Analysis of the National Childhood Obesity Database 2005-06

A report for the Department of Health by the South East Public Health Observatory on behalf of the Association of Public Health Observatories

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National Childhood Obesity Database 2005-06: Initial Findings

Key points

- The National Childhood Obesity Database (NCOD) is the largest database of its kind in the world, with enormous potential as a tool both for tracking and analysing trends in childhood obesity, and for guiding evidence based interventions to tackle this major public health problem.
- The first year of data collection has been hampered by a number of practical difficulties. These have had a significant impact on data quality and seriously limit the reliability of the results for this year, as a result of which many of the figures in this report need to be treated with considerable caution.
- There is anecdotal evidence of higher rates of opting out of the measurement process among heavier children, which is supported by the findings of this analysis. This means the figures obtained from the NCOD are likely systematically to underestimate the prevalence of overweight and obesity.
- Altogether, 538,400 children in Reception Year and Year 6 were measured – approximately 48% of those eligible.
- 80% of Primary Care Trusts (PCTs) returned some data on schools in their area, but response rates (the proportion of eligible children who were measured) varied widely across England.
- Nationally, of those children measured, 12.3% of girls and 13.4% of boys in Year R were found to be overweight, and 9.2% of boys and 10.7% of girls in the same year group were found to be obese. In Year 6, 13.8% of boys and girls were overweight, and 15.4% of girls and 18.9% of boys were obese.
- The best comparison figures available (from the Health Survey for England) show higher levels of overweight and obesity, although they follow a similar pattern.
- Comparing the NCOD results for different areas shows that the higher the response rate, the higher the apparent prevalence of obesity. This suggests that as response rate increases the estimates from the data more closely approach the true prevalence for that area.
- Improving response rates is the most important challenge facing the programme, especially tackling selective opting out by children with high BMIs which will bias the results.
- Lessons learned from 2005-06 will improve the systems for 2006-07 and strengthen reporting, data uploading and data analysis.
- Analysis of the data strongly suggests that results from the 2005-06 academic year significantly underestimate the prevalence of childhood obesity. It is therefore likely that the more accurate data anticipated in 2006-07 will appear to show an increase in obesity prevalence.

1. Introduction

The National Childhood Obesity Database (NCOD) has been established as part of the Government's programme to tackle the continuing rise in obesity, and specifically obesity in children. Childhood obesity is the subject of a Public Service Agreement (PSA) target set in July 2004, which aims to halt the year-on-year rise in obesity among children under 11 by 2010 in England.

In order to assist with monitoring progress against the PSA target at regional and local level, annual measurement of height and weight among primary school children in Reception Year and Year 6 was introduced in 2005-06. This will complement tracking at national level through the Health Survey for England and aims to provide reliable and comprehensive data at local level on obesity in children, which will also be useful in informing planning and the targeting of resources to tackle obesity.

The measurement exercise is coordinated locally by Primary Care Trusts (PCTs) with the support and cooperation of schools and the Department for Education and Skills (DfES). Children's heights and weights are measured in school and the data entered into a specially designed spreadsheet which PCTs use to upload the data to UNIFY, the Department of Health's performance management system. During the upload process the spreadsheet calculates pupils' Body Mass Index (BMI) by dividing weight (in kg) by height squared (in m^2). Age and sex-specific child growth curves[1] are then used to identify the proportion of children who are overweight or obese according to their BMI and age (in years and months). Overweight is defined as greater than the 85th centile, and obese as greater than the 95th centile. The number of pupils measured and the numbers obese and overweight are then aggregated on the basis of school, sex and age. These aggregated totals are then stored in UNIFY for each PCT.

Introducing the measurement exercise has been a huge undertaking for all concerned and has involved the development of complex systems for data collection, reporting and collation. In addition to gathering the first tranche of data, the first year of measurement has provided the opportunity to test and refine these systems and to improve the arrangements for future years.

Due to a range of difficulties experienced in the first year the 2005-06 dataset is incomplete. Although a considerable amount of valuable information can be derived from it, detailed analysis of patterns of overweight and obesity at local level is not appropriate as the results would be unreliable and potentially misleading. This report summarises the data available and provides high level analysis of the prevalence of overweight and obesity among the children measured in 2005-06.

[1] T J Cole, 1990, data obtained from Harlow Publishing

Benefits of the National Childhood Obesity Database

Despite the limitations of the first round of data collection and analysis, it is already clear that the NCOD will be a very valuable resource, compiling BMI data on a much greater number of children than any previous dataset. Once the systems are fully functional, the NCOD will be an extremely powerful tool for analysing, interpreting and tracking childhood obesity in the years to come and will allow detailed exploration of associations (for example, with local level deprivation) and trends.

2. Response rates at national level

Across England as a whole, 538,400 children were weighed and measured as part of the first year of the measurement exercise (NB for ease of reading, all counts in this report have been rounded to the nearest hundred). This amounts to approximately 48% of all eligible pupils.

The exercise included pupils in the Reception Year (Year R), aged 4-5 years, and pupils in Year 6, aged 10-11 years. Of those measured:

- 297,600 were in Year R: approximately 57% of all Year R pupils
- 240,800 were in Year 6: approximately 42% of all Year 6 pupils

As the measurement exercise predated the October 2006 restructuring of PCTs, the data were collected and uploaded by “old” PCTs. Response rates varied widely across the country, but altogether 243 out of 303 former PCTs (80%) returned some information on pupils in their area. Together, PCTs entered data onto UNIFY for a total of around 13,000 schools (approximately 72% of the total number of eligible schools in the country). Not all of these returns contained height and weight data, but at least some measurements were received from over 12,000 schools (approximately 67%).

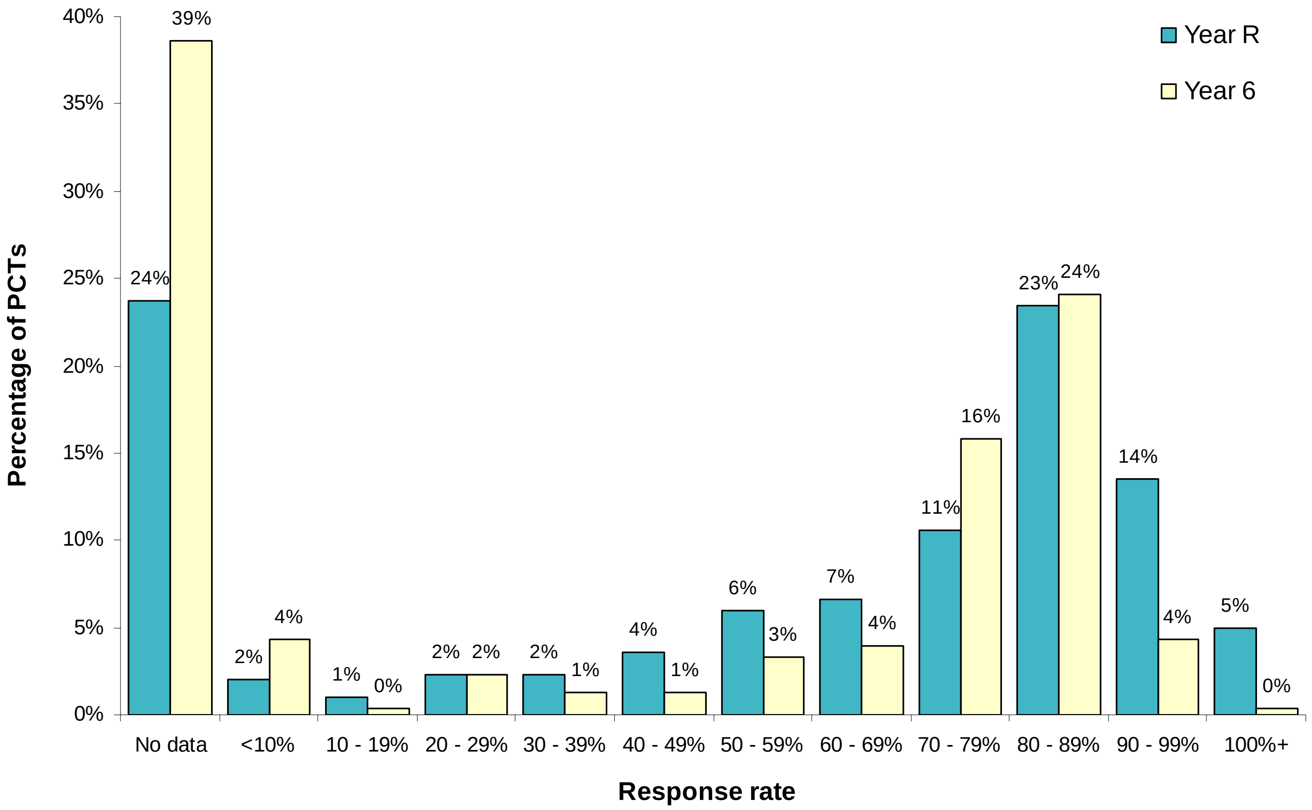
Response rates have been analysed by PCT, but are provisional for a number of reasons:

