to suggest that the obesity prevalence among girls of this age is undergoing a sustained decrease.

Obesity prevalence among children in Year 6 rose between 2009/10 and 2010/11, and this also appears to be part of a longer term trend. The addition of a further year of good quality NCMP data into trend analysis seems to confirm that obesity prevalence is indeed rising for this age group.

Changes in mean BMI for age

Mean BMI decreased among children in Reception between 2009/10 and 2010/11, but there was no significant change among children in Year 6 over this time.

When all years of NCMP measurements are considered together, there is no evidence of a long term trend in Reception, but there has been a significant increase in mean BMI over time among children in Year 6.

Changes in the distribution of children's BMI

The decrease in BMI between 2009/10 and 2010/11 among children in Reception was spread across the whole sample. In Year 6, small increases for children with a high BMI since 2009/10 cancelled out small decreases for children with a low BMI and resulted in no overall change.

Between 2006/07 and 2010/11 the lack of change in mean BMI among children in Reception is due to small increases in BMI among children with a low BMI being balanced out by decreases among those children with a high BMI. In Year 6 the increases since 2007/08 are spread fairly evenly across the child population.

Changes in health inequalities

There was no consistent pattern of change in health inequalities between 2009/10 and 2010/11 for any of the age and sex groups covered by the NCMP. However, over the whole

time period covered by the NCMP the data show a trend of widening health inequalities for boys in Reception, and both boys and girls in Year 6.

Children in the Reception year living in the least deprived parts of England show a decrease in obesity prevalence, whereas there is very little change among children living in the most deprived areas. This pattern is seen for both boys and girls of this age, although the pattern is more pronounced for boys.

In Year 6 the widening of health inequalities results from obesity prevalence remaining constant or showing little change among children living in the least deprived parts of the country, but increasing among children living in the most deprived areas.

Changes in obesity prevalence by ethnic group

Between 2009/10 and 2010/11 there were limited changes in obesity prevalence by ethnic group and any such changes were mostly restricted to children classed as White British.

When all years of Reception year NCMP measurements are considered, the only population group where a significant trend over time can be detected is among boys of Indian ethnicity. Among this population group obesity prevalence has increased.

In Year 6 there is a significant trend of increasing obesity prevalence for girls classed as White British, Bangladeshi, and Any Other Asian background. When broader ethnic groupings are used, obesity prevalence seems to be increasing among all White and Asian girls of this age. A similar pattern seems to be emerging for boys although this is not quite statistically significant based on available data.

Important caveats

The surveillance approach used to collect NCMP data results in a sample of child measurements that cannot easily be controlled to ensure it is consistent and representative. Factors such as levels of participation and changes in data quality have previously been demonstrated to have an effect on statistics such as the reported obesity prevalence at national level. It is therefore very important to exercise caution when interpreting any findings based on NCMP data.

Between 2006/07 and 2007/08 there were substantial changes in levels of NCMP participation and data quality, which have been shown to affect the reported prevalence of obesity for children in Year 6. To avoid bias when interpreting the trend over time for children in Year 6 the 2006/07 data have been excluded from the analysis. In addition the 2006/07 data have not been used when assessing the trend by ethnic group, due to the low levels of completeness of ethnicity coding in that year.

Conclusions

The changes in child obesity observed between 2009/10 and 2010/11 seem to better reflect the long term trend than those observed between 2008/09 and 2009/10, when obesity prevalence increased in both school years.

Although the addition of the 2010/11 data suggests that obesity prevalence is not universally increasing for children in the age groups measured by the NCMP, the findings are mixed. The trend in children's BMI within some sections of the child population appears to be moving in a 'healthy' direction, but for others there is evidence that obesity is still a growing problem.

At population level, both the decreases in obesity prevalence and the changes in the distribution of BMI among children in Reception can be considered to be a 'healthy' change. However, obesity prevalence has decreased most among the least deprived children and has shown little change among the most deprived. Furthermore, there is some evidence that obesity prevalence might still be increasing among some sections of the child population in this age group – as shown by the trend of rising obesity prevalence for Indian boys in Reception.

For children in Year 6 the trend in obesity prevalence, mean BMI, and the distribution of BMI since 2007/08 suggests movement in an 'unhealthy' direction – i.e. the risk of future obesity related ill health among children this age has increased over this time. Again these changes are not distributed evenly across sociodemographic groups. The rate of increase in obesity prevalence is greater in more deprived areas. Although there is less evidence for differences by ethnic group, the data do suggest that the rate of increase in obesity prevalence among children in Year 6 from Asian ethnic groups, especially girls, might be greater than that for the population as a whole.

iv. Summary of key findings

	Reception		Year 6	
	Boys	Girls	Boys	Girls
Changes in prevalence of obesity	Significant decrease since 2009/10, and some evidence of a downward trend over the period covered by the NCMP.	Significant decrease since 2009/10, but over the period covered by the NCMP there is no statistically significant trend.	Significant increase since 2009/10 and a significant upwards trend between 2007/08 and 2010/11.	
Changes in mean BMI for age	Significant decrease since 2009/10, but over the period covered by the NCMP there is no statistically significant trend.		No significant change since 2009/10, but a statistically significant trend of increasing mean BMI between 2007/08 and 2010/11.	
Changes in BMI distribution	The decrease in mean BMI since 2009/10 was spread evenly across the population. Over the period covered by the NCMP, mean BMI has increased among children with a low BMI but decreased among the most obese, resulting in no change at population level.		Since 2009/10 mean BMI increased among the most obese children but decreased among those with the lowest BMI, resulting in no change at population level. The increases in mean BMI since 2007/08 are spread evenly across the population.	
Changes in health inequalities	No significant change since 2009/10, but over the period covered by the NCMP, health inequalities appear to be widening. Obesity prevalence seems to be decreasing in the least deprived areas, but remaining constant in the most deprived areas. This pattern is more pronounced among boys than girls.		Between 2007/08 and 2010/11 health inequalities have widened. Obesity prevalence seems to be remaining constant in the least deprived areas, but increasing in the most deprived areas.	
Changes in obesity prevalence by ethnic group	Since 2009/10 obesity prevalence decreased among boys classed as White British. Only boys from the Indian ethnic group show a significant trend over the period 2007/08 to 2010/11; obesity prevalence appears to have increased for this ethnic group.	Since 2009/10 obesity prevalence decreased among girls classed as White British. There is no robust evidence of a significant trend for any specific ethnic group between 2007/08 and 2010/11.	Since 2009/10 obesity prevalence increased among boys classed as Any Other White Background. There is no robust evidence of differences between ethnic groups in the trend between 2007/08 and 2010/11.	Since 2009/10 obesity prevalence increased among girls classed as White British. Girls from the White British, Bangladeshi, and Any Other Asian ethnic groups show a significant trend of increasing obesity prevalence between 2007/08 and 2010/11.

1. Introduction

The National Child Measurement Programme (NCMP) is an annual programme that measures the height and weight of children aged 4–5 years (Reception) and 10–11 years (Year 6) in England. The 2010/11 NCMP was the fifth year of this system of national child measurement.^a

This report is the third in a series of annual reports from the National Obesity Observatory (NOO) which use NCMP data to examine the changes in children's body mass index that have taken place since 2006/07. The first of these reports looked at changes between 2006/07 and 2008/09, and was the first in-depth investigation into trends in the NCMP data.² In order to support the most effective possible action to tackle obesity it is important to continue to monitor these trends. This is the most recent update of this analysis.

This report uses the same approaches as previous NOO reports. It examines changes in obesity prevalence, mean BMI, and the distribution of BMI by age and sex, as well as looking at how obesity prevalence varies in different socioeconomic and ethnic groups.

2. The National Child Measurement Programme dataset

The 2010/11 NCMP dataset contains the largest number of child measurements collected to date by the programme, with a total of 1,036,608 measurements of children from state maintained schools. Overall participation in the NCMP was 92.6% in 2010/11, the highest ever achieved. Figure 1a shows the number of children measured by the NCMP by year of measurement, school year, and sex. Figure 1b shows the increases in participation in the NCMP for each year of measurement by school year.

In Reception, both the number of children measured and participation have risen for each year of measurement. In Year 6, more children were measured in 2009/10 than in 2010/11, the first time a year on year decrease has been observed, but due to annual variation in the number children eligible for measurement, this still represents a small increase in overall participation from 92.9% to 93.4%.

^a In 2005/06 the National Child Obesity Database collected child measurements of school children in England, but the data from this programme are not detailed enough, nor of high enough quality, to be used to monitor trends over time.

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

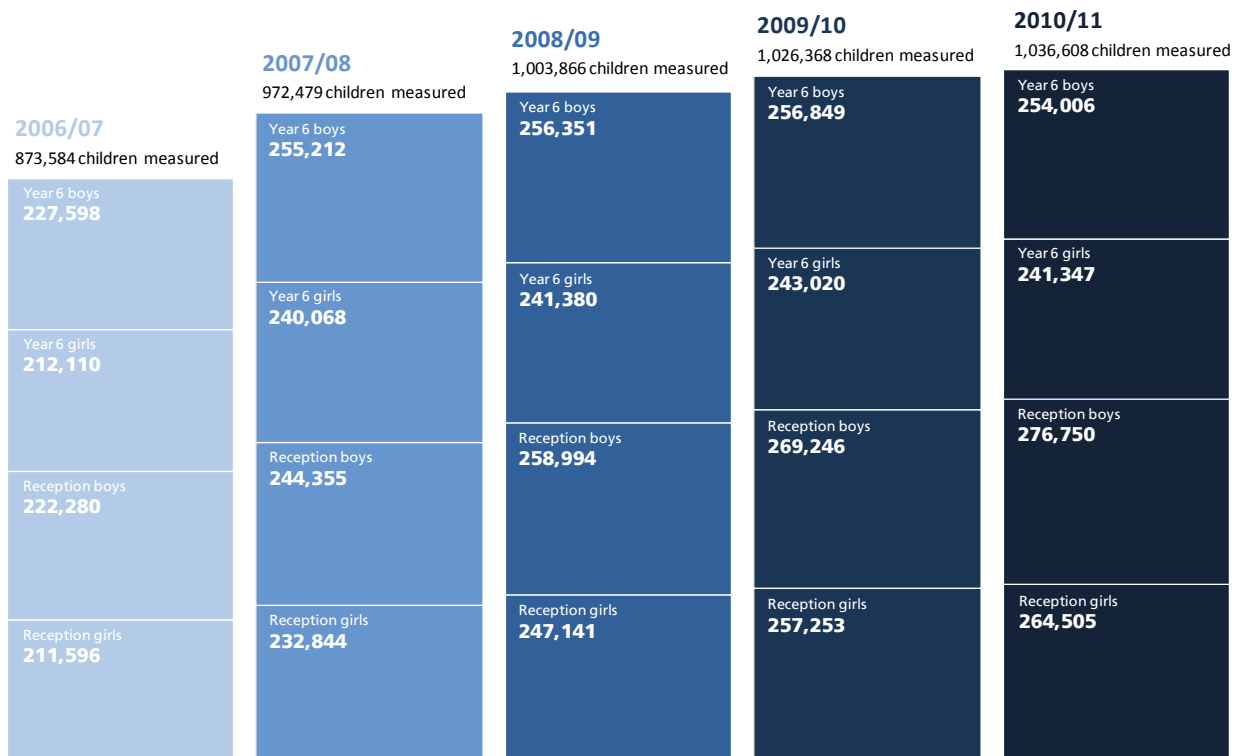
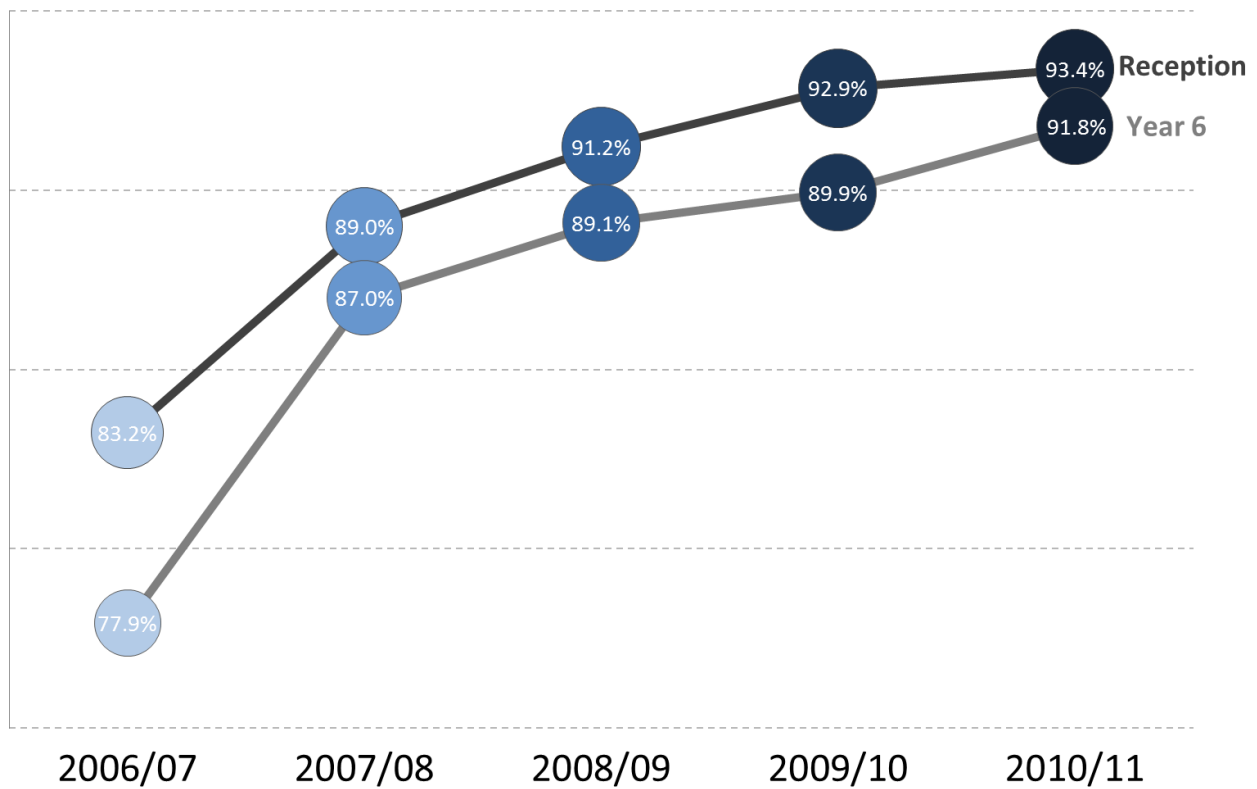


Figure 1b: Level of participation by year of measurement and school year



3. Methods

This report is based on the NCMP datasets for the five years 2006/07, 2007/08, 2008/09, 2009/10, and 2010/11.

