Are Teachers' Judgements of Pupils' ability influenced by body shape?

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Abstract

Background: Evidence indicates that teachers can judge pupils based on their physical appearance, including their body shape. Teacher bias towards obese pupils has been suggested as a potential pathway through which obese children attain at relatively lower academic levels. The aim of this study was to investigate whether teachers' judgements of pupils' ability are influenced by the body shape of the child. **Methods:** The sample includes English, singleton children in state schools from the Millennium Cohort Study. The data were taken from the fourth wave of data collection, when the children were approximately aged 7. 5 086 / 5 072 children had teacher ability ratings of reading and maths respectively. Logistic regression analyses were used to test whether teachers' perceptions of child's reading and mathematics ability were influenced by pupil's waist circumference, conditional upon cognitive tests scores of reading and maths ability. **Results:** After adjustment for cognitive test scores, there is no significant overall relationship between pupil's waist circumference and teacher judgements of ability. No statistically significant differences in the probability of being judged as above average ability remain after further adjustment for potential confounders. **Conclusions:** There is little evidence that teachers' judgments of pupils' ability are influenced by obesity.

Introduction

Generalised stigma towards the obese is well documented (1). Indeed obesity may well be the last acceptable form of prejudice in society. Persistent negative stereotypes of obese children have been demonstrated by both children and adults at different points in time (2-6). It has been suggested that the stigmatisation of obese children has become worse over time (7).

Recent evidence suggests that teachers stereotype children's ability based characteristics such as gender, ethnicity and income (8, 9). Given the extent of the stigmatisation of the obese in society, perhaps teachers' perceptions of pupils' ability levels are also influenced by the body shape of the child. Obese pupils do tend to have lower educational attainment, and teacher bias has been suggested as a potential explanatory pathway (10, 11).

Previous research indicates a link between physical attractiveness of a child and teacher expectations (12, 13). 'Less attractive' children are expected to be of lower ability and to be less successful in life. PE teachers have been shown to judge obese pupils' cognitive abilities and social skills more negatively than non-obese children (14, 15). Furthermore, responses to the fat phobia scale (16) showed that PE teachers held more negative attitudes towards overweight pupils than normal weight pupils (15).

Whilst it might be expected that PE teachers would hold more negative attitudes towards obesity, teachers in general have also been shown to hold anti-fat attitudes towards obesity (17), and to

demonstrate fat bias when rating pupil characteristics based on photographs (18, 19).

Given previous research, it seems plausible that teachers' judgments of pupils' ability could be influenced by the body shape of the child. This could have important implications for Key Stage 1 (KS1) and Foundation stage profile (FSP) results, as these assessments are based purely on in-school assessment by class teachers. The FSP is assessed when children are aged 5 and KS1 when children are aged 7, so they form an initial foundation of recorded attainment.

Given strong associations between early attainment and later progress and achievement (20), and indications that early academic success may lead to self-fulfilling prophesies in later schooling (21), if children are under-assessed during primary school, this may set a trajectory where the overweight child does not fulfil their potential. The aim of this research, therefore, is to investigate whether teachers' assessments of pupil ability are affected by pupil's body shape.

Method

Sample

The Millennium Cohort Study (MCS) is a UK longitudinal birth cohort study. The sample population was drawn from all live births in the UK over a period of just over a year. In England and Wales all children born between 1 September 2000 and 31 August 2001 were included in the sample, forming an academic cohort for these

countries. Data collection took place when children were approximately 9 months old (sweep 1, in 2001), approximately 3 years old (sweep 2), approximately 5 years old (sweep 3), approximately 7 years old (sweep 4) and approximately 11 years old (sweep 5). Data from the fourth sweep of the Millennium Cohort Study is used in this analysis.