- The task of “cleaning” the data (eg coding of school names, which were entered as free text items on the upload forms, and removing duplicate and incorrectly entered data) has not been completed. Because of teething problems with the UNIFY system this phase of the analysis has been extremely complicated and laborious.
- Allocation of schools to PCTs is not always straightforward, so it is not clear exactly how many (and which) schools each PCT is responsible for. There is uncertainty about some schools which are geographically within one PCT, but covered by school nurses from another (so that the latter PCT was responsible for collecting their height and weight data). Data on some of these schools have been reported by two different PCTs. Figures in this report have been based on the PCT that entered data onto UNIFY.

- Calculating response rates depends on having accurate denominators – in this case the total number of pupils in each school (and hence each PCT). Pupil numbers change over time, especially in Year R where pupils often join throughout the year. Although DfES has supplied two sets of pupil numbers for different time periods, it has been difficult to determine the most appropriate figures to use for each school.
- Some PCTs collected data for independent schools and special schools, which was an optional addition to the measurement exercise. It has not always been possible to identify these schools to ensure that PCT denominators were accurately calculated.
- There are still some data to be added to the dataset from PCTs which submitted information after the UNIFY system was closed to uploads.

Figure 1 presents the distribution of provisional response rates by PCT, broken down by school year. It shows the proportion of eligible children – those attending schools within each PCT's area – for whom data were returned. The fact that the data need to be interpreted with some caution is clearly apparent from the fact that a number of PCTs appear to have response rates over 100%, especially for Year R. This illustrates the impact of the factors outlined above on data quality: these issues will continue to be addressed as the data cleaning and analysis proceeds.

Figure 1: Provisional response rates by PCT and school year for all 303 former PCTs. Response rate represents the proportion of eligible children (attending schools within the PCT) for whom data were returned



PCT response rates were often different for the two school years included in the exercise and tended to be higher for Year R children than Year 6 children, as Figure 1 illustrates. Approximately 77% of PCTs returned some data on Year R children and 62% of PCTs returned some data on Year 6 children.

It is not possible to estimate what proportion of the children not measured were not approached for measuring and what proportion opted out. This is important, because although either alternative might introduce selection bias, the latter is particularly likely to do so. Opt-out parental consent was required in order for children to be weighed and measured, and widespread anecdotal evidence suggests that consent was more often withheld for children whose appearance suggested that they may be overweight or obese. If this is the case, the figures obtained even from those PCTs (and schools) with high response rates may substantially underestimate the prevalence of overweight and obese children.

Response rates have also been analysed by sex. No significant difference was found in response rates between males and females in Year R, but in the Year 6 sample the response rate for boys (42.3%) was significantly higher than that for girls (40.8%) ($p < 0.01$)[2]. Assuming there is no sex bias in the children approached for measuring, and correcting for different numbers of boys and girls in the population, this suggests that approximately an additional 3% of Year 6 girls opted out of the exercise compared to boys of the same age. This may reflect a greater sensitivity about body image among girls of this age, and a greater propensity for girls who are overweight to opt out of the measurement exercise (a theory which is again supported by anecdotal evidence). Again, this may bias the results and underestimate the prevalence of overweight and obesity among Year 6 girls. Further analysis of the cleaned NCOD data may shed greater light on the issue of selective opting out, but additional research may be needed to determine the extent of the problem and to explore possible solutions.

3. Prevalence of overweight and obesity at national level

National prevalence figures for obesity and overweight are shown in Tables 1 and 2 and represented graphically in Figure 2. These figures are based on all data currently in UNIFY; this means that data submitted late by PCTs are not included, and there may also be some duplicate data and other errors which have not yet been ironed out. At national level these errors should balance out and any inaccuracy in the figures resulting from data errors should be small.

However, the prevalence figures presented below and elsewhere in this report must be treated with a great deal of caution, for the following reasons:

[2] P values are a way of expressing the likelihood that there is a real difference between two figures being compared – in this case, two response rates. A p value of < 0.01 means there is less than a one percent chance that the observed difference between the figures has arisen by chance, so we can say with some certainty that the difference is meaningful.

Poor response rate

Across the country as a whole, the response rate was less than 50%, which is too low to provide a reliable estimate of national prevalence. The response rate varied widely between PCTs and indeed between regions (see section 4 below). If the prevalence of obesity in areas with very poor coverage differs significantly from the national average, the "missing" data from these areas could have a marked impact on local, and even national, prevalence figures.

Relationship between response rates and prevalence estimates

Analysis of the dataset shows that the higher the response rate, the higher the apparent prevalence of obesity. This suggests that, as the response rate increases, the prevalence estimates from the data more closely approach the likely true prevalence. The results for areas or groups (eg sexes or age groups) with lower response rates are therefore likely to fall even further short of the true prevalence, which makes comparisons between groups with different response rates even less reliable.

It is worth noting that improved response rates in future years would be expected to lead to higher estimates of obesity prevalence. These will not necessarily reflect a real increase in the prevalence of obesity, simply a closer approximation to the true prevalence in the population.

Coverage and opting out

Even limiting the analysis to PCTs with a reasonably high response rate would not necessarily improve the accuracy of the estimates obtained, since coverage among children approached is the most important aspect of the response rate. Data from a PCT in which 50% of schools achieved 90% coverage, for example, would be more reliable than data from a PCT in which 90% of schools achieved 50% coverage, although both would have the same overall response rate. (However, if there were marked differences in obesity prevalence between the schools which measured children and those which did not then the "missing" schools might bias the PCT's results significantly.)

Selection bias

As explained above, there are many anecdotal reports of selection bias in the sample, with overweight and obese children reported as being more likely to opt out of being measured, and differences in sex-specific response rates in Year 6 which show that girls of this age are more likely to opt out than boys. This may result in underestimates of overweight and obesity across the board, and may account for the apparently lower prevalence of obesity in girls in Year 6.

Table 1: Prevalence of obesity and overweight among children in Year R, by sex, England, 2005-06

	Total number of children measured	Overweight		Obese		Overweight and obese combined	
		Number	***%****	***Number***	***%****	***Number***	***%****
Female	145,200	17,800	12.3% *(12.1 - 12.4%)*	13,300	9.2% *(9.0% - 9.3%)*	31,100	21.4% *(21.2 – 21.6%)*
Male	152,400	20,400	13.4% *(13.2 - 13.6%)*	16,400	10.7% *(10.6 - 10.9%)*	36,800	24.1% *(23.9 – 24.3%)*
Both sexes combined	297,600	38,200	12.8% *(12.7 - 13.0%)*	29,700	10.0% *(9.9% - 10.1%)*	67,900	22.8% *(22.7 – 23.0%)*