Only data for pupils attending state-maintained schools have been included in the analysis. Only a very small proportion of independent and special schools are covered in the NCMP datasets and therefore for consistency over time and between areas, these records have been excluded from the analysis for this and previous reports.

The number of valid records remaining after data cleaning by the Health and Social Care Information Centre (HSCIC) for the five years of measurement is shown in Figure 1a, 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)³ BMI distribution have been classified as obese. This definition is the most commonly used for child obesity prevalence figures in England, and is consistent with that used in the Health Survey for England (HSE) and NCMP reports published by the HSCIC.

Where appropriate, trends over time have been analysed using un-weighted linear regression. The data from each year of NCMP measurements have not been weighted by the number of children measured as this variable does not vary substantially in relative terms, with the exception of 2006/07. The increase in participation between 2006/07 and later years may have had a disproportionately large effect on reported trends, especially in Year 6. As a result most trend analysis for Year 6 has been presented both including and excluding the 2006/07 data. Due to the low levels of completeness of ethnicity coding in 2006/07 all trend analysis based on ethnicity has been conducted with data from 2007/08 to 2010/11 only.

Any differences reported between population groups or between 2009/10 and 2010/11 have been found to be statistically significant at a 95% significance level using the techniques recommended by Altman et al.⁴ It is important to note that a statistically significant difference may exist between two values, even where 95% confidence limits appear to overlap on the charts shown.

The trend analysis within this report is based on only four or five datapoints, which limits the potential to detect statistically significant differences over time. Therefore, where such analysis is presented, some differences over time have been identified despite not being strictly significant at the 95% significance level. P-values have been provided for all trend analysis to show the probability that the apparent trend has occurred by chance.

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

4. Changes in children's BMI at population level

- Since 2009/10, obesity prevalence has decreased among both boys and girls in Reception, but increased among children in Year 6.
- Across all years of NCMP measurements there is some evidence that the trend in obesity prevalence shows a decrease for boys in Reception. There is no strong evidence for any consistent trend among girls in Reception.
- Over the same time period the trend in obesity prevalence for both boys and girls in Year 6 shows an increase over time. This persists when data from 2006/07 are excluded due to low levels of participation and poor data quality in that year.
- The mean BMI of children in Reception was lower in 2010/11 than in 2009/10, but shows no consistent trend over all years of NCMP measurements. However, the lack of apparent change in mean BMI for this age group over the longer term appears to be due to decreases in BMI at the top end of the BMI distribution being balanced out by increases for children with low BMI.
- There was no significant change in mean BMI among children in Year 6 between 2009/10 and 2010/11. However, between these years there were small increases in BMI at the top end of the BMI distribution, and decreases at the bottom end for both boys and girls. These changes balance out to show no change for the Year 6 age group as a whole.
- Over all years of NCMP measurements the mean BMI of children in Year 6 has shown a significant increase, spread evenly throughout the BMI distribution.

4.1 Change in obesity prevalence

Changes since 2009/10

As the HSCIC's annual report on the 2010/11 NCMP showed,⁵ the prevalence of obesity fell slightly for all children in Reception between 2009/10 and 2010/11, but increased slightly for all children in Year 6.

This report provides further detail on these changes, examining the trend over time by sex as well as by age group (Figure 2). This confirms that the changes seen for all children between 2009/10 and 2010 /11 remain statistically significant when split by sex.

Prevalence of obesity for all children in Reception fell by 0.39% (95% confidence limits of -0.50% to -0.28%). There was no difference between boys and girls in the size of the observed decrease; obesity prevalence for boys fell by 0.37% (-0.53% to -0.21%), compared to a fall of 0.42% for girls (-0.57% to -0.26%).

In Year 6 the overall increase since 2009/10 was 0.30% (0.14% to 0.45%). Although the reported increase was larger for girls of this age, there was again no statistically significant difference in the increase by sex; obesity prevalence for boys increased by 0.23% (0.01% to 0.46%), compared to 0.37% for girls (0.16% to 0.58%).

Trend over all years of NCMP measurements

Assessed over all five years of NCMP measurements two different trends in obesity prevalence appear to be emerging, which are broadly in line with the changes observed between 2009/10 and 2010/11. In the Reception year obesity prevalence may be decreasing among boys, although for girls there is no strong evidence of any change. In Year 6 the data show a

pattern of increasing obesity prevalence over the period covered by the NCMP for both boys and girls.

In the Reception year as whole, obesity prevalence has decreased at a rate of around 0.07% per year over the period covered by the NCMP, but this finding is not statistically significant ($p=0.285$, 95% confidence limits of -0.23% to 0.10%).

Boys in Reception show a more consistent pattern of decreases in obesity prevalence than girls; the reported obesity prevalence has fallen in each year of measurement, with the exception of 2009/10. Across the five years of NCMP obesity prevalence appears to have fallen by around 0.11% per year, and although this trend is not significant at a 95% confidence level ($p=0.105$, -0.27% to 0.04%) it is unlikely to have arisen by chance.

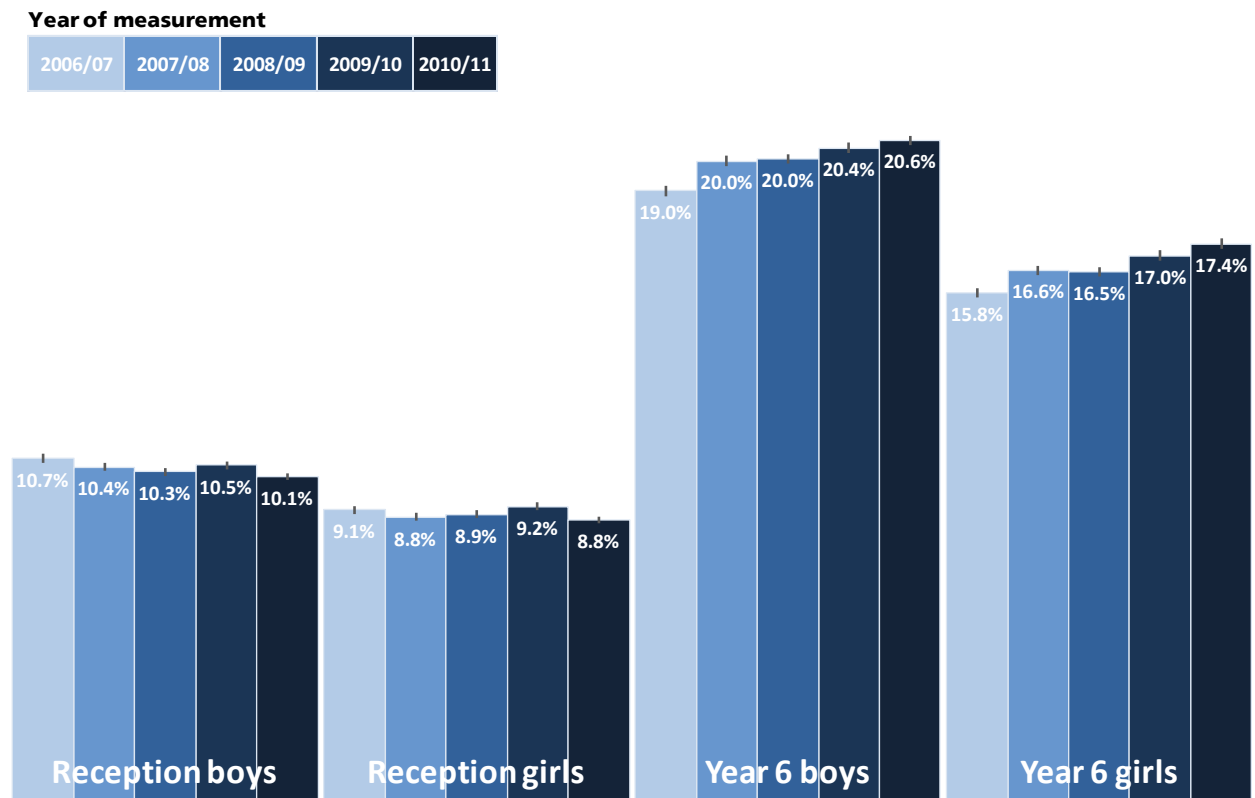
Changes in obesity prevalence among girls in Reception over the period covered by the NCMP do not show a significant trend ($p=0.659$, -0.22% to 0.16%).

In Year 6 the pattern is much more clear-cut. Overall obesity prevalence for children of this age shows a statistically significant increase of 0.35% per year over the period covered by the NCMP ($p=0.012$, 0.15% to 0.56%), and the rate of increase has been very similar for both boys at 0.36% ($p=0.019$, 0.11% to 0.60%) and girls at 0.35% ($p=0.008$, 0.18% to 0.53%).

As described in previous reports, between 2006/07 and 2007/08 there was a significant increase in the reported obesity prevalence for children in Year 6, but the apparent rise may have resulted from the substantial change in both participation and data quality in the NCMP between those years.^{5,6}

If the 2006/07 data are excluded from analysis the trend in obesity prevalence for all Year 6 children still shows a statistically significant annual increase of 0.26% per year ($p=0.046$, 0.01% to 0.51%). Splitting the data by sex shows a statistically significant increase of 0.23% per year for boys ($p=0.023$, 0.08% to 0.38%) and an increase of 0.30% per year for girls which, although not quite significant at a 95% significance level, is unlikely to have arisen by chance ($p=0.066$, -0.05% to 0.65%).

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



4.2 Change in mean BMI for age

Mean BMI z score^b provides an alternative summary measure of BMI across the child population. Children’s BMI changes with age, and so use of the BMI z score rather than actual BMI values will adjust for any small differences in the age of children between years of NCMP measurements.

One advantage of examining the mean BMI of the child population, rather than only examining the prevalence of obesity, is that this measure takes account of the BMI of all children measured. It can therefore pick up changes in the BMI of children who are under the threshold for obesity. Figure 3 shows BMI z score by age and sex groups for all years of NCMP measurement.

Changes since 2009/10

Between 2009/10 and 2010/11 mean BMI decreased for both boys and girls in Reception. The mean BMI of boys decreased by 0.017 standard deviations (SDS) (95% confidence limits of -0.023 to -0.012) and for girls by 0.020 SDS (-0.026 to -0.015).

In Year 6 there was no statistically significant difference in mean BMI between 2009/10 and 2010/11 for either boys or girls.

^b BMI adjusted for age and sex, based on the BMI reference within the British 1990 growth reference

Trend over all years of NCMP measurements

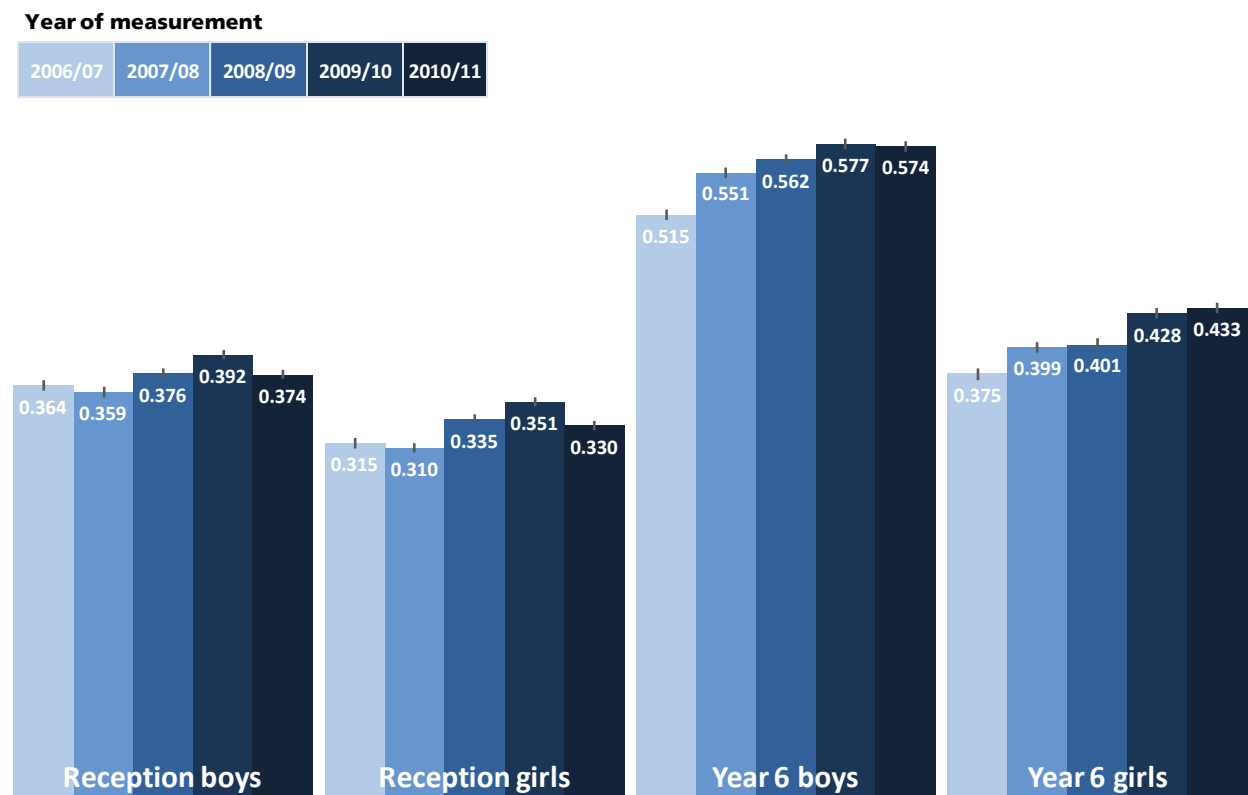
When assessed over all five years of NCMP measurements, mean BMI shows a different pattern of changes from those seen between 2009/10 and 2010/11. There is little evidence of a consistent trend in Reception, but Year 6 shows a significant increase over time.