Only English, singleton children not attending fee paying schools were included in this analysis. Twins and triplets were not included because bias may operate differently for siblings, with perceptions of one potentially impacting on the perceptions of the other(s). 8 867 children met these criteria. The sample is restricted in this way to make it as homogenous as possible, so that different education systems or other influences on teacher bias and stereotyping are minimised. Responses to the survey of teachers at sweep four were only received for a subsample of pupils. 5 086 children had teacher ratings for reading and 5 072 children had teacher ratings for maths. While the obtained sample at sweep 4 is considerably smaller than the sample of English children at sweep 1 (11 695), comparisons (described elsewhere (8)) with nationally representative statistics from the Department for Education (DfE) in 2008-2009 suggest the sample does not appear to be biased.

In some cases one teacher responds for more than one child. Therefore responses were clustered by teacher serial number to account for the fact that these responses would be more similar

than those from two different teachers. This gave 3113 clusters for maths and 3123 clusters for reading.

Dependent Variables

Teachers were asked to 'rate [the given] aspect of the study child's ability and attainment in [reading / maths]…in relation to all children of this age…' They were asked to label the child as 'well above average / above average / average / below average / well below average.'

Binary variables were created for whether the teacher judged the pupil's ability in maths or reading to be above average (i.e. well above average and above average) or not. As a robustness check binary variables were also created for whether the teacher judged the pupil's ability to be below average (including below average and well below average) or not.

The characteristics of the sample are presented in table 1. As can be seen in the table, teachers rated a large proportion of pupils as above average ability in reading (45.39%) and maths (39.81%) and relatively few pupils were rated as below average ability.

Independent Variables

Cognitive tests were taken by the children when they were about age 7. These tests were administered in their homes by a survey administrator and included the British Ability Scale Word Reading test (see http://www.gl-assessment.co.uk/products/bas3) and a shortened version of the Progress in Mathematics test (see

http://www.gl-assessment.co.uk/products/progress-maths). The Word Reading test assesses children's English reading ability and the Progress in Maths test measures ability across the use of numbers, shapes and skill in data handling. Rasch scaling was used to convert the raw scores of the shortened Progress in Mathematics test into equivalent scores had the children completed the whole test (see(22)).

Child body shape was measured using Waist Circumference (WC) measurements. WC was chosen over other measures such as BMI or body fat, because adiposity measured in this way is more easily observable by the teachers. However, robustness checks were also carried out using deciles of BMI and percentage body fat (measured using BF-522W scales). The waist circumference of this English subsample was compared with the full MCS sample at sweep 4 (taking into account the complex sample design and attrition from the sample using the 'svy' commands in Stata), to ascertain whether or not children in this subsample were representative in terms of their body shape. The mean WC (English subsample=57.03(SE=0.08): Full MCS=57.16(SE=0.07)) and median WC (English subsample=56: Full MCS=56) were very similar in both samples.

WC was measured to the nearest millimetre using a SECA tape. Where possible, measurements were taken against the skin, otherwise they were taken over light clothing. There was a standardised procedure for measuring waist circumference; this involved visually finding the midpoint between the lower ribs and

hip bone. Measurements were taken twice using the same protocol; where discrepancies were found a third measure was taken (23). WC ranged from 39.5 to 87.8cm in the sample and was divided into equal tenths (deciles). As children with the highest waist circumference are the focus of the analysis, they are used as the reference category.

Covariates, or "control variables" were included in the model because they could be potential confounders in the relationship between child's body shape and teacher's judgements of child's ability. Interviewer measured and cleaned height (cm) was included as waist circumference will vary by height, and it was important to separate out the effect of small/large children generally, who may be developmentally more mature, and slim/fat children. By including height in the analysis it is possible to test for potential interaction effects.

Demographic characteristics of the children were also controlled for including: Parent report of child's sex, parent report of child's ethnicity (White / Black African / Black Caribbean / Bangladeshi / Pakistani / Indian), OECD equivalised weekly familial income measured at sweep 4 and parent report of perceived financial situation (Living comfortably/ Doing alright/ Just about getting by/ Finding it quite difficult/ Finding it very difficult). Other control variables included parent report on whether English is a second language (EAL), as this provides some indication both of the family's culture and the child's communicative capacity, teacher report of

any recognised Special Educational Needs (SEN), as children with SEN are more likely to be overweight/obese (24), and month of birth of the child, because of the well documented relationship between month of birth and child attainment (8) as well as the possibility that older children may have larger body shapes.