** 95% confidence intervals are shown in brackets*[3]

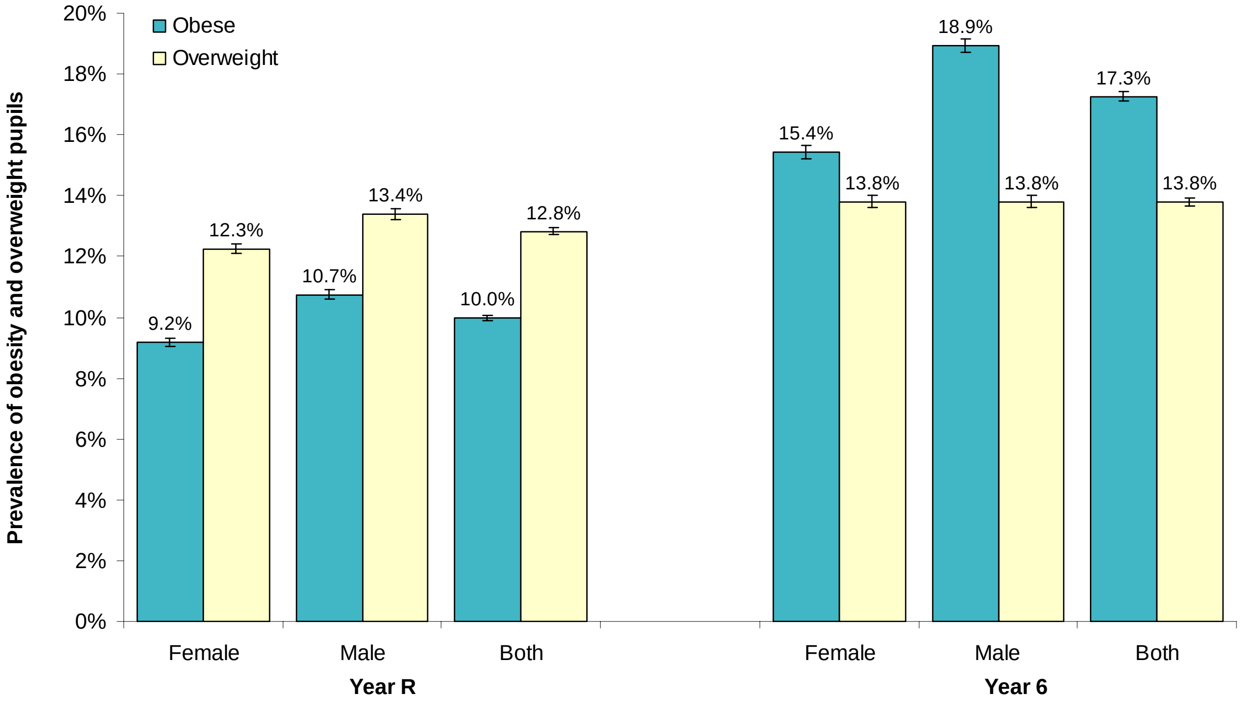
Table 2: Prevalence of obesity and overweight among children in Year 6, by sex, England, 2005-06

	Total number of children measured	Overweight		Obese		Overweight and obese combined	
		Number	***%****	***Number***	***%****	***Number***	***%****
Female	115,400	15,900	13.8% *(13.6 - 14.0%)*	17,800	15.4% *(15.2 - 15.6%)*	33,700	29.2% *(29.0 – 29.5%)*
Male	125,400	17,300	13.8% *(13.6 - 14.0%)*	23,800	18.9% *(18.7 - 19.2%)*	41,100	32.7% *(32.5 – 33.0%)*
Both sexes combined	240,800	33,200	13.8% *(13.7 - 13.9%)*	41,600	17.3% *(17.1 - 17.4%)*	74,800	31.1% *(30.9 – 31.2%)*

** 95% confidence intervals are shown in brackets*

[3] 95% confidence limits give an indication of the likely error around a rate or percentage estimate which has been calculated from measurements based on a sample of the population. They indicate the range within which the true value for the population as a whole can be expected to lie, taking natural random variation into account. Confidence limits are calculated from sample size, and the NCOD has relatively narrow confidence limits because of the large size of the sample. It is important to note that confidence limits do not reflect error due to issues such as data quality and low response rates, which are very important factors in this case, so they may give a misleading impression of the degree of precision. Further information about confidence limits in this report is given in the appendix.

Figure 2: Prevalence of obesity and overweight among children, by sex and school year, England, 2005-06



The prevalence of overweight is similar in both sexes and both age groups, although slightly higher in Year 6 than Year R, and among boys compared to girls in the younger age group. The prevalence of obesity is substantially higher in Year 6 than Year R, however, and also markedly higher in boys than girls in both age groups.

Figures 3 and 4 compare the NCOD figures with the estimates of national obesity prevalence in children obtained from the Health Survey for England (HSE) for 2001 and 2002.[4] These are the most recent data currently published that include the relevant age bands. The 2002 HSE included a "boost" sample of children and has been combined here with data from the previous year in order to increase the sample size. Although the HSE figures are based on a relatively small number of children (2784 children aged 4, 5, 10 and 11 years were measured in 2001 and 2002 combined, which is nearly 200 times smaller than the NCOD sample) they should for the time being be regarded as more reliable and as a reference standard to which the NCOD figures can be compared.

[4] Source: Health Survey for England 2002. Joint Surveys Unit. http://www.archive2.official-documents.co.uk/document/deps/doh/survey02/hcyp/tables/hcypt159.htm (accessed 21/11/06)

Figure 3: Reported prevalence of obesity and overweight in boys, by age group, comparing data from the Health Survey for England (2001-02) and provisional data from the NCOD (2005-06)

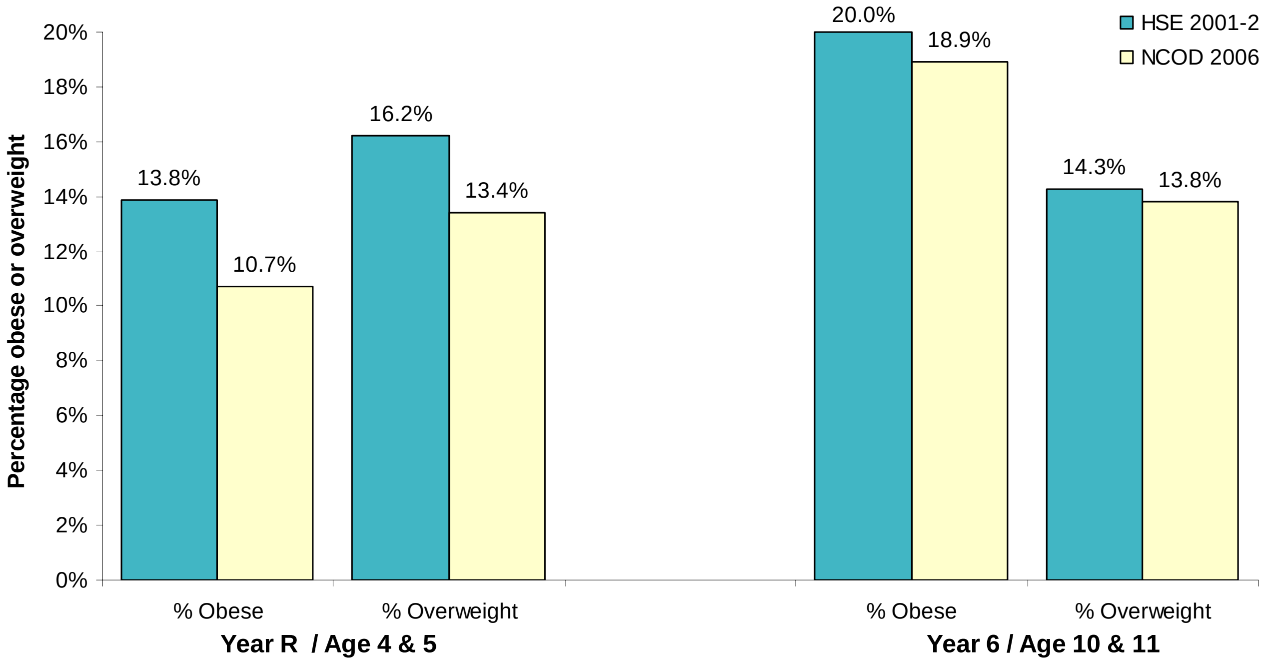
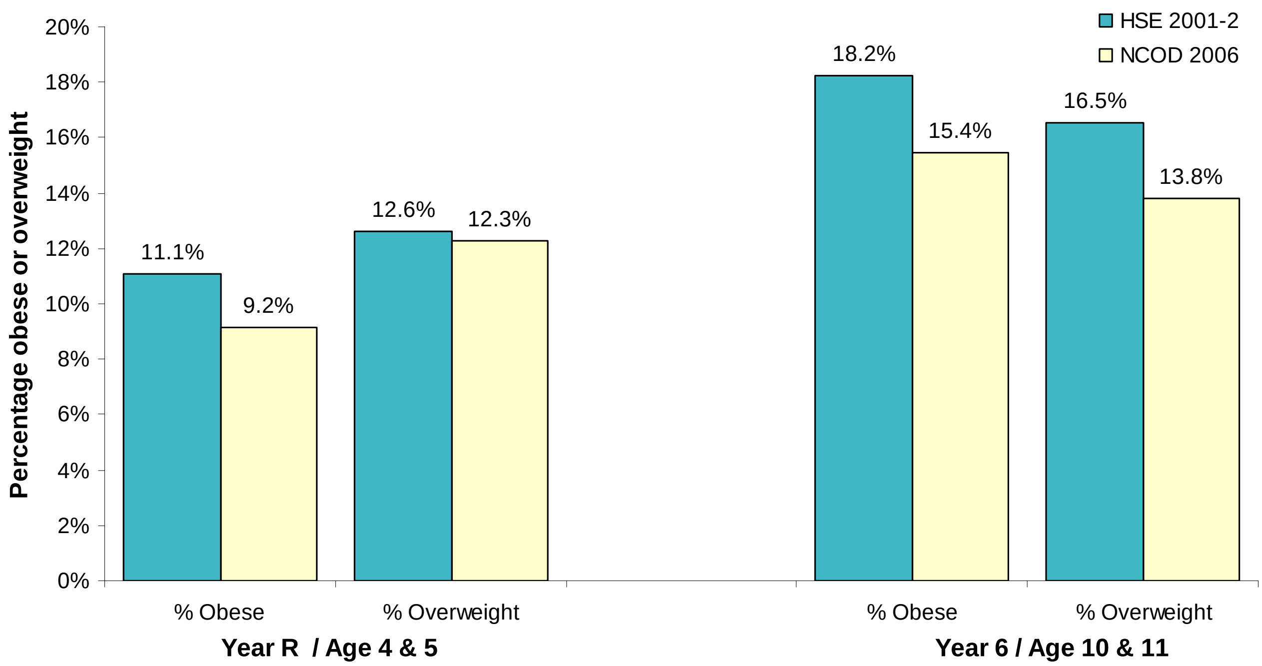