Linear regression of the five years of BMI measurements shows a small, and non-significant increase of around 0.006 SDS per year for children in Reception ($p=0.206$, 95% confidence limits of -0.006 to 0.018). Analysis for boys and girls separately shows similar results.

In Year 6 the mean BMI of boys has shown an average increase of 0.014 SDS per year over the period covered by the NCMP ($p=0.033$, 0.002 to 0.267). For girls the change has been 0.015 SDS ($p=0.006$, 0.008 to 0.212). When the 2006/07 data are excluded from the analysis, the increase over time is not quite significant at the 95% confidence level, although this pattern is unlikely to have occurred by chance; 0.008 SDS per year for boys ($p=0.084$, -0.003 to 0.019) and 0.013 SDS per year for girls ($p=0.058$, -0.001 to 0.027).

If the observed trend in mean BMI among Year 6 children represents a real underlying change in the population, the rate of increase equates to a rise of over one BMI centile for this age group as a whole since 2007/08. Based on the results of the linear regression model, the mean BMI of girls in Year 6 was on the 64.9th centile of the UK90 BMI reference in 2007/08 compared to the 66.3rd centile in 2010/11, an increase of 1.4 centiles. The mean BMI of boys of this age increased from the 70.7th centile in 2007/08 to the 71.6th in 2010/11, an increase of 0.8 centiles.

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



4.3 Changes in child BMI distribution, analysed by twentile

It is possible to use NCMP data to examine how the observed changes in children's BMI are distributed across the population. To enable easier interpretation of changes in the distribution the data have been divided into twenty groups (twentiles) based on the child's BMI z score for each age group and sex. The first twentile contains the 5% of the child population with the lowest BMI for age, and the 20th twentile contains the 5% of the population with the highest BMI for age.

Figures 4a–d show the change in mean BMI z score across all years of NCMP measurements for each twentile of the population. The figures shown represent the difference from the mean BMI z score for that section of the BMI distribution within the UK90 reference population.

This analysis groups children with similar BMI z scores together so the standard deviation, and thus the standard error, around the estimates of mean BMI for each twentile is very small. Confidence limits are not shown on these charts as in most cases, they would not be visible. In addition, as even very small differences between years would be statistically significant, changes between 2009/10 and 2010/11 for each twentile have not been individually tested for significant differences. Instead the overall pattern of change has been described.

Changes since 2009/10

The reduction in mean BMI between 2009/10 and 2010/11 seen for Reception year as a whole appears to be spread evenly across the child population. All twentiles show decreases on a similar scale between 2009/10 and 2010/11 for both boys and girls.

A different pattern is seen however in Year 6, where the data show a decrease in BMI at the lower end of the BMI distribution and increases at the higher end. For boys there were small increases in BMI between 2009/10 and 2010/11 among the 30% of boys with the highest BMI for age (the top six twentiles), and decreases for the 70% of boys with the lowest BMI. For girls, decreases were observed among the 25% of the population with the lowest BMI, and increases among the 75% with the highest BMI.

This finding demonstrates that the lack of change in mean BMI across the whole Year 6 population between 2009/10 and 2010/11 hides an underlying pattern of increases in BMI among children with a high BMI, but decreases among children with the lowest risk of obesity related ill health.

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

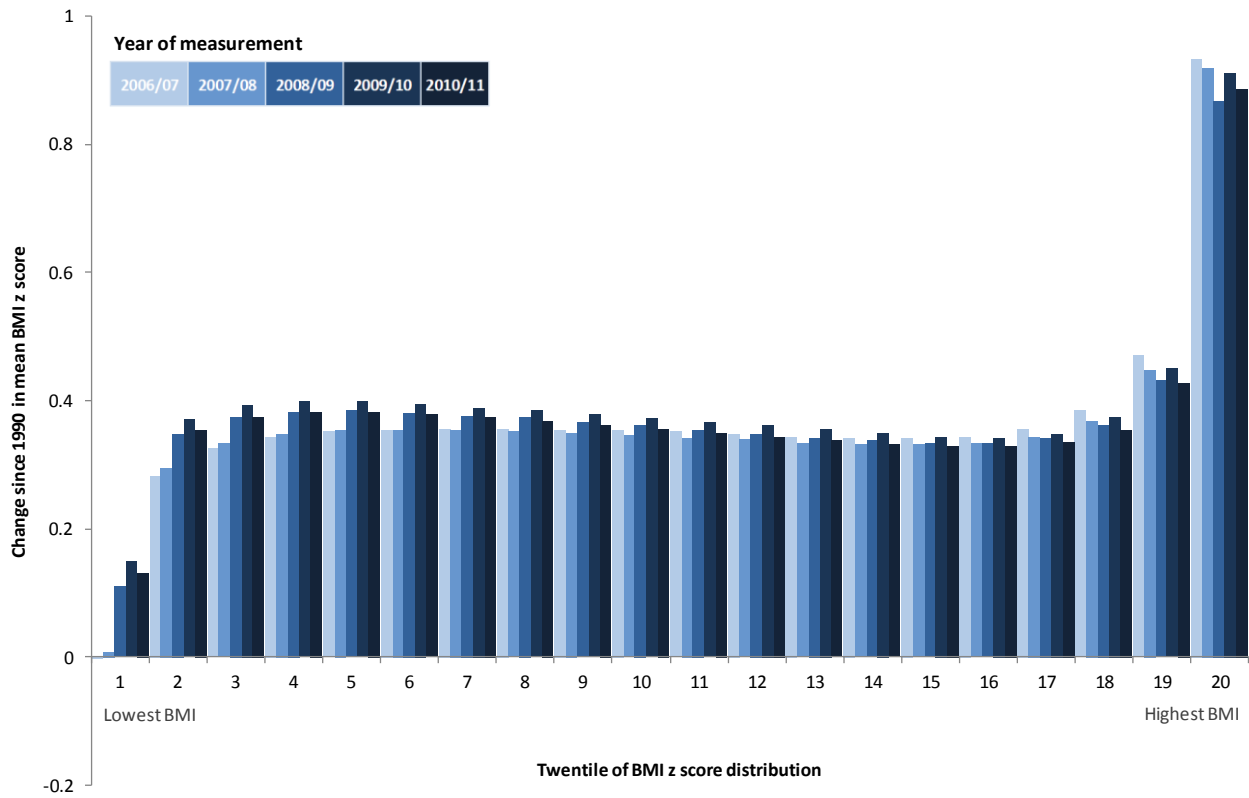


Figure 4b: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement; Reception, girls

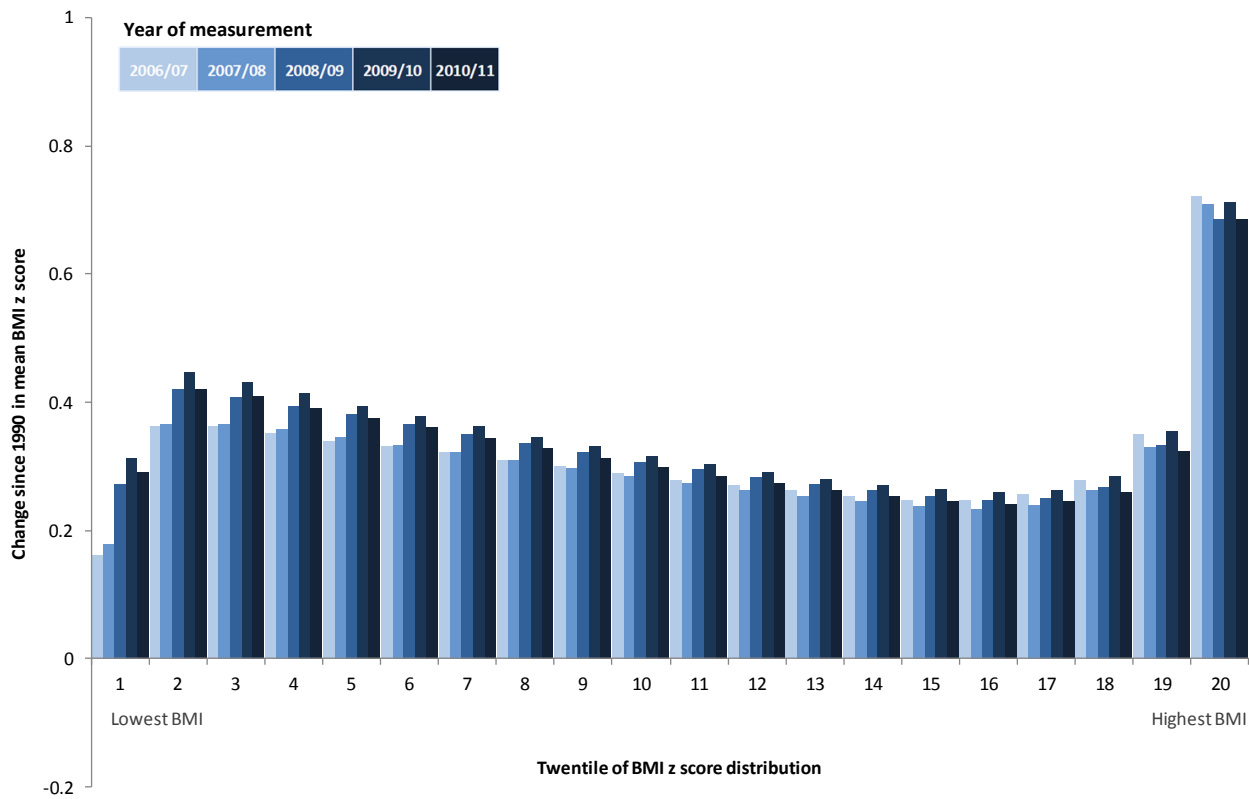


Figure 4c: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement; Year 6, boys

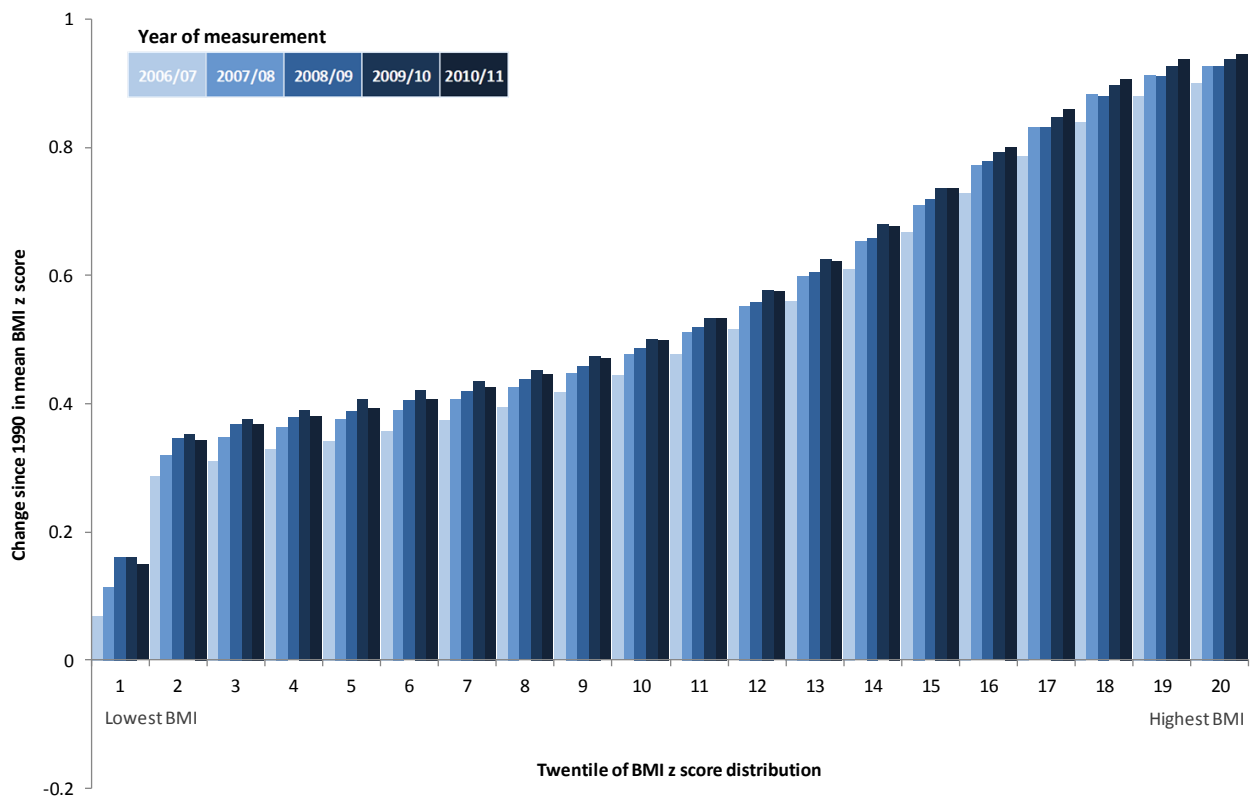
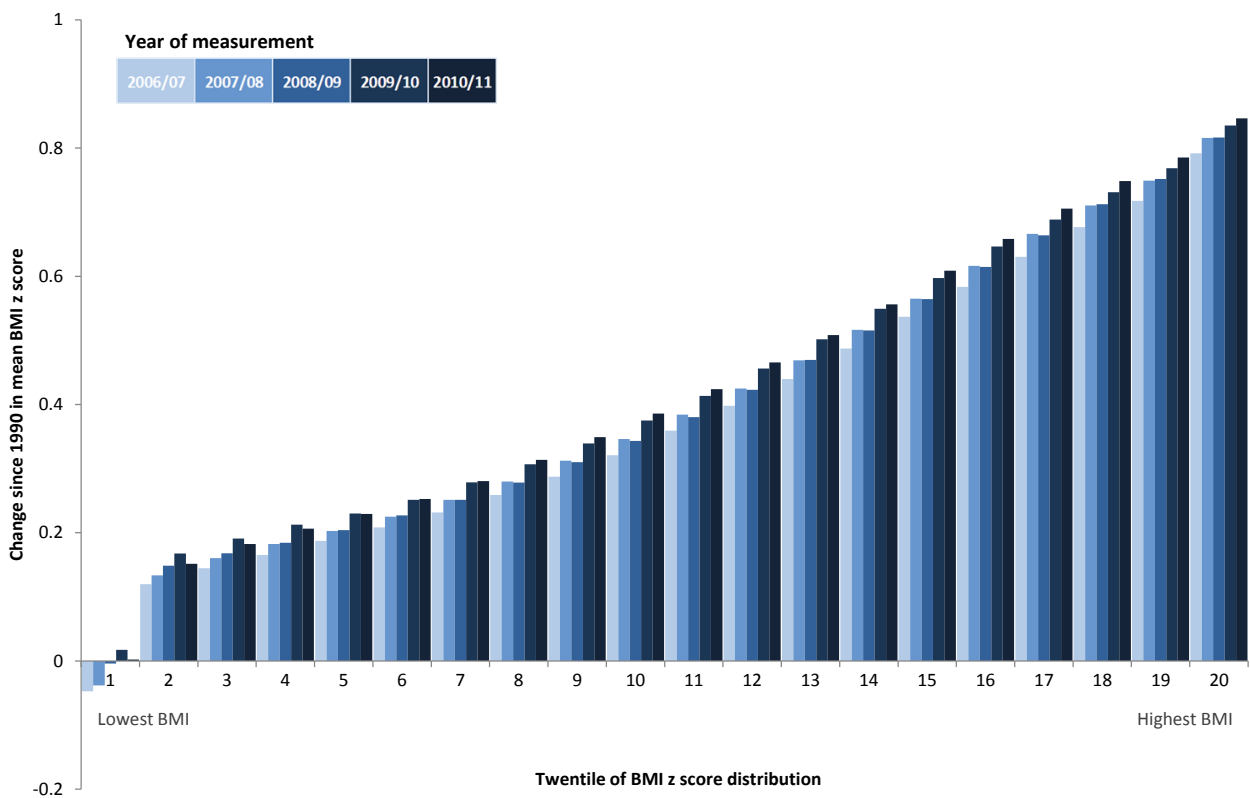