Statistical Analysis

The data were analysed using Stata version 12 (25). Nested same sample logistic regression models were used to examine the extent to which pupil's body shape influenced teachers' perceptions of student ability. These logistic regression models had the binary indicators of teachers' perceptions of reading or mathematical ability as the outcome variable. The results are presented as marginal effects; therefore they represent the difference in probability of being judged as above average ability, in reading or maths, compared to the highest WC decile.

Firstly the unadjusted relationship between waist circumference and teacher's judgements of pupil's ability were analysed (model 0), then this relationship was adjusted for height (model 1). Reading or mathematic cognitive test scores were then included for the appropriate outcome variable as predictor variables (model 2), so that the results could be interpreted as the probability of being judged above or below average ability, given body shape, conditional upon cognitive test scores.

The other covariates were added to the model sequentially. In Model 3 the probabilities were further adjusted for sex, ethnicity, income, & perceived financial situation, and in Model 4 they were adjusted for EAL, SEN recognition and month of birth. Interaction effects between height and waist circumference were tested to investigate the effect of different body shapes on teacher judgements. Robustness checks were also carried out using different outcome measures and different measures of child body shape. These additional analyses are not reported in the tables, but all are available from the authors upon request.

[Table 1 about here]

Results

Reading

The results for teacher judgements of reading ability are shown on the right hand side of table 2 and table 3. Table 2 shows the relationship between pupil's waist circumference and teacher judgments, and table 3 shows the conditional relationship after controlling for cognitive test scores.

For the unadjusted analyses (table 2, model 0), children in WC decile 6 & 8 had significantly higher probabilities of being judged as above average ability. After adjustment for height (model 1), all WC deciles had a higher probability of being judged as above average ability than the highest WC decile and most of these differences were statistically significant or approaching significance.

After the addition of the reading cognitive test scores, children in WC decile 5,6 & 7 were significantly more likely to be judged as above average ability than children in WC decile 10. The difference in probability was particularly large for WC decile 6, whose probability of being judged as above average ability was 12 percentage points higher than children in the largest WC decile. Parameter tests revealed that the overall relationship between waist circumference and teacher judgements of reading ability was not significant, but was approaching significance (χ^2(10)=17.19, p<0.10), conditional upon cognitive tests scores of reading ability.

Following the adjustment for demographic characteristics (model 3), the overall relationship between WC and teacher judgements of ability was no longer borderline significant (χ^2(10)=10.61, p>0.05). However, pupils in WC decile 6 were still significantly more likely to be deemed as above average ability than children in WC decile 10. The direction of the differences in probability was still in the expected direction, with almost exclusively (except WC decile 3) higher probabilities for pupils that were not obese. After full adjustment of the model (model 4), no significant differences in the probability of being judged as above average ability remained. However, higher probabilities of being judged as above average ability were still estimated for children in WC decile 2,5,6,7 & 9.

<u>Maths</u>

Maths

The results for teacher judgements of math ability are shown on the left hand side of tables 2 and 3. The unadjusted relationship between WC and teacher judgments (Model 0), showed that children in WC decile 1 had significantly lower probability, and children in WC decile 6 significantly higher probability of being judged as above average ability. After adjustment for height (model 1), all WC deciles were more likely to be judged as above average ability than WC decile 10 and the difference in probability was significant for WC deciles, 2,5,6 & 8.

However, after adjustment for cognitive test scores of math ability, the overall relationship between WC and teacher judgements of ability was not significant (χ^2(10)=14.91, p>0.05). Pupils in WC decile 2 were significantly more likely than those in WC decile 10 to be judged as above average ability. After adjustment for demographic characteristics, the difference in probability between WC decile 2 and 10 was no longer significant, and after full adjustment of the model (model 4), most of the WC deciles had lower probabilities of being judged as above average ability. There were no statistically significant differences in probability, but children in WC decile 3 had a probability which was seven percentage points lower than children in WC decile 10, which was approaching significance (p<0.10).