Figure 4: Reported prevalence of obesity and overweight in girls, by age group, comparing data from the Health Survey for England (2001-02) and provisional data from the NCOD (2005-06)



The pattern seen in both datasets is similar:

- an increase in the prevalence of obesity (and in most cases also of overweight) with age
- higher rates of overweight than obesity in Year R, but higher rates of obesity than overweight in Year 6
- higher rates of both overweight and obesity among boys than girls in Year R, and higher rates of obesity among boys than girls in Year 6

Although the differences between the HSE and NCOD figures are not significant at the 95% significance level (with the exception of the figures for obese males in Year R), figures 3 and 4 show that data from the NCOD tend to give lower estimates of prevalence than the HSE for both age groups and both sexes, and for both overweight and obesity. Given that the steady rise in childhood obesity is believed to have continued between 2001-02 and 2005-06, the prevalence estimates from the NCOD would be expected to be higher than the HSE estimates, rather than the other way round.

This comparison therefore suggests that the NCOD figures underestimate the likely true prevalence of overweight and obesity among children in England, and provides evidence to support reports of selection bias in the sample. Further analysis will help elucidate this, but again additional research may be needed to explore the reasons for this and ways of addressing it in future years.

The difference between the two sets of prevalence estimates is more substantial for Year R boys and Year 6 girls, suggesting that the NCOD figures underestimate prevalence more markedly in these groups and again supporting reports of selective opting out among heavier girls in Year 6.

It is worth emphasising that the marked difference in obesity prevalence between the two age groups means that any “mixed” prevalence figures that combine Year R and Year 6 data without age standardisation will reflect more the age-mix of the sample than any underlying differences in obesity prevalence. Given that the response rate for Year R and Year 6 varies widely by PCT, combining the two age groups and then comparing PCTs is likely to give misleading results. As the relative response rates for Year R and Year 6 are likely to change in future years this will also make comparison of such “mixed” prevalence figures for the same PCT over time unreliable.

4. Response rates by Strategic Health Authority

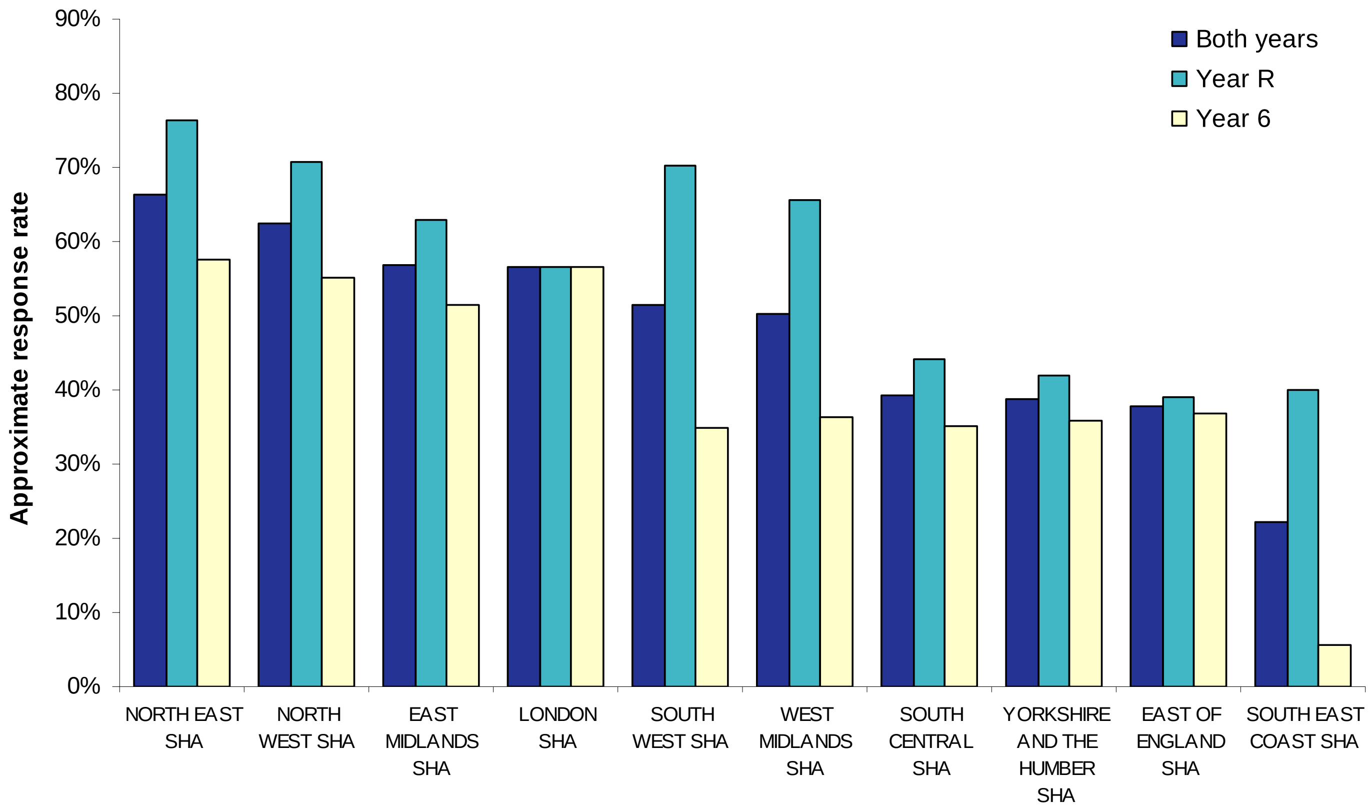
Table 3 shows approximate provisional response rates aggregated to Strategic Health Authority (SHA) level, split by school year. The SHA boundaries reflect the current configuration, which was adopted on 1 July 2006; these are therefore not the SHAs that were in existence at the time of the weighing and measuring exercise. The same figures are illustrated graphically in Figure 5.

Table 3: Provisional response rates by SHA and school year.