Figure 4d: Change in mean BMI z score since 1990, by twentile of BMI distribution and year of measurement; Year 6, girls



Trend over all years of NCMP measurements

Although Figures 4a–d show the mean BMI z score for each twentile of the BMI distribution for all five years of NCMP measurement, it is not easy to make an overall assessment of the trend over time with so many data points to examine. In order to detect any trend over time within each twentile group these data have been re-analysed using linear regression. Figures 4e and 4f show the estimated annual change in mean BMI z score for each twentile of the BMI distribution by age and sex with 95% confidence limits.

Analysis for Reception year has been based on all data from 2006/07 to 2010/11, but that for Year 6 uses data from 2007/08 onwards. In both cases the inclusion or exclusion of 2006/07 data makes very little difference to the actual pattern of change across the distribution. However, inclusion of the 2006/07 data substantially increases the magnitude of the reported change for children in Year 6. As this effect is likely to result from the improvements in NCMP participation and data quality between 2006/07 and 2007/08 for this age group, the 2006/07 data have not been included when producing the estimates for Year 6.

Assessed in this way, the trend across all five years of NCMP measurements, exhibits a slightly different pattern to that seen between 2009/10 and 2010/11.

As Figure 4e shows, the pattern across all twentiles of the BMI distribution in Reception takes the form of a slope, ranging from increases for children with the lowest BMI, to decreases among children with the highest BMI. Although most individual twentiles show no statistically significant trend over the five years of NCMP measurements at the 95% confidence level, the consistency of the overall pattern across all twentiles and both sexes does suggest this is not a chance occurrence. The 10% of boys and the 5% of girls with the lowest BMI for age do show a significant change over time using this approach, with a small increase in BMI among this section of the child population.

In Year 6 the pattern across the past four years of NCMP measurements is different (Figure 4f). Here the data suggest that the increases in mean BMI at population level since 2007/08 (as described in section 4.2), have been spread across the whole BMI distribution. However, as with the data for Reception, most individual twentiles show no statistically significant trend over the four years of NCMP measurements included in this analysis. The trend is statistically significant for the 15% of girls with the highest BMI for age. For boys, only twentiles 15, 16, and 17 (i.e. boys with a BMI that is higher than 70% of boys measured in this age group, but lower than 15% of boys), show a statistically significant increase over time.

Figure 4e: Annual change in mean BMI z score 2006/07 to 2010/11 (with 95% confidence limits) within twentiles of the BMI distribution by sex; Reception

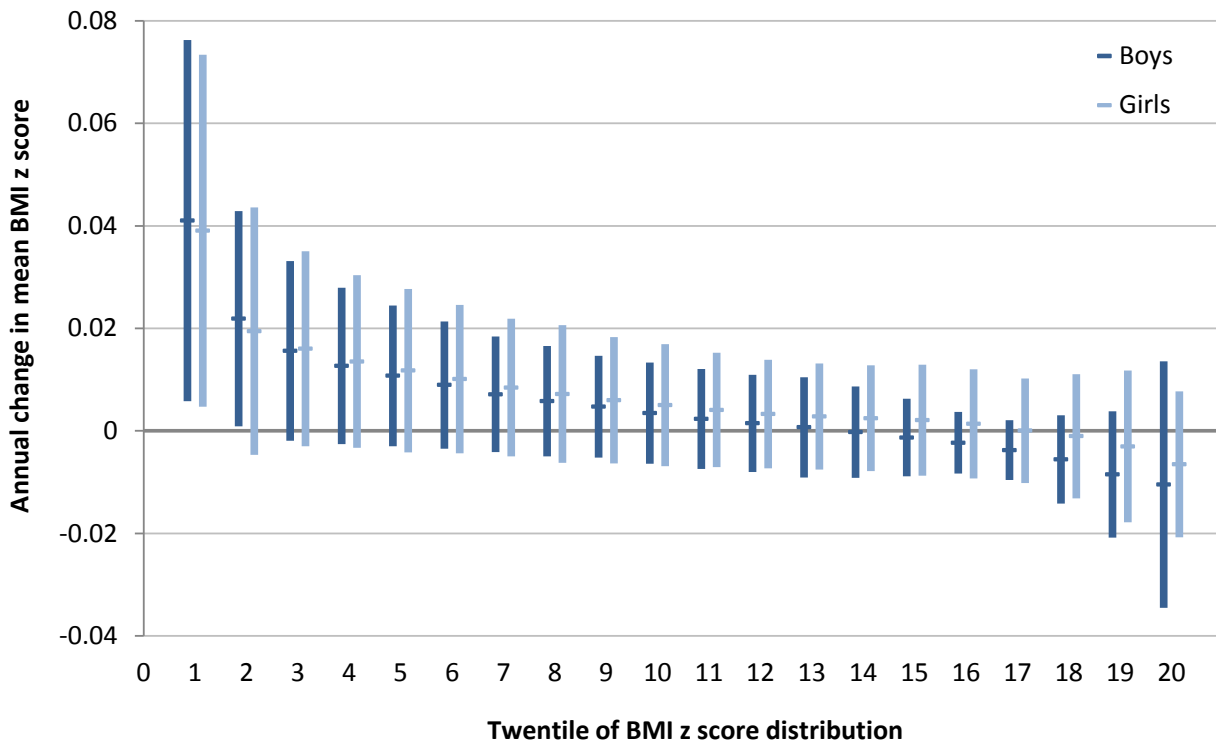
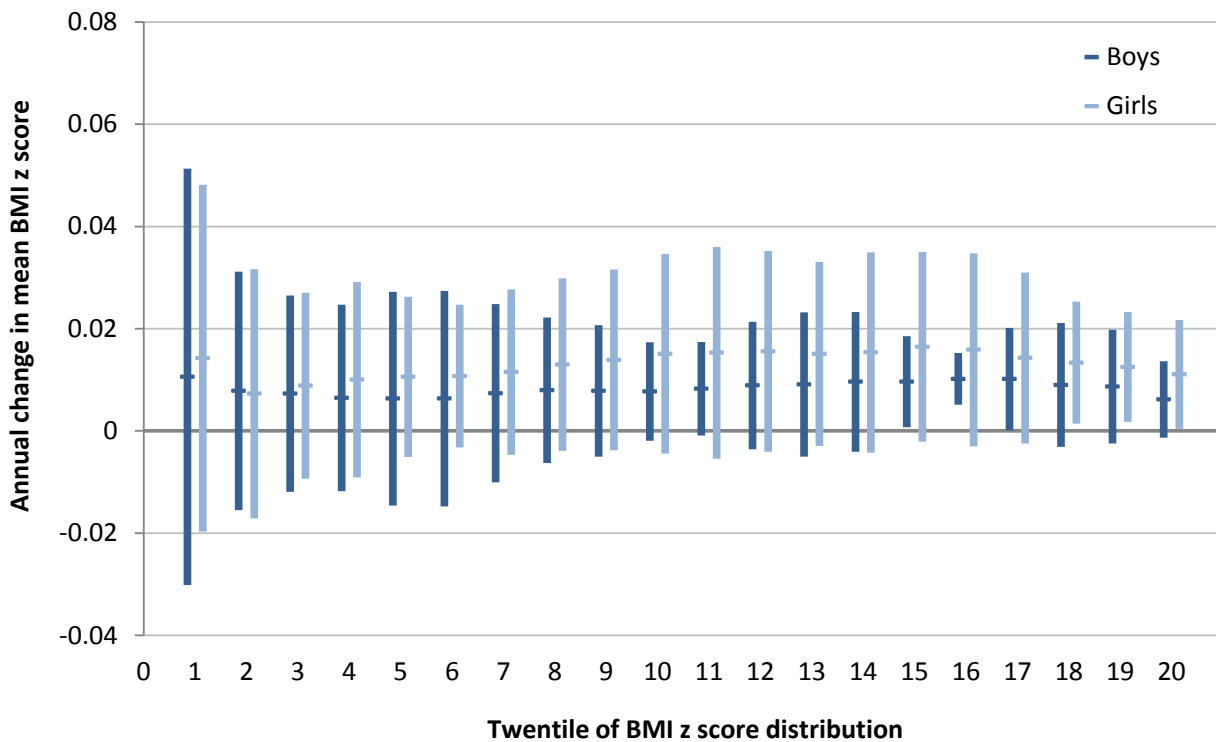


Figure 4f: Annual change in mean BMI z score 2007/08 to 2010/11 (with 95% confidence limits) within twentiles of the BMI distribution by sex; Year 6



5. Changes in health inequalities in child obesity

- Obesity prevalence is higher in more socioeconomically deprived areas compared to less deprived areas. However, there is no strong evidence of any change in these health inequalities between 2009/10 and 2010/11.
- Across all years of NCMP measurements, the gap in obesity prevalence between the most and least deprived areas appears to be widening among boys in Reception, and among both boys and girls in Year 6.
- In Reception, obesity prevalence appears to be decreasing among the least deprived children, but remaining relatively constant among those living in the most deprived areas. This pattern is more pronounced for boys than girls, but does seem to affect both sexes.
- In Year 6, obesity prevalence appears to be increasing among children from the most deprived areas while remaining relatively constant among the least deprived sections of the population.

5.1 Obesity prevalence and deprivation

Child obesity prevalence shows a close association with socioeconomic deprivation. Obesity prevalence among children living in the most deprived 10% of areas around the country is nearly twice that for children living in the least deprived 10% of areas, and increases in a near linear fashion between these extremes.

In order to assess how obesity prevalence has changed across socioeconomic groups, the child population has been divided into ten deciles based on the Index of Multiple Deprivation (IMD) 2010 for each child's place of residence. In this analysis decile one contains the most deprived 10% of the child population, and decile ten contains the least deprived 10%.

Only children with valid geographical coding have been included in this analysis. The proportion of records with such coding has increased over the five years of the NCMP. In 2006/07 around 57% of child records included valid coding for place of residence, increasing to 95% in 2007/08, and over 99% in 2008/09 and later years. However, the process of analysing any changes in health inequalities using national deciles of deprivation should reduce the potential impact of this increase over time.

Figures 5a–d show the association between obesity prevalence and deprivation by year of NCMP measurement.

Changes since 2009/10

In Reception, the decrease in obesity prevalence observed at national level between 2009/10 and 2010/11 has affected all deciles of deprivation relatively evenly. There were statistically significant decreases in obesity prevalence for deciles 3, 6, 7, and 10 for boys and 3, 4, 8, and 9 for girls, but the overall pattern is one of similar decreases across the child population of Reception age, regardless of socioeconomic status.

In Year 6, no individual deprivation deciles showed a statistically significant change in obesity prevalence between 2009/10 and 2010/11, but when the changes are assessed across all deciles, there is a weak pattern of larger increases in obesity prevalence among the more deprived sections of the child population.

Trend over all years of NCMP measurement

It is difficult to quantify or to test the robustness of any trend in health inequalities over time by visual examination of figures 5a–d. Therefore, two different techniques have been employed to examine these patterns more closely. The slope index of inequality (SII) is used to detect changes in the gradient of the lines of best fit, i.e. changes over time in the size of the 'inequality gap' between rich and poor. Regression analysis of the trend in obesity prevalence within deciles of deprivation is used to examine the nature of these changes. The results of these analyses are described in the following sections.