[Table 2 about here]

[Table 3 about here]

An interaction between height (divided into quintiles) and WC was tested, as this allowed us to look at a range of height/waist combinations. The interaction was not significant for reading (χ^2(36)=28.82, p>0.05) or maths (χ^2(36)=24.71, p>0.05). Interestingly, the effect of height persisted until adjustment for month of birth, suggesting that height may be proxying birth month.

Robustness

The following robustness checks were carried out to ensure the null finding was not constructed through specific choices made by the researchers. The logistic regression models were run with teacher judgements of below average ability, rather than above average ability. Two other measures of body shape were also utilised instead of waist circumference, BMI and body fat percentage. Cognitive test scores were entered into model using deciles rather than the continuous measure, to allow for non-linearity in the impact of academic ability. The results from these analyses are substantively no different from those presented here. After full adjustment of the model, there was very little evidence of any bias in teacher perceptions of children's ability by children's body shape, conditional upon cognitive test scores.

Discussion

The overall results suggest little association between teacher's judgements of reading or math ability and child's waist circumference, conditional upon cognitive test scores. The

relationship between WC adjusted for height and teacher judgements (model 1) shows the expected relationship, with children who were not obese significantly more likely to be judged as above average ability. However, for both reading and maths, there was no overall relationship between waist circumference and teacher judgements, conditional upon test scores (model 2). This suggests no direct relationship between children's waist size and bias in teacher judgements of ability in reading and maths.

The attenuation of the relationship between waist size and teacher judgements after controlling for cognitive test scores may suggest some relationship between waist size and cognitive test performance. However, it is more likely that cognitive test scores are proxying for other characteristics of the children, such as income, ethnicity, SEN, EAL (8).

The remaining differences found between children with different WC measurements conditional upon cognitive test scores were no longer statistically significant after adjustment for the control variables. This means that the difference in probability could largely be attributed to the correlation between waist circumference and these other factors, rather than a direct effect of waist circumference on teacher judgements.

Our overall findings therefore contradict previous studies (17-19).Perhaps methodological differences can account for these

seeming disparities. In previous studies, teachers are being asked to judge unknown pupils based on very limited information, just a photograph or a photograph and an essay. In contrast, the teachers in this sample actually teach the pupils in question and have more information than the pupil's physical appearance to judge them on. Therefore physical appearance may play less of a role in their judgements, than for example, their past experiences with the pupil and their prior observations of the pupil's ability.

Many of the studies in this area are quite old or based on reasonably old data, so it may be that, despite suggestions that stigma towards the obese has widened over time (7), teachers' perceptions of pupils are less influenced by obesity presently, perhaps due to increasing prevalence rates. This may because it is becoming the norm for teachers to see larger body shapes, as fat becomes the new normal (26).

Whilst the findings suggest no significant effect of WC on teacher judgements of ability for either reading or maths, there is some indication that for reading, children who have waist circumferences in the middle of the distribution have a higher probability of being judged as above average ability. The same is not found for mathematics, whereby after full adjustment of the model, all other WC groups have an equal or lower estimated probability of being judged as above average ability. This is congruent with previous research, which finds greater biases and disparities according to pupil characteristics in teacher perceptions of reading ability (8, 27).

This may be because maths ability and performance can be more concretely and discretely measured and demonstrated than reading ability. If judgement of reading involves a greater degree of subjective discretion than judgement of maths, this allows more scope for bias based on extraneous pupil characteristics.

Any bias in teachers' perceptions of ability may lead to less accurate assessments. Teacher assessments form a large part of initial educational attainment, which can be used to set and stream pupils into ability groups. It is well known that educational attainment largely tracks through childhood, so that high achievers at KS1 tend to stay high achievers at GCSE level (28). It is therefore very good news that overall teacher judgements of pupils ability appear not to be influenced by pupil's waist size.

However if teacher bias is not the link between child obesity and lower attainment, as we suggest here, then we have to consider other potential pathways. Nutrition is a plausible pathway, as nutrition is closely linked to obesity and academic performance of children (29). Another potential pathway could be the differential brain activity in obese and non-obese children (30). It may well be that some of these differences can account for lower attainment also.