Strategic Health Authority	Both years		Year R		Year 6	
	Pupils measured	Response	Pupils measured	Response	Pupils measured	Response
North East SHA	37400	66.3%	20000	76.5%	17400	57.6%
North West SHA	98300	62.5%	52600	70.6%	45700	55.1%
Yorkshire and the Humber SHA	43900	38.7%	22000	41.8%	21900	35.9%
East Midlands SHA	53000	56.8%	27200	62.9%	25700	51.5%
West Midlands SHA	62600	50.3%	38900	65.7%	23700	36.4%
East Of England SHA	46000	37.8%	22400	38.9%	23600	36.7%
London SHA	90800	56.6%	45600	56.7%	45300	56.5%
South East Coast SHA	19700	22.1%	17100	40.0%	2600	5.6%
South Central SHA	32700	39.3%	17300	44.1%	15400	35.0%
South West SHA	54100	51.5%	34600	70.3%	19500	34.9%

Note: Response rate represents the proportion of eligible children for whom data were returned

Figure 5: Provisional response rates by SHA and school year



There is clearly substantial variation in response rates between SHA areas – from 22% in the South East Coast SHA to 66% in the North East for both year groups combined. Even greater differences are apparent when Year R and Year 6 are considered separately; this is an almost ten-fold difference between the lowest and the highest response rates for Year 6. Given that these figures represent a relatively high level of aggregation (on average 30 old PCTs or 15 new PCTs per SHA), they illustrate clearly the patchy nature of the data received in this first year of the measurement exercise.

Interestingly, the response rate for Year R is consistently higher than that for Year 6, despite the wide variations between SHAs seen within each year group. This is likely to be because many PCTs already record height and weight for this age group as part of routine health checks.

The variation in response rates is also illustrated in the three maps below (Figures 6, 7 and 8) which group SHA-level response rates into bands and display the spread geographically. They show response rates for Year R and Year 6 separately and combined, and demonstrate clearly that response rates were generally higher in the north and west of the country than in the south and east, although London is also consistently in the second to top band.

Figure 6: Provisional response percentages by SHA – Year R

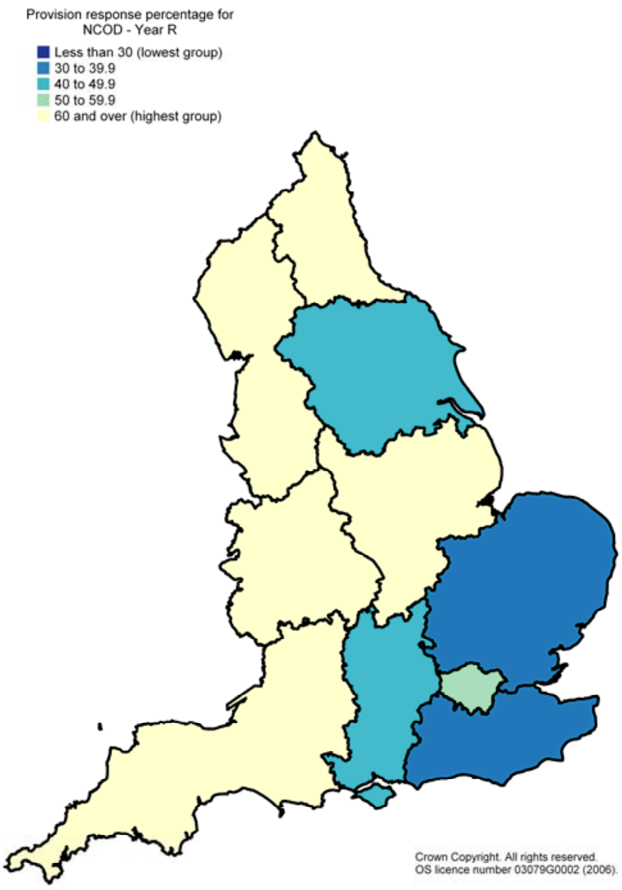


Figure 7: Provisional response percentages by SHA – Year 6

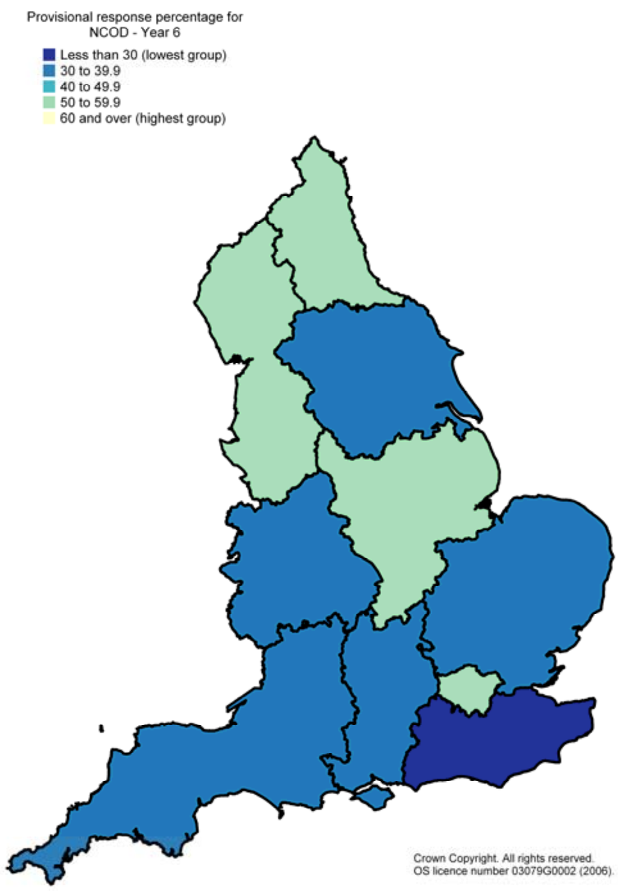
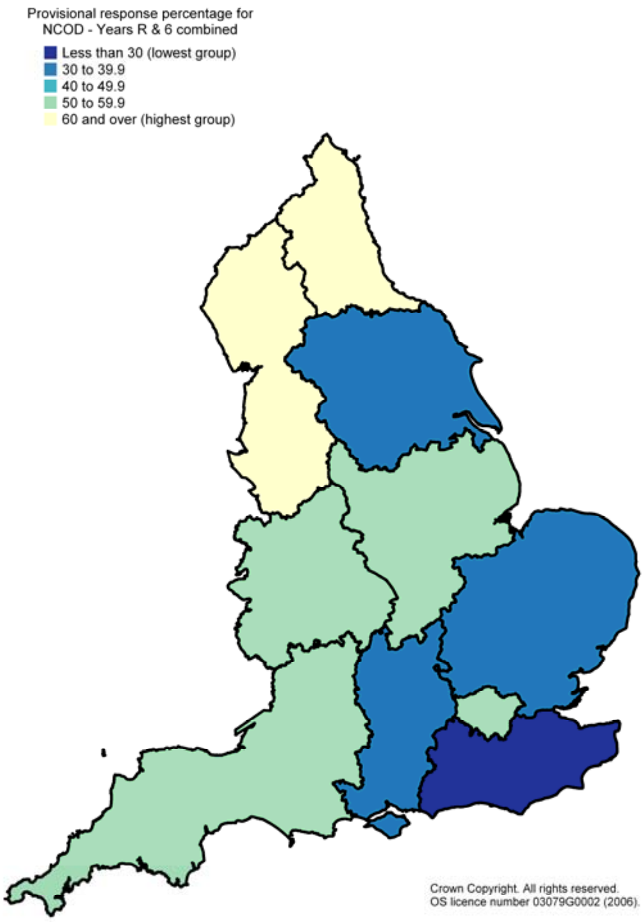


Figure 8: Provisional response percentages by SHA: Years R and 6 combined



5. Prevalence of overweight and obesity by Strategic Health Authority

Figures 9 and 10 show the estimated prevalence of overweight and obesity (for boys and girls combined) split by Strategic Health Authority. These data should be treated with particular caution and regarded as approximate figures rather than firm estimates. The same warnings about data quality which were set out in section 3 in respect of the national prevalence figures apply again here, along with some additional caveats:

Variation in response rates between SHAs

It is clear from the preceding section that response rates varied substantially between SHAs, and in some cases were so low (for example, 6% for Year 6 in the South East Coast SHA) as to make the data unusable as a representative sample of children in that area. Four out of ten SHAs achieved less than a 50% response rate for Year R, and seven out of ten achieved less than 50% for Year 6. Even the SHA with the best coverage (North East) did not reach 80% coverage for Year R and fell short of 70% for Year 6. Analysing these data on a regional basis is likely to be even more misleading than combining them across the country to give national level data. In addition, comparing prevalence figures derived from areas with widely differing response rates means that like is not being compared with like: data from some areas are potentially more reliable than others.