Figure 5a: Prevalence of obesity (with 95% confidence limits) by IMD 2010 decile and year of measurement: Reception, boys

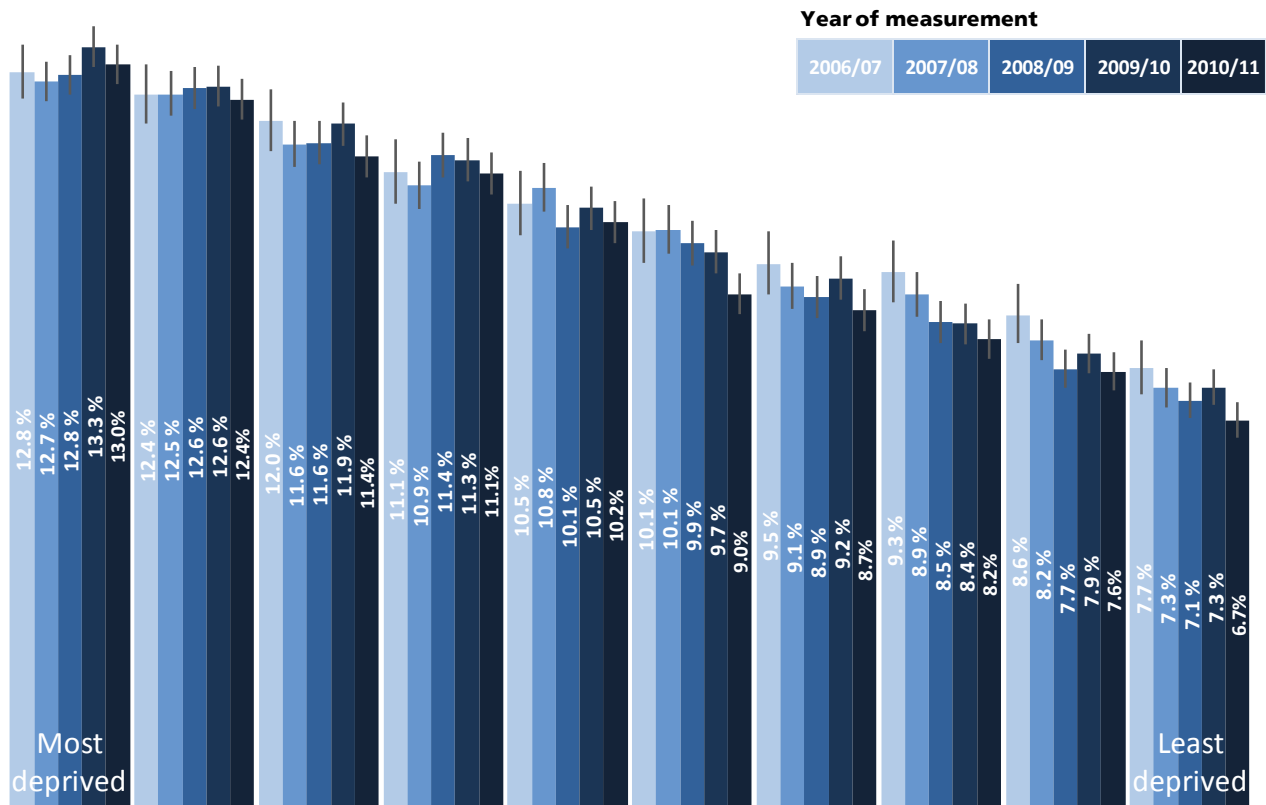


Figure 5b: Prevalence of obesity (with 95% confidence limits) by IMD 2010 decile and year of measurement: Reception, girls

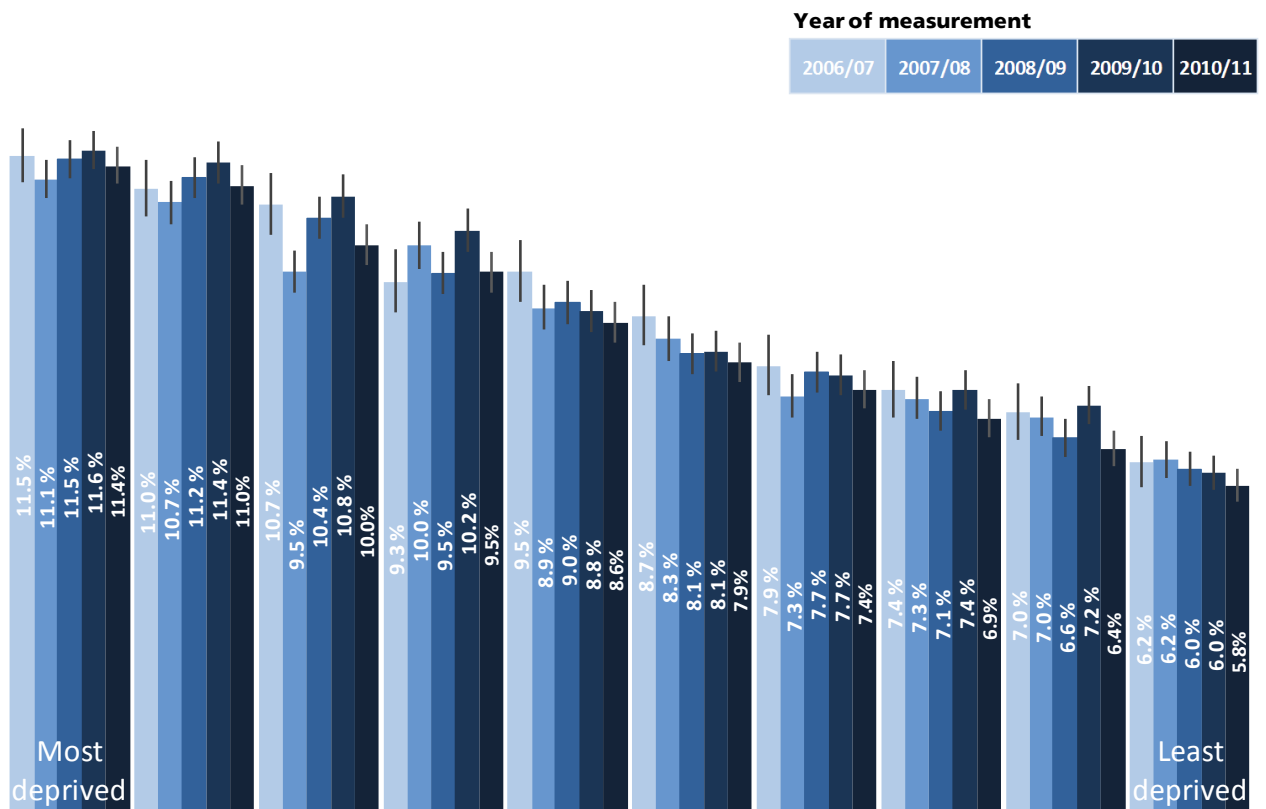


Figure 5c: Prevalence of obesity (with 95% confidence limits) by IMD 2010 decile and year of measurement: Year 6, boys

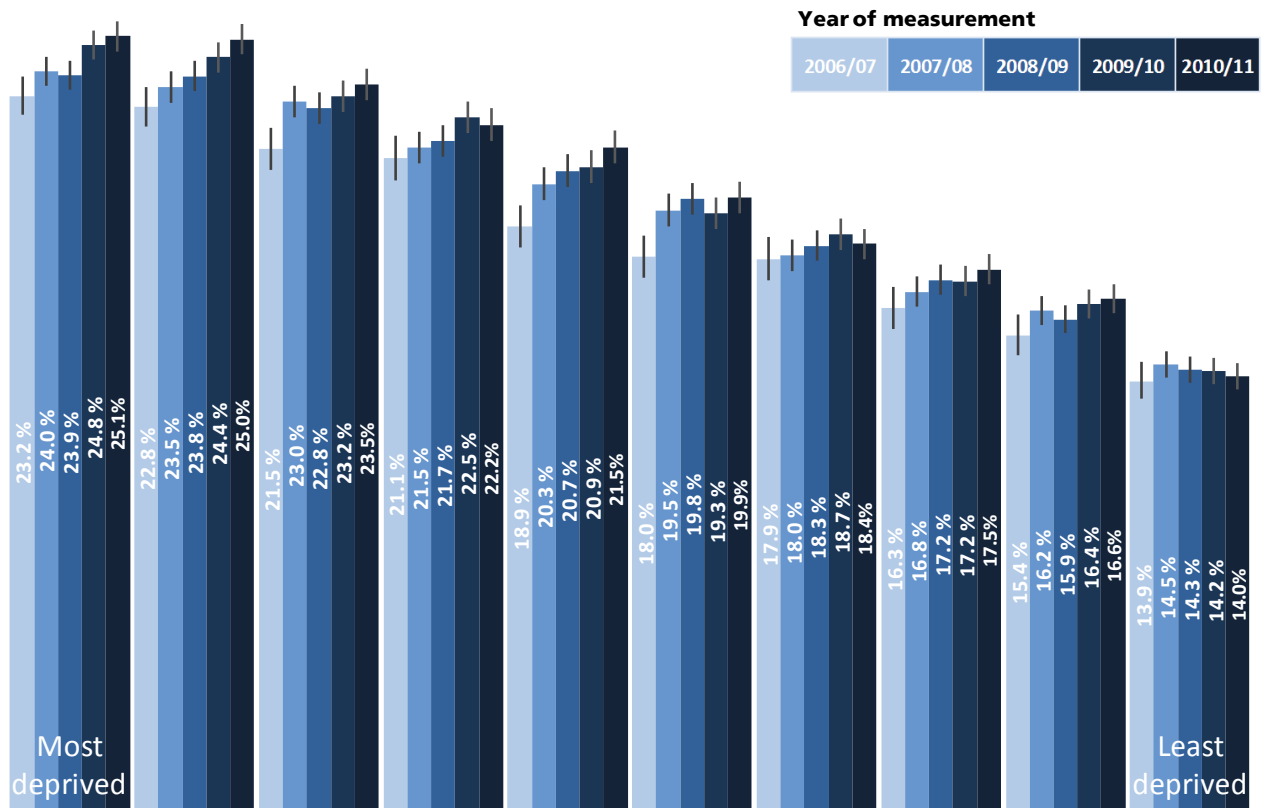
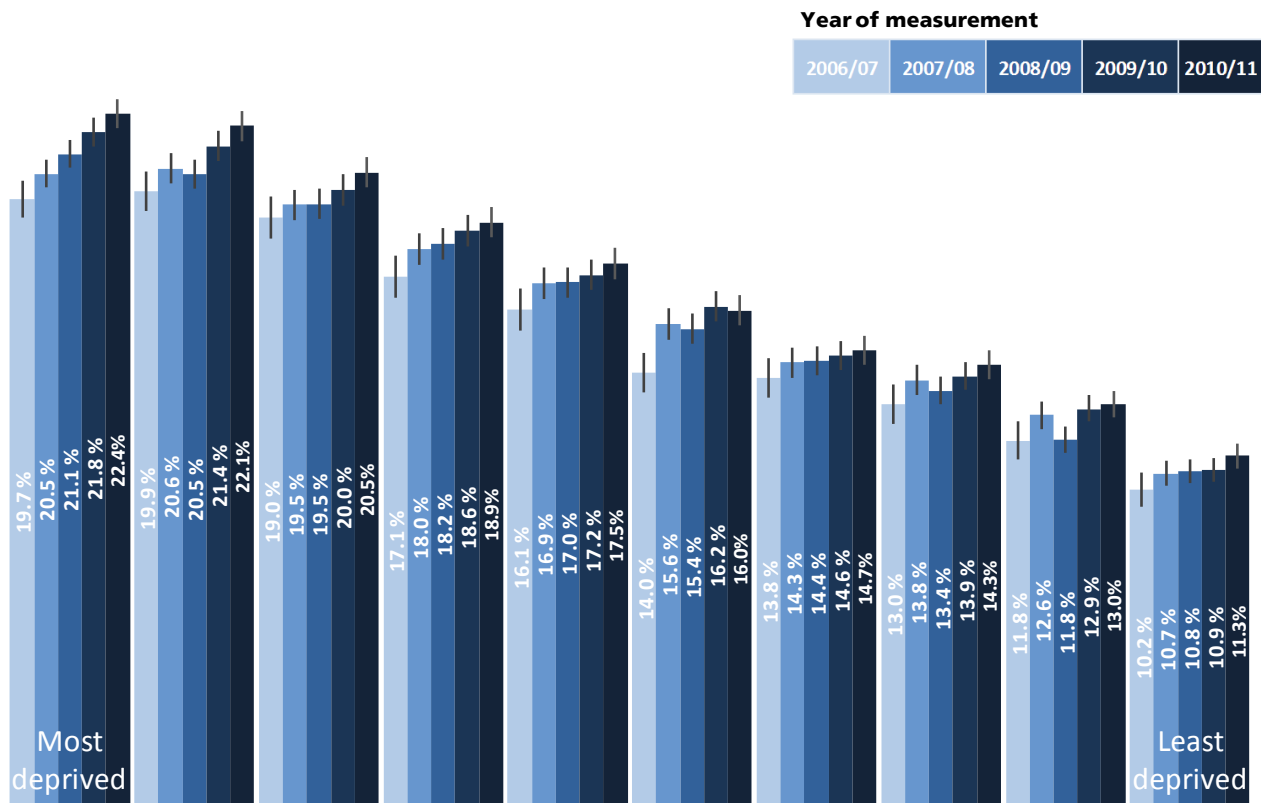


Figure 5d: Prevalence of obesity (with 95% confidence limits) by IMD 2010 decile and year of measurement: Year 6, girls