Local factors leading to systematic bias

The different response rates seen in different SHAs might reflect some differences in local factors which could introduce bias on top of the unpredictable random variation caused by generally low response rates. Although individual PCTs were responsible for collecting and uploading their own data, neighbouring PCTs may have experienced similar local problems (eg high “opt out” rates leading to selection bias, and practical difficulties in carrying out the weighing and measuring leading to measurement bias) which could therefore have a significant impact on a whole SHA’s data. Even SHAs with relatively good response rates could be subject to this kind of bias, since any response rate less than 100% might conceal a systematic tendency for disproportionately high opting out by particular groups of children.

In addition, as explained in section 3 above, areas with lower response rates will tend to underestimate prevalence to a greater degree than those with higher response rates. This is another source of systematic bias.

Figure 9: Prevalence of obesity and overweight among children in Year R, by Strategic Health Authority, England, 2005-06

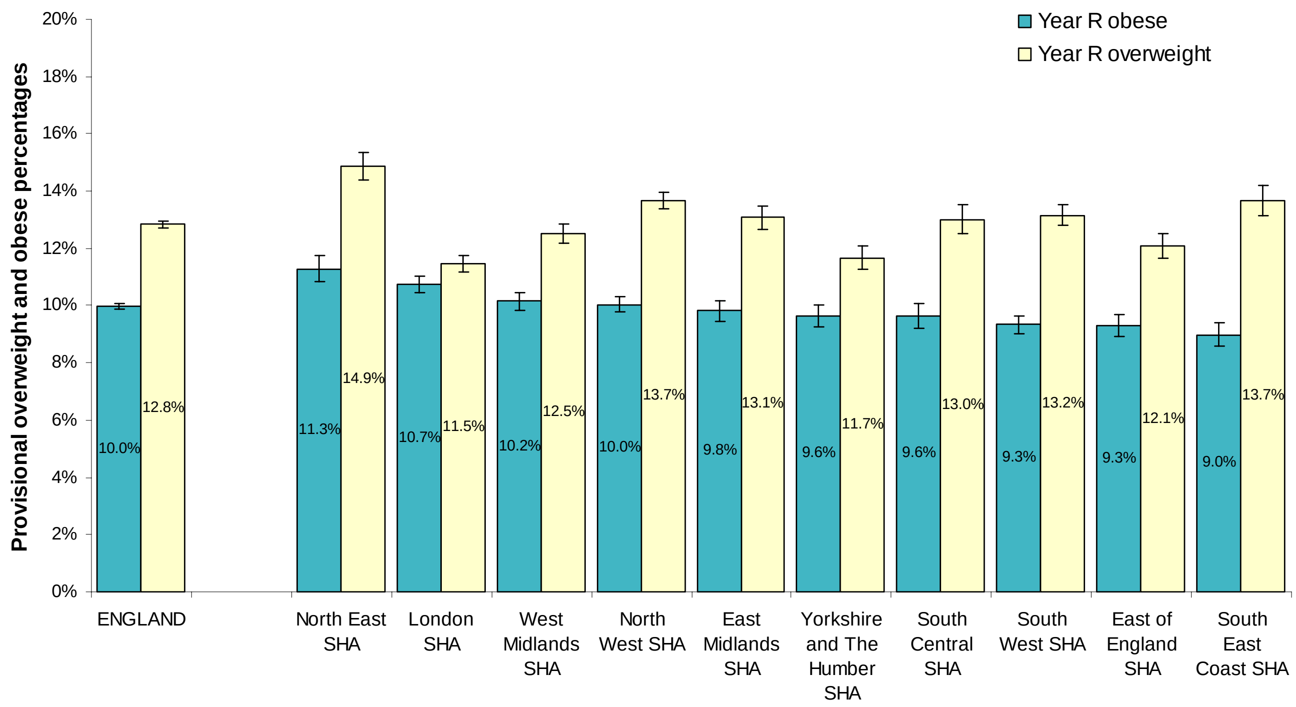
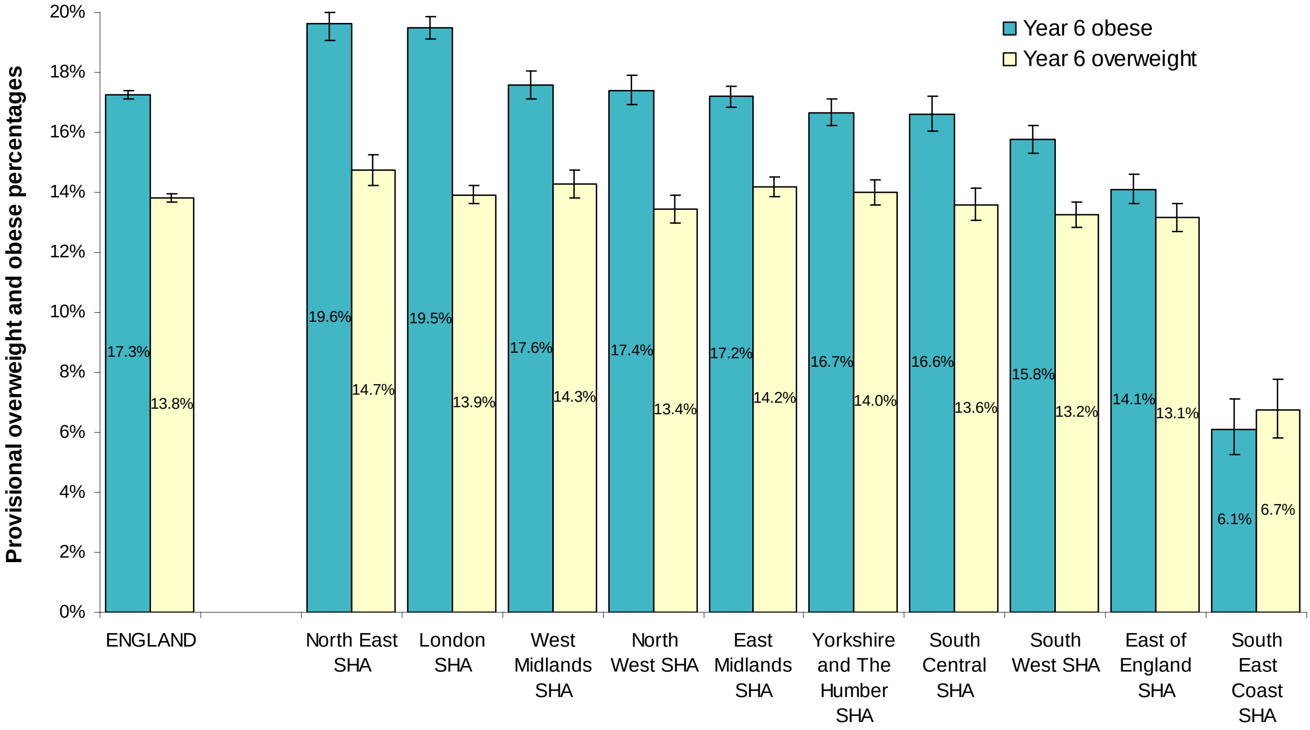


Figure 10: Prevalence of obesity and overweight among children in Year 6, by Strategic Health Authority, England, 2005-06



For Year R, there is surprisingly little variation in obesity prevalence between SHAs (rates range from 9.0% to 11.3%, against a national average of 10.0%) but wider variation in the prevalence of overweight (rates range from 11.5% to 14.9%, against a national average of 12.8%). All SHAs follow the national pattern for this age group, with overweight outstripping obesity in each case. However, there is little correlation between rates of overweight and obesity within each SHA (coefficient of determination (R^2) = 0.05).[5] In London, for example, 10.7% of Year R children are obese and 11.5% are overweight, a difference of just 0.8%, whereas in South East Coast SHA 9.0% are obese and 13.7% are overweight, a difference of 4.7% - almost six times greater than in London. This may be a reflection on the unreliability of the data.