5.2 Changes in the slope index of inequality

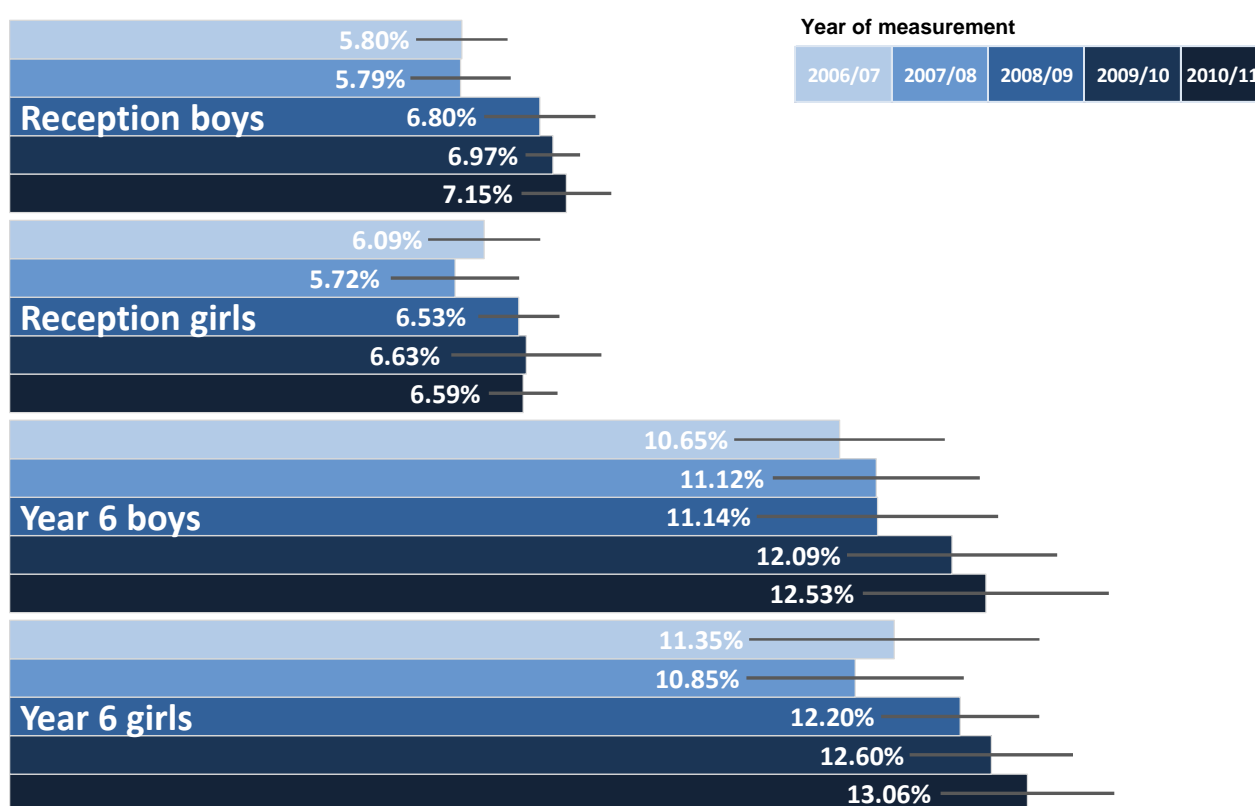
The slope index of inequality (SII) estimates the size of the difference in obesity prevalence between the most and least deprived children in England.⁷ This measure shows that the absolute difference in child obesity prevalence between the most and least deprived areas of England was around 7% in Reception and 13% in Year 6 in 2010/11 (Figure 6).

There are limited statistically significant differences between the SII for individual years, and the SII for 2010/11 is not significantly different from that for 2009/10 for any of the age and sex groups covered by the NCMP. However, when assessed across all years of the NCMP, significant changes in the SII can be detected.

Linear regression of the SII across the five years of NCMP measurements suggests that health inequalities for boys in Reception have increased at a rate of 0.39% per year ($p=0.021$, 95% confidence limits 0.11% to 0.49%). There was no statistically significant trend for girls in Reception over this time.

Over the same time period, the SII increased by 0.47% per year ($p=0.008$, 0.23% to 0.71%) for boys in Year 6 and by 0.52% for girls ($p=0.035$, 0.07% to 0.97%) of this age. If the 2006/07 data are excluded from this analysis, the annual increase for boys is 0.70% ($p=0.030$, 0.17% to 1.22%) but for girls, the increase in the SII over the period 2007/08 to 2010/11 (0.43% per year) was not significant at the 95% significance level ($p=0.110$, -0.243 to 1.11%).

Figure 6: Change in the slope index of inequality for obesity and deprivation (with 95% confidence limits) by year of measurement, school year, and sex



5.3 Changes in obesity prevalence within deprivation deciles

The SII assesses the pattern of obesity prevalence *across* deprivation deciles, but cannot provide information on the nature of this change. To examine this, the trend over time in obesity prevalence *within* deprivation deciles has also been assessed using linear regression (Figures 7a–b).

As with the analysis presented in Figures 4e and 4f, this analysis uses data from 2006/07 to 2010/11 for the Reception year but only data from 2007/08 onwards for Year 6. Again, the pattern of change is very similar regardless of whether the 2006/07 data are included or excluded, but the magnitude of change in Year 6 is larger when the 2006/07 data are used.

Although the 95% confidence limits are large around the individual data points, the overall pattern is consistent across all age and sex groups – exhibiting a downwards linear slope from more deprived to less deprived areas.

In Reception, obesity prevalence appears to be decreasing by around 0.1% to 0.2% per year in the least deprived areas but remaining constant in the most deprived areas. In Year 6, obesity prevalence appears to be increasing at a rate of around 0.5% per year in the most deprived areas, whilst remaining relatively stable in the least deprived areas.

Interestingly, this analysis suggests that obesity prevalence among the least deprived 10% of boys seems to have decreased by around -0.12% per year ($p=0.019$, 95% confidence limits of -0.20% to -0.05%). This is noteworthy as this is the only section of the population of boys in Year 6 where there is evidence of a statistically significant and sustained decrease in obesity prevalence.

Figure 7a: Annual change in obesity prevalence 2006/07 to 2010/11 (with 95% confidence limits) within deprivation deciles by sex; Reception

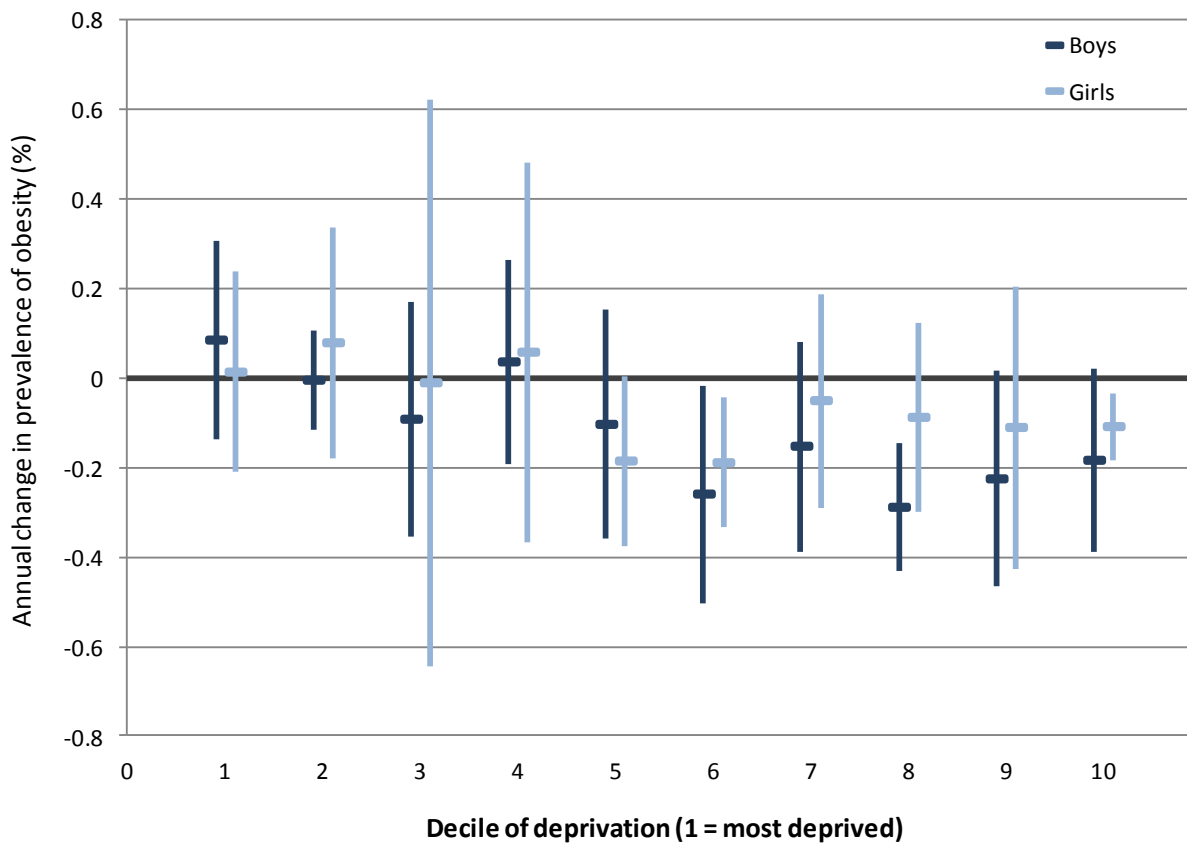
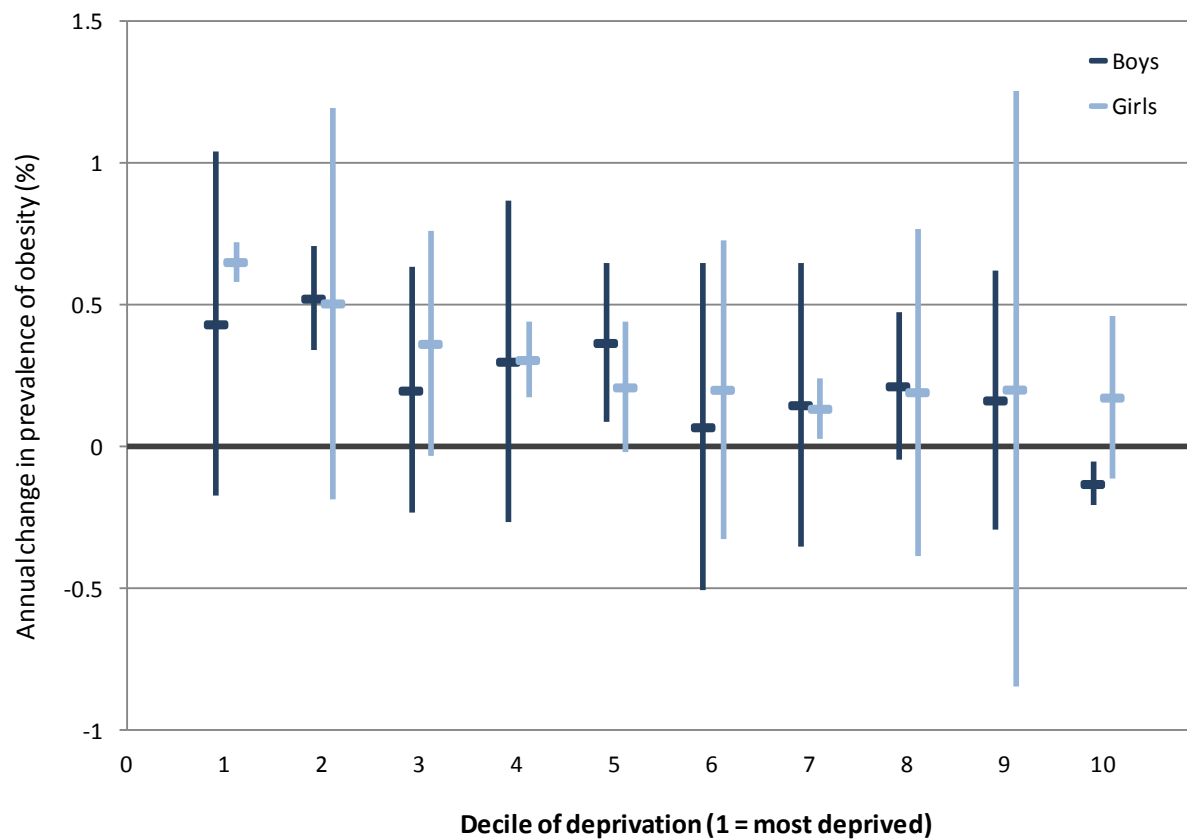


Figure 7b: Annual change in obesity prevalence 2007/08 to 2010/11 (with 95% confidence limits) within deprivation deciles by sex; Year 6



6. Changes in child obesity prevalence by ethnic group

- Most ethnic groups show no statistically significant change in obesity prevalence between 2009/10 and 2010/11. This suggests that the changes in obesity prevalence observed at national level over this time are likely to have been experienced by all ethnic groups.
- The same is seen over all years covered by the NCMP, with few ethnic groups showing a consistent pattern of changes over time. Children classed as White British in Year 6 have shown a statistically significant trend of increasing obesity prevalence since 2007/08, as have girls within the Bangladeshi and 'Any Other Asian' ethnic groups.
- Boys in Reception classed as Indian have also shown a significant trend of increasing obesity prevalence since 2007/08 – which contrasts with the decrease observed for this age and sex group as a whole.
- When the NCMP data are split by ethnic group, the year on year variation around these estimates is too large for consistent trends to be easily detected. However, when grouped into broad ethnic groups a significant increase over time can be seen for all girls in Year 6 within the 'White' and 'Asian' ethnic groups.

Previous analysis, using both NCMP and HSE data, has shown that child obesity prevalence varies substantially between ethnic groups. In general, such analysis shows that children classed as White British have lower obesity prevalence than most other ethnic groups.

Figures 8a–d show the prevalence of obesity by ethnic group across all years of NCMP measurement, split by school year and sex.

It is important to note that the number of records with valid ethnicity coding has increased over the five years of the NCMP. In 2006/07 only 32% of child records were provided with a valid ethnic code. This increased to 67% in 2007/08, 77% in 2008/09, and 83% in both 2009/10 and 2010/11. This increase means the trend over time must be assessed with caution, especially when the 2006/07 data is included.

Changes since 2009/10

There were few statistically significant differences in obesity prevalence between 2009/10 and 2010/11 when the data are analysed by ethnic group.

In Reception, the only statistically significant change in obesity prevalence was among children classed as White British. Obesity prevalence among this group decreased by 0.34% (95% confidence limits of -0.55% to -0.14%) for boys, and by 0.47% (-0.67% to -0.28%) for girls.

In Year 6, obesity prevalence for girls classed as White British showed a statistically significant increase between 2009/10 and 2010/11 – rising by 0.39% (0.13% to 0.66%). In addition, girls from the Pakistani ethnic group showed a statistically significant increase in obesity prevalence, rising by 1.37% (0.11% to 2.63%). Among boys in Year 6, only the 'Any Other White' ethnic group showed a significant increase in prevalence, rising by 2.22% (1.14% to 3.30%).

Trend over all years of NCMP measurement

When all years of NCMP measurement are used in the analysis, there are very few ethnic groups where a consistent trend over time can be detected using linear regression. Due to the substantial increase in levels of ethnic coding in the NCMP data between 2006/07 and later years (which could affect the reported trend over time by ethnic group), the results below are based on analysis from 2007/08 to 2010/11 for both Reception and Year 6.

In the Reception year, linear regression of the trend within each ethnic group shows that obesity prevalence for boys classed as Indian has increased by 0.33% per year since 2007/08 ($p=0.011$, 95% confidence limits of 0.14% to 0.51%). When analysed in this way, the only other ethnic groups to display a significant trend over time in Reception were ones where very small numbers of children were measured (less than 1,000 per year for each age and sex group).

Obesity prevalence appears to have decreased for White Irish girls at a rate of 0.22% per year ($p=0.012$, -0.35% to -0.09%), but increased for Chinese boys at a rate of 0.54% per year ($p=0.016$, 0.19% to 0.90%) and by 0.93% per year for Chinese girls ($p=0.032$, 0.15% to 1.71%). However, the small number of children measured within these ethnic groups, and the resulting wide confidence limits around the estimates of obesity prevalence within each year, means the apparent trend within these groups should be treated with caution.

In Year 6 there is a statistically significant linear trend of increase in child obesity for both boys and girls classed as White British. Since 2007/08 obesity prevalence among boys has increased by 0.18% per year ($p=0.022$, 0.05% to 0.31%), and by 0.33% per year for girls ($p=0.035$, 0.04% to 0.62%). In addition, there is a trend of increasing obesity prevalence for Bangladeshi girls at a rate of 1.19% per year ($p<0.001$, 0.98% to 1.40%) and for girls classed as 'Any Other Asian Background' at a rate of 0.70% per year ($p=0.029$, 0.14% to 1.25%).

As figures 8a–d demonstrate, when the NCMP data are split by ethnic group the confidence limits around the estimates of obesity prevalence are large, as is the amount of year on year variation within ethnic groups. This makes it difficult to assess whether there has been a significant linear trend over time, especially when only four robust data points are available for analysis. The data have therefore also been analysed using the broader categories of White (containing the White British, White Irish, Any Other White Background ethnic groups), Asian (Bangladeshi, Indian, Pakistani, Any Other Asian Background), Black (Black African, Black Caribbean, Any Other Black Background), and Mixed (White and Asian, White and Black African, White and Black Caribbean, Any Other Mixed Background).

These broad ethnic groups show no statistically significant change since 2007/08 for children in Reception or boys in Year 6. However it is possible to detect a statistically significant linear trend since 2007/08 among girls in Year 6 within the White and Asian groupings. Obesity prevalence among White girls in Year 6 has risen by 0.3% per year ($p=0.037$, 0.03% to 0.57%) and among Asian girls of this age by 0.68% per year ($p=0.032$, 0.11% to 1.25%).

Although no other significant differences are apparent in this analysis, the trend over time for boys in Year 6 within both the White and Asian groupings does suggest that a steady increase in obesity prevalence may have occurred; obesity prevalence appears to have risen among White boys by 0.20% per year ($p=0.053$, -0.01% to 0.40%) and among Asian boys by 0.40% per year ($p=0.062$, -0.04% to 0.83%).