For Year 6, the variability is greater – probably due to the lower, and more variable, response rates for this year group. Both obesity and overweight appear to be very low in the South East Coast, but given the 6% response rate for this area these figures should probably be disregarded. Among the remaining SHAs, obesity prevalence ranges from 14.1% to 19.6% (England average 17.3%) and overweight ranges from 13.1% to 14.7% (England average 13.8%). These SHAs again mirror the national pattern for the age group, with obesity outstripping overweight – but there is a stronger relationship between

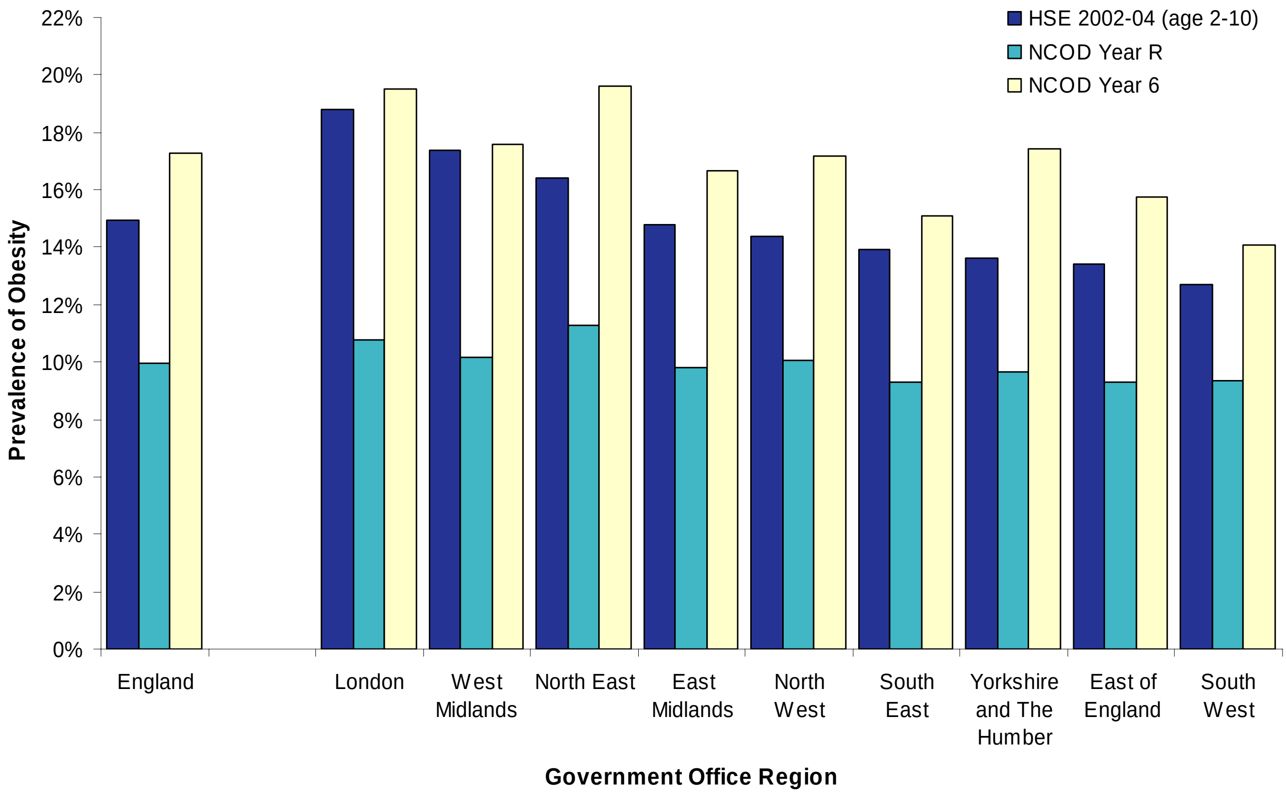
[5] The coefficient of determination reflects the relationship or linkage between two variables. Specifically, it is a measure of how much of the variation in Variable A can be explained by changes in Variable B. In this example, only 5% of the variation in the prevalence of obesity can be explained by the prevalence of overweight pupils. We would expect these two variables to be more closely linked.

the prevalence of overweight and obese pupils within each SHA (coefficient of determination (R^2) = 0.5). In this case, London SHA has the largest (rather than the smallest) difference, at 5.6%, and the South West has the smallest, at 1.0%.

Figure 11 and Table 4 compare the NCOD figures with the estimates of childhood obesity prevalence by region obtained from the HSE for 2002, 2003 and 2004 data combined.[6] Because the HSE data are based on Government Office regions, the South East and South Central SHAs have been combined in this chart. The HSE figures include all children aged 2-10 which means that they cannot be compared directly to either year group in the NCOD. HSE data on overweight children are not routinely available by region and so are not included.

It should again be emphasised that although the HSE data are based on a much smaller sample than the NCOD, low response rates and data quality concerns associated with these figures mean that results from the HSE are used here as a reference standard to which the NCOD can be compared.

Figure 11: Reported prevalence of obesity in children by region, comparing figures from the Health Survey for England (2002-04) and provisional data from the NCOD (2005-06)



[6] Statistics on Obesity, Physical Activity and Diet: England, 2006. The Information Centre for Health and Social Care, London, 2006.

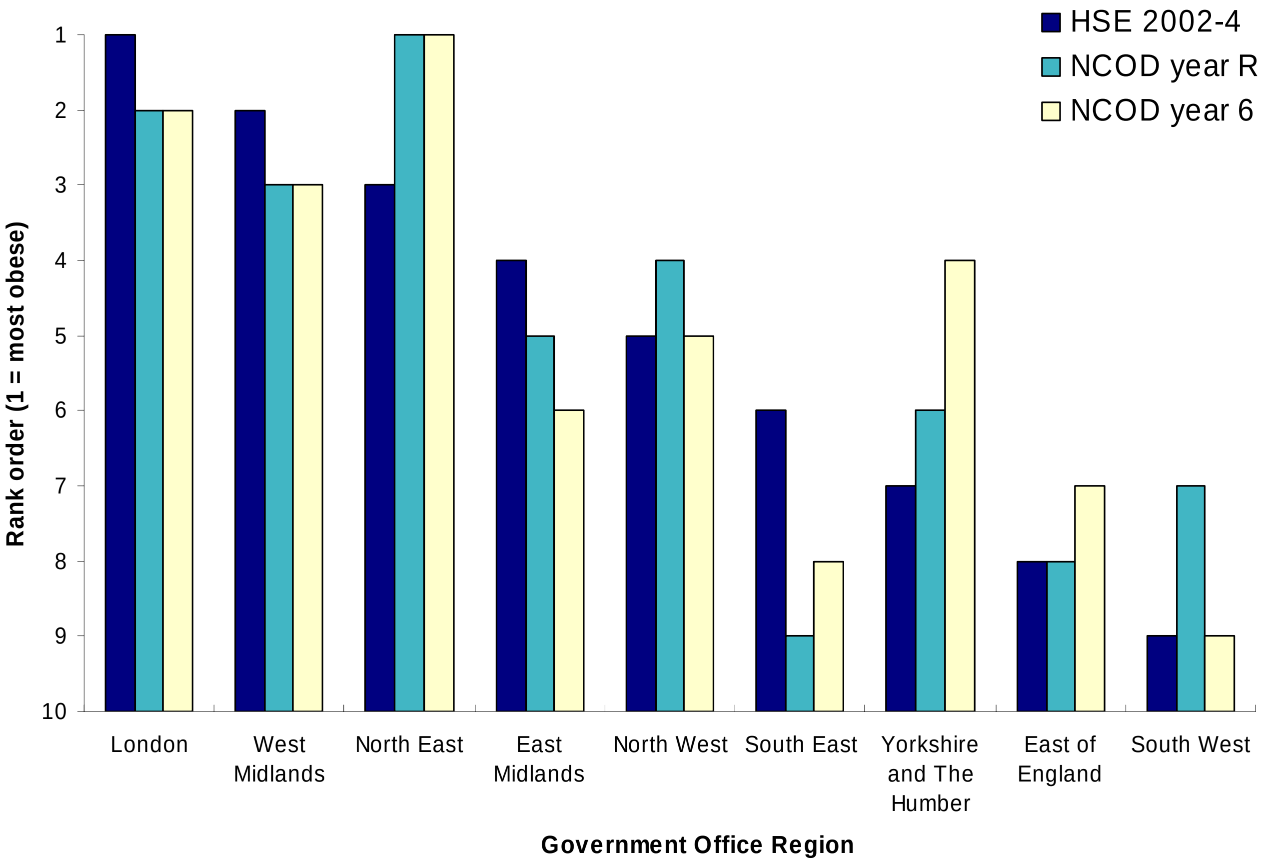
Table 4: Reported prevalence of obesity in children by region, comparing figures from the Health Survey for England (2002-04) and provisional data from the NCOD (2005-06)