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

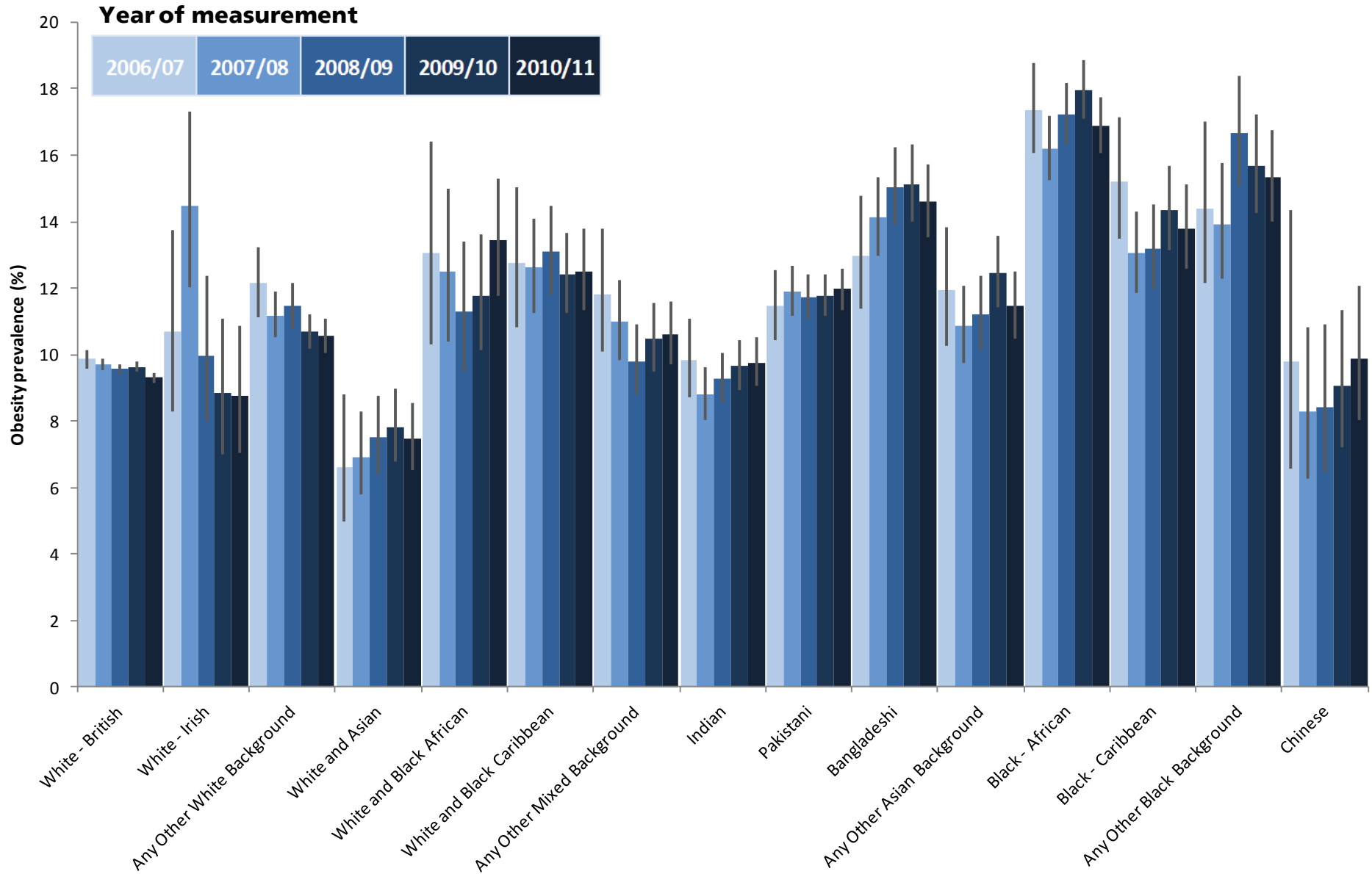


Figure 8b: Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Reception, girls

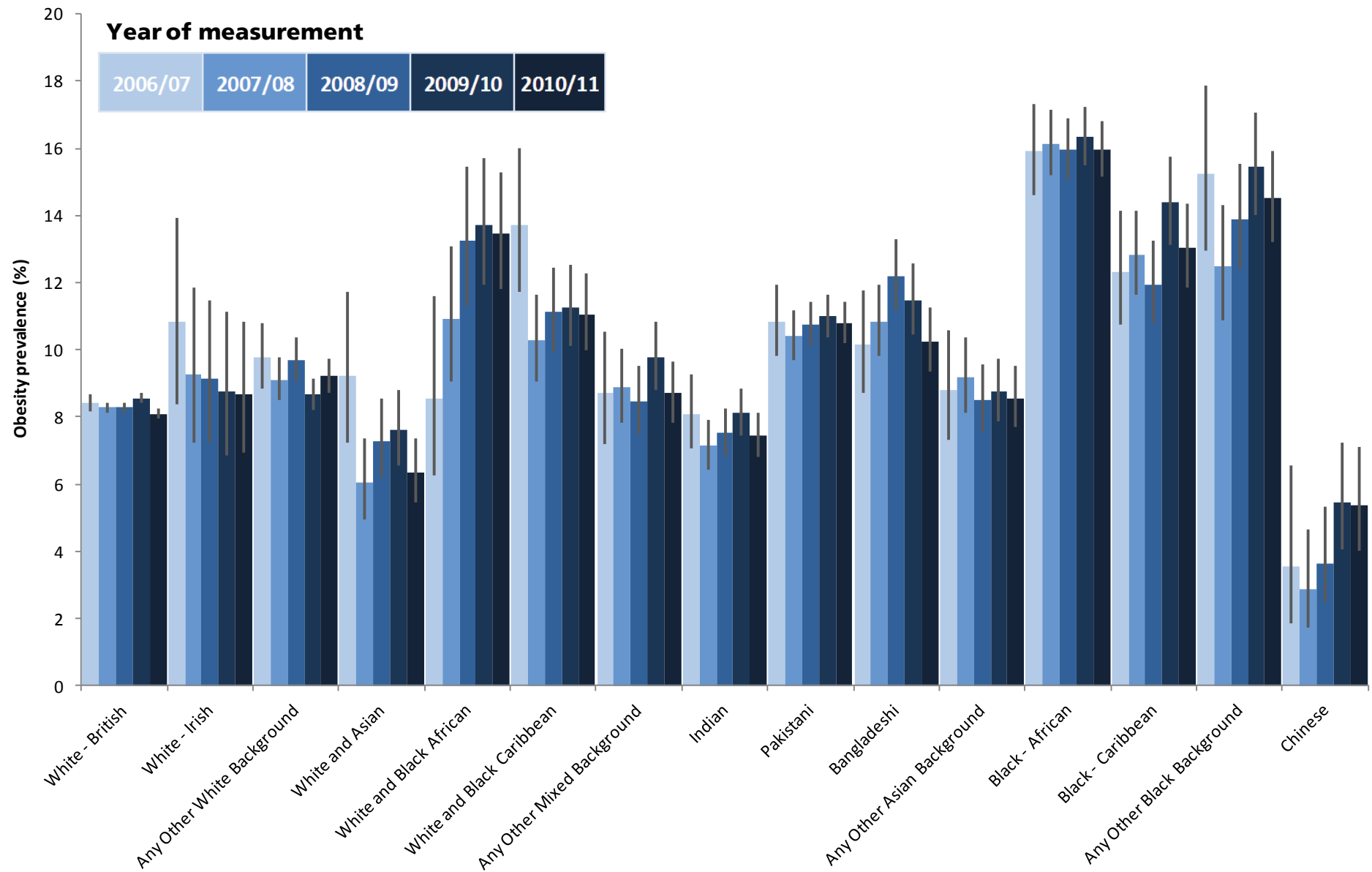


Figure 8c: Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Year 6, boys

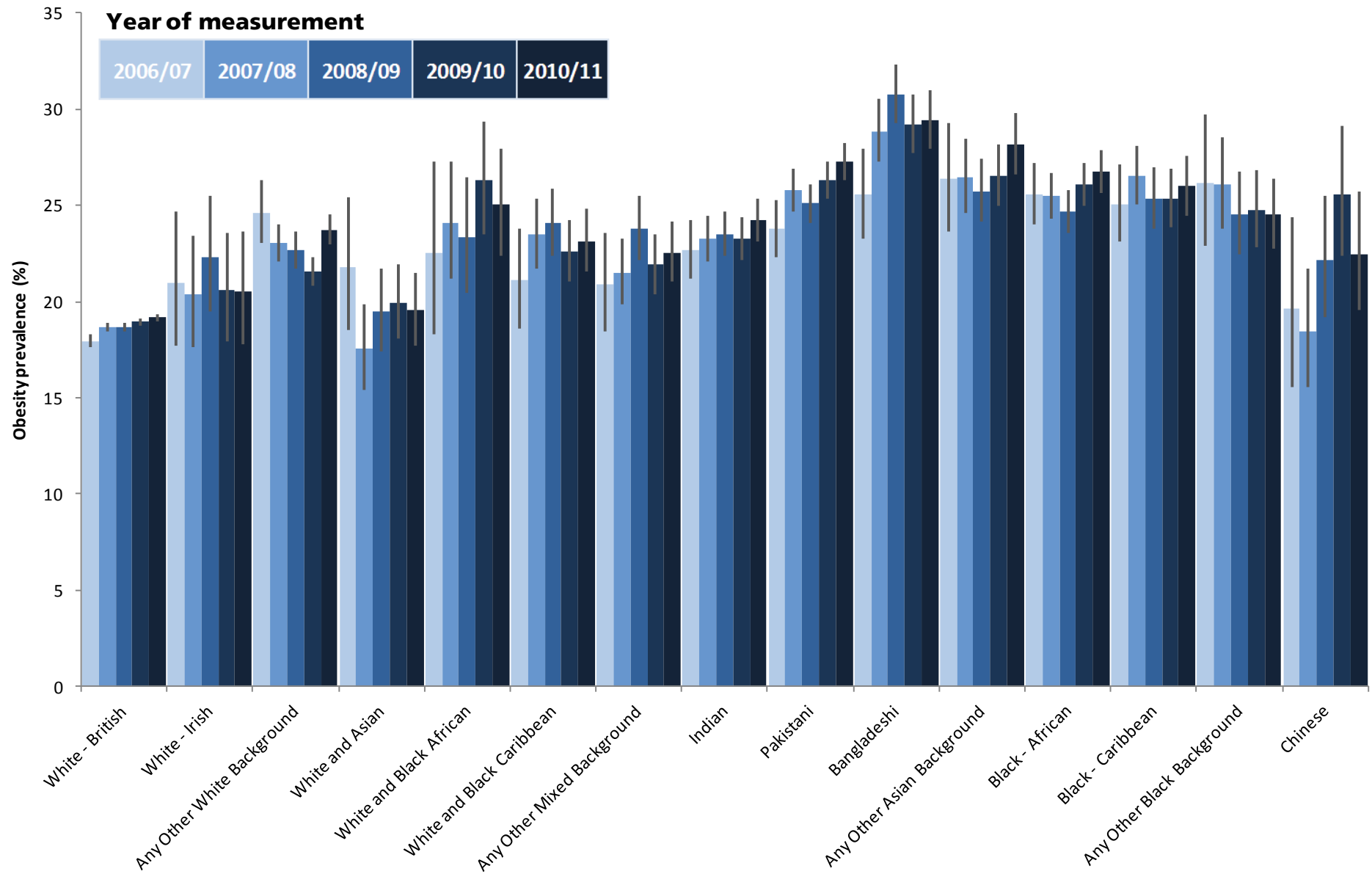
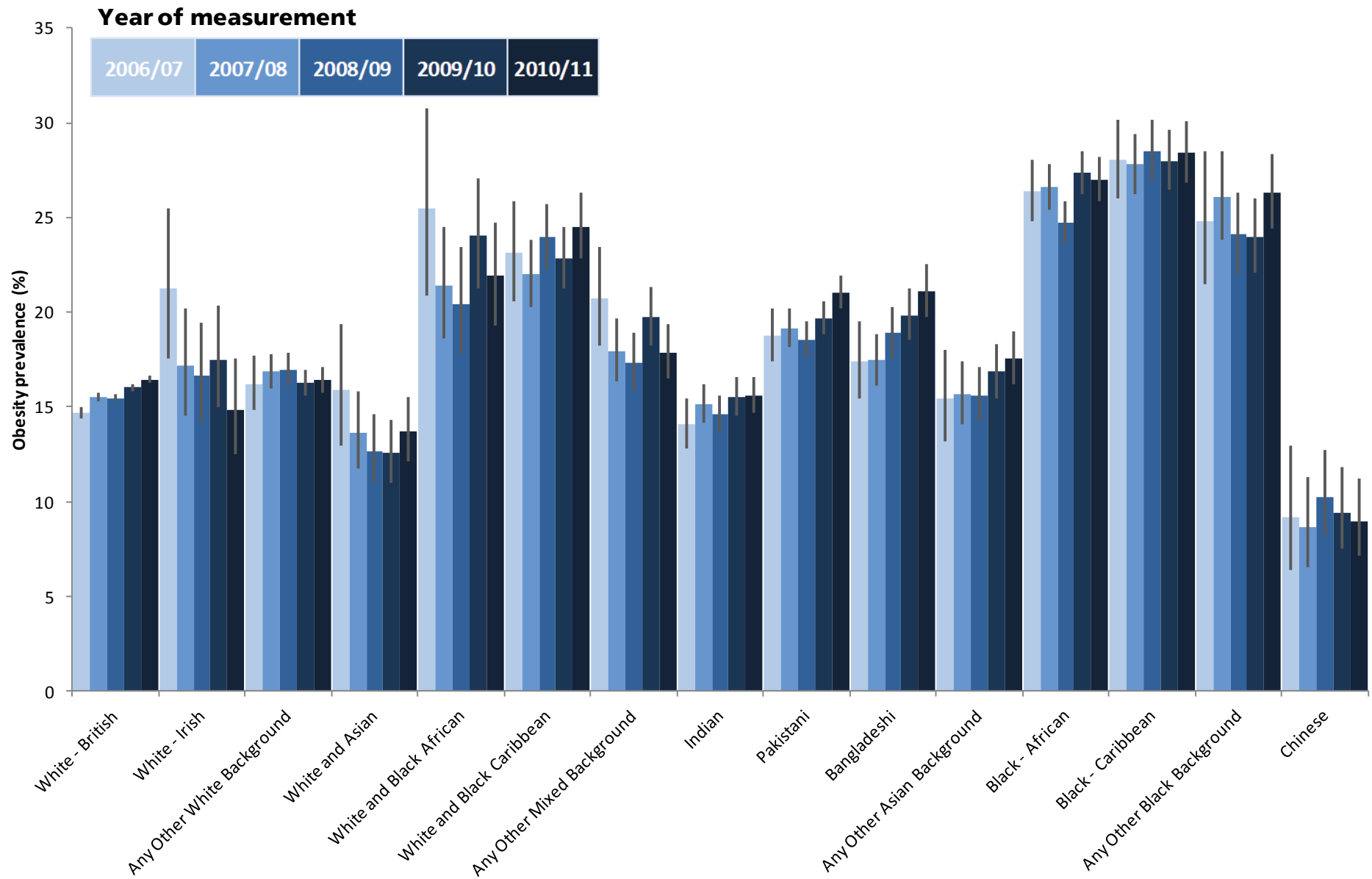


Figure 8d: Prevalence of obesity (with 95% confidence limits) by ethnic group and year of measurement: Year 6, girls



7. Conclusions, limitations and discussion

7.1 Conclusions

The addition of the latest 2010/11 NCMP data better enables us to identify and interpret trends in child BMI over the period covered by the NCMP.

The decreases observed in obesity prevalence between 2009/10 and 2010/11 among children in Reception fit well with the overall trend since 2006/07. However, at present the evidence for declining obesity prevalence for children in this age group is not entirely conclusive, and is also stronger for boys than for girls.

Although mean BMI shows no significant trend over time for children in Reception, the change observed in the distribution of BMI at this age suggests that 'healthy' changes may be taking place; BMI has increased among those sections of the child population with a low BMI for their age (whose health is more likely to benefit from an increase in BMI), but decreased slightly among children with a high BMI for age.

However, for other population groups – especially children in Year 6 – the emerging trends are of greater concern, and there is very little evidence of any such 'healthy' changes.

In Year 6 both obesity prevalence and mean BMI seem to have increased over the period covered by the NCMP – and the increases in mean BMI have been spread evenly across the child population. The problem is therefore not only one of more children becoming obese, but also the BMI of the most obese children also appears to be increasing over time.

When the NCMP data are broken down by other demographic characteristics this shows further areas of concern. Health inequalities do appear to be widening, certainly for boys in Reception and all children in Year 6. The decrease in obesity prevalence among all children in Reception does not seem to have affected children living in the most deprived areas of the country to the same extent as those living in the least deprived areas. Although increases in obesity prevalence have occurred among all children in Year 6 regardless of sociodemographic status, the rate of increase is greater for children living in the most deprived areas.

When examined by ethnicity, the NCMP provides little robust evidence for differences in the trend over time between ethnic groups. The relatively small number of children measured for most ethnic groups (compared to the number of children classed as White British), and also the small proportion of 2006/07 records with valid ethnic coding, hinder the identification of statistically significant changes over time.

The findings that do emerge from NCMP analysis by ethnic groups are not encouraging. There is a trend of increasing obesity prevalence among boys in Reception from the Indian ethnic group, despite an apparent decrease in obesity prevalence for boys of this age at population level. This demonstrates that even within sections of the child population where 'healthy' changes in children's BMI are occurring, there are still sub-populations where obesity prevalence is still increasing.

The increases in obesity prevalence seen for the Year 6 age group can be detected in the White British population, and also within all White and Asian ethnic groups for girls (and to a lesser extent for boys). The increases at population level therefore do not seem to be restricted to specific ethnic groups. Although it is too early to say with confidence, the rate of increases

seen among Asian groups in Year 6 are greater in magnitude (although not significantly different) from those for the White population.

7.2 Caveats and limitations of this analysis

As noted in previous NOO NCMP reports,^{1,2} the large number of records within the NCMP dataset allows a level of detailed analysis that is not possible with most data sources. However the surveillance approach that results in such large numbers of child measurements brings some disadvantages. Primarily, the sample cannot be controlled as carefully as it would be in most research studies. Such studies typically use a sampling framework to ensure the sample is representative of the national population, and employ quality control measures to ensure data quality is consistent across all data collection units and over time.

In previous years of NCMP analysis, links have been shown between the reported prevalence of obesity and factors such as local participation rate and data quality measures. The significant increase in obesity prevalence among children in Year 6 between 2006/07 and 2007/08 has been largely attributed to the improvements made in this regard over this period.

Over the last four years of the NCMP, data quality has improved further. However, the improvements since 2006/07 have not been as dramatic as those between 2006/07 and 2007/08. It therefore seems unlikely that the changes between 2007/08 and 2010/11 presented within this report could be caused entirely by changes in NCMP participation or data quality.

It is possible that other factors, which have not yet been assessed in detail, could affect the observed trend over time. There have, for example, been some changes in the timing of NCMP measures throughout the school year over the past four years. These could potentially have had an impact on the reported trend in obesity prevalence. Further detailed analysis into such aspects of the NCMP dataset would be needed to fully understand if these can explain some of the observed changes in obesity prevalence and mean BMI.

Another limitation of this analysis is that trend over time has been assessed within this report using a linear regression model. This is effective at determining whether a consistent pattern of increase or decrease has taken place within child BMI measurements. However, this approach will not yield a significant result if the prevailing trend is not linear – for example if child obesity had increased in earlier years, but begun to decrease in later years of measurement.

With only four or five years of robust NCMP data available for the analysis of trend it is not yet possible to test for changes over time that are non-linear in nature. Such analysis will however be possible in future years.

This analysis has also not considered the trend in child BMI classifications other than obese. Further analysis of the trend in child underweight, healthy weight and overweight might provide additional findings of interest. However, the analysis of BMI distribution presented within this report does give some indication of the sort of changes that could be expected.

7.3 Discussion

The 2010/11 NCMP data suggest that the trend in child obesity prevalence differs by age. In Reception the prevailing trend appears to be one of decreasing prevalence, although the

evidence is stronger for boys. In Year 6 prevalence is increasing for both boys and girls. Both mean BMI and the distribution of BMI also appear to be changing for the better in Reception, but getting worse in Year 6.

The NCMP data suggest that increased focus may be needed on reducing child obesity prevalence among older children, and that more may need to be done in terms of population level interventions to slow the increase in the BMI of children who are currently at a healthy weight.

At all age groups, an even greater focus may be beneficial for children living in deprived areas, as they are currently experiencing less healthy changes in BMI than their less deprived counterparts. There is only limited evidence at this time of differing trends between ethnic groups.

It is also important to recognise that, even in those sections of the child population where child obesity prevalence is decreasing (or the trend is flattening), the proportion of children who are obese or whose BMI would not be considered to be healthy is still at an undesirable level. Both mean BMI and child obesity, even across the most 'healthy' parts of the child population, are typically above the levels seen in 1990. All parts of the child population are therefore likely to benefit from reductions in excess weight and this should be considered when interventions are designed and delivered.

8. References

1. Dinsdale H, Ridler C, Rutter H. National Child Measurement Programme: Changes in children's body mass index between 2006/07 and 2009/10. Oxford: National Obesity Observatory, 2011.
http://www.noo.org.uk/uploads/doc/vid_13261_NCMP_Changes_in_childrens_BMI.pdf
2. Dinsdale H, Ridler C. National Child Measurement Programme: Changes in children's body mass index between 2006/07 and 2008/09. Oxford: National Obesity Observatory, 2010.
http://www.noo.org.uk/uploads/doc/vid_6540_NOO_NCMP_v1.pdf
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 Health and Social Care Information Centre. National Child Measurement Programme: England, 2010/11 School Year. London: Health and Social Care Information Centre. December 2011.
http://www.ic.nhs.uk/webfiles/publications/003_Health_Lifestyles/ncmp%202010-11/NCMP_2010_11_Report.pdf
6. Ridler C, Townsend N, Dinsdale H, Mulhall C, Rutter H. 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
7. 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>

All web links accessed 21/03/2012

9. Reader Information

Title	National Child Measurement Programme: Changes in children's body mass index between 2006/07 and 2010/11
Authors	Hywell Dinsdale Caroline Ridler Harry Rutter
Acknowledgements	Paul Eastwood, The Health and Social Care Information Centre Shireen Mathrani, National Obesity Observatory Sharif Salah, The Health and Social Care Information Centre Di Swanston, National Obesity Observatory Rosie Taylor, Department of Health Katherine Thompson, Department of Health
Publication date	March 2012
Target audience	Public Health Observatories Primary Care Trusts Local Authorities
Description	Examination of changes in obesity prevalence and mean BMI between 2006/07 and 2010/11, based on analysis of the National Child Measurement Programme data.
How to cite	Dinsdale H, Ridler C, Rutter H. National Child Measurement Programme: Changes in children's body mass index between 2006/07 and 2010/11. Oxford: National Obesity Observatory, 2012.
Contact	National Obesity Observatory www.noo.org.uk ncmp@noo.org.uk
Electronic location	www.noo.org.uk/NCMP
Copyright	© National Obesity Observatory, 2012

National Obesity Observatory

DELIVERED BY