Government Office Region	HSE 2002-4			NCOD YR			NCOD Y6		
	Prevalence	Upper 95% limit	Lower 95% limit	Prevalence	Upper 95% limit	Lower 95% limit	Prevalence	Upper 95% limit	Lower 95% limit
London	18.8%	21.7%	16.2%	10.7%	11.0%	10.5%	19.5%	19.9%	19.1%
West Midlands	17.4%	20.4%	14.7%	10.2%	10.5%	9.9%	17.6%	18.1%	17.1%
North East	16.4%	20.5%	13.0%	11.3%	11.7%	10.9%	19.6%	20.2%	19.0%
East Midlands	14.8%	17.9%	12.2%	9.8%	10.2%	9.5%	16.7%	17.1%	16.2%
North West	14.4%	16.9%	12.2%	10.0%	10.3%	9.8%	17.2%	17.5%	16.9%
South East	13.9%	16.1%	11.9%	9.3%	9.6%	9.0%	15.1%	15.6%	14.6%
Yorkshire and The Humber	13.6%	16.3%	11.3%	9.6%	10.0%	9.3%	17.4%	17.9%	16.9%
East of England	13.4%	16.0%	11.1%	9.3%	9.7%	8.9%	15.8%	16.2%	15.3%
South West	12.7%	15.5%	10.4%	9.3%	9.7%	9.0%	14.1%	14.6%	13.6%
England	15.0%	15.8%	14.1%	10.0%	10.1%	9.9%	17.3%	17.4%	17.1%

Due to the sample size of the HSE, the prevalence estimates have wide confidence limits and most differences between regions are not statistically significant. London is the only exception, having a significantly higher prevalence of obesity than the England average. The larger sample size of the NCOD means that more statistically significant differences are apparent between regions. Because the confidence limits do not take account of poor response rates or other data quality issues, little weight should be attached to these differences.

Given the uncertainty surrounding the prevalence figures derived from the NCOD, examining rank order is a useful way of comparing regional prevalence from each source. In Figure 11 the regions are arranged in rank order by HSE prevalence, and the pattern which emerges can be seen more clearly when the results are plotted purely by rank, as in Figure 12. Although the ranks differ it is interesting to see a degree of correspondence, with some regions consistently receiving low ranks whilst others are always ranked high. The correlation between the prevalence figures for obesity from the HSE and the NCOD data is reasonable: R^2 is 0.63 for Year R and 0.66 for Year 6, both significant correlations at the 95% significance level.

Figure 12: Rank obesity prevalence by region, comparing HSE (2002-04) and NCOD (2006)



6. Conclusions

The National Childhood Obesity Database is potentially an extremely valuable source of data on childhood obesity because of the very large numbers involved and the fact that it collates data from across the country in a uniform and consistent way. Over half a million children were weighed and measured across England as a whole in 2005-06 – nearly half of those eligible.

This first year of data collection has involved significant practical challenges and the establishment of complex systems for collecting, reporting and collating data. As a result, the dataset for 2005-06 is incomplete and the data have required considerable cleaning, which is still not complete. However, the experience of collecting, uploading and analysing the data for 2005-06 has yielded many useful lessons and should enable the measurement exercise and data analysis to proceed more smoothly in future years. These lessons could not have been learned without careful scrutiny of this year's dataset.

Several factors limit the reliability of the results cited in this report and mean that they must be treated with caution. Poor response rates in many areas, problems with the uploading of data, uncertainty about denominators and reports of selection bias due to the preferential opting out of children with higher

BMIs all mean that the figures are unreliable. This is especially true of the regional figures, since many of these factors will be exaggerated at that level of analysis.

Nationally, of those children measured, 12.3% of girls and 13.4% of boys in Year R were found to be overweight, and 9.2% of boys and 10.7% of girls in the same year group were found to be obese. In Year 6, 13.8% of boys and girls were overweight, and 15.4% of girls and 18.9% of boys were obese.

Comparison with figures from the Health Survey for England suggest that the NCOD underestimates the real prevalence of obesity in children, although it is encouraging that the overall patterns (eg relative prevalence of overweight and obesity between age groups and sexes) are similar for NCOD and HSE, and that the rank order for Strategic Health Authorities is similar too. This suggests that any systematic errors are fairly consistent across regions – although there is evidence that the figures for Year 6 girls are less reliable than the others.

The most important challenge for future years will be improving the response rate at every level. This includes ensuring that every child in the classroom is equally likely to be measured, and overcoming the preferential opting out of overweight and obese children which will otherwise continue to be a significant and unpredictable source of selection bias. Further research might be helpful to investigate the impact of selective opting out and to explore ways of achieving the maximum level of coverage.

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Appendix: confidence limits

As explained in a footnote in section 3 of this report, confidence limits give an indication of the likely error around a rate or percentage estimate which has been calculated from measurements on a sample of the population. Taking account of the sample size involved, they indicate the range within which the true value for the population as a whole can be expected to lie. For example, we can be 95% sure that the true population value lies within the range defined by 95% confidence limits. Larger sample sizes lead to narrower confidence intervals, since there is less natural random variation in the results when more individuals are measured.

The prevalence estimates from the NCOD have relatively narrow confidence limits because of its large sample size. However, confidence limits do not include any assessment of error from other sources, such as low response rates, bias or poor data quality. These are all very important factors in this case. As a result, the narrow confidence limits may give a misleading impression of precision.

Despite this, confidence limits are shown in this report on graphs which present only prevalence figures from the NCOD (Figures 2, 9 and 10). Confidence limits are valid for these figures, since they compare data from the same source – 'like with like'. Although they cannot account for the potential effects of bias in the sample or any other data quality problems, these confidence limits give an indication of whether any observed differences in prevalence (e.g. between boys and girls, or between Year R and Year 6) are likely to be real, or whether they are likely to be due to chance and the small numbers involved. Where confidence limits for two subgroups do not overlap, the difference can be said to be statistically significant.

For example, consider the difference between the estimated prevalence of obesity in boys and girls in Year 6, as shown in Figure 2. Here the confidence limits do not cross, so within the sample there is a significant difference between male and female obesity prevalence. This does not mean that a difference really exists within the population as a whole. Much of this observed difference in prevalence may be due to selective opting out of heavier girls. In this instance, however, statistical analysis shows that, even if all the girls who seem to have opted out (given the difference in response rate between boys and girls in this year group) were in fact obese, there would be still be a significant difference in obesity prevalence between the sexes for Year 6, although the difference would be much smaller (0.5% instead of 3.5%). The confidence limits are useful, therefore, since they indicate whether observed differences are worth further investigation.

The confidence limits around prevalence estimates from the HSE are relatively wide, since they are based on a much smaller sample. However, because of the precise way in which the sampling and measurements are undertaken, HSE figures are regarded for the purposes of this report as more reliable, and as a benchmark to which NCOD results can be compared.

Confidence limits are not shown in this report on graphs where data from the NCOD and the HSE are compared (Figures 3, 4, and 11), because they could give a misleading impression that the NCOD figures are more reliable. In the case of Figure 11 the confidence limits are included in a table within the main body of the report. Confidence limits for Figures 3 and 4 are set out in Table 5 below so that they are available if required.

Table 5: Prevalence of obesity in children by sex and age group, comparing figures from HSE (2001-2) and NCOD (2006), with 95% confidence limits

Sex / Survey / Age group		Measured	Obese			Overweight		
			Prevalence	Upper 95% limit	Lower 95% limit	Prevalence	Upper 95% limit	Lower 95% limit
Males								
HSE	Age 4&5	659	13.8%	16.7%	11.4%	16.2%	19.3%	13.6%
NCOD	Year R	152400	10.7%	10.9%	10.6%	13.4%	13.6%	13.2%
HSE	Age 10&11	738	20.0%	23.0%	17.3%	14.3%	17.0%	11.9%
NCOD	Year 6	125400	18.9%	19.2%	18.7%	13.8%	14.0%	13.6%
Females								
HSE	Age 4&5	663	11.1%	13.7%	8.9%	12.6%	15.4%	10.3%
NCOD	Year R	145200	9.2%	9.3%	9.0%	12.3%	12.4%	12.1%
HSE	Age 10&11	724	18.2%	21.2%	15.6%	16.5%	19.4%	14.0%
NCOD	Year 6	115400	15.4%	15.6%	15.2%	13.8%	14.0%	13.6%