<u>Strengths & Limitations</u>

There are several strengths to this analysis. Firstly most studies in this area use small sample sizes, because of the cost and time

restrictions posed on primary data collection. The sample size in this analysis is large in comparison, allowing for greater statistical power and increased confidence in the results. Secondly, the method of measuring teacher judgements conditional upon children's obtained cognitive test scores has, to the authors' knowledge, not been applied for this purpose before. This method provides a measure of discrimination as it identifies the discrepancy between the teachers judgements of ability and test-measured ability. Thirdly the responses to the teacher survey are completely confidential and are not part of or required by the education and assessment system. Therefore they do not inform evaluations of the teacher or the school. These judgement measures are more likely to be agenda free than other teacher assessments of ability, and should more accurately reflect the teacher's actual perceptions of the pupil's ability.

One potential limitation to this study is that the deciles of waist circumference do not directly correspond to any predefined obesity or underweight cut off criteria. Given that the aim of using WC measures was to capture visually observable differences in children's body shape, this limitation isn't problematic for the interpretation of the results. Furthermore robustness checks using two other measures of children's body composition found similar results to those presented here.

Conclusion

We find little evidence that teachers' judgements of pupils' ability in reading or maths are influenced by child obesity. Teacher bias cannot explain why obese children have lower educational attainment, so alternative explanations should be explored.

Conflicts of interest statement

There are no conflicts of interest to disclose

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Table 1. Characteristics of the sub sample of the Millennium Cohort Study used in this analysis.

Characteristic	n (%)
Teacher Perceptions	
Reading above average	2 308 (45.39%)
Maths above average	2 019 (39.81%)
Sex	
Male	2 590 (50.39%)
SEN	
SEN ever recognised - yes	1183 (23.26%)
OECD poverty indicator	
Below 60% Median	1 458 (28.39%)
EAL	
English only	4 427 (86.13%)
Ethnicity	
White	4 103 (80.58%)
Mixed	173 (3.40%)
Indian	156 (3.06%)
Pakistani	287 (5.64%)
Bangladeshi	87 (1.71%)
Black Carribean	70 (1.37%)
Black African	119(2.34%)
Other Ethnic	97 (1.90%)
Cognitive Test Scores	Mean (SD)
Word Reading test	109.57 (29.83)
Mathematics test	18.48 (5.81)
Waist Circumference (WC)	Mean (SD)
overall	57.02 (5.94)
Deciles of WC	Mean WC (cm)
Lowest 1	49.32
2	51.98
3	53.29
4	54.27
5	55.48
6	56.63
7	57.84
8	59.54
9	62.52
Highest 10	70.21

Table 2. Unadjusted odds ratios for the likelihood of being classified as above average ability in reading ability and math ability by deciles of waist circumference.

	Maths		Reading	
	Model 0	Model 1	Model 0	Model 1
1.waist	-0.06	0.04	-0.02	0.06
	(0.03)*	(0.03)	(0.03)	(0.03)+
2.waist	0.03	0.11	0.03	0.09
	(0.03)	(0.03)***	(0.03)	(0.03)**
3.waist	-0.04	0.03	-0.02	0.04
	(0.03)	(0.03)	(0.03)	(0.03)
4.waist	-0.00	0.06	0.03	0.08
	(0.03)	(0.03)+	(0.03)	(0.03)*
5.waist	0.04	0.09	0.06	0.10
	(0.03)	(0.03)**	(0.03)+	(0.03)***
6.waist	0.07	0.11	0.08	0.11
	(0.03)*	(0.03)***	(0.03)*	(0.03)***
7.waist	0.02	0.05	0.03	0.06
	(0.03)	(0.03)+	(0.03)	(0.03)*
8.waist	0.04	0.07	0.07	0.09
	(0.03)	(0.03)*	(0.03)*	(0.03)**
9.waist	0.03	0.05	0.05	0.06
	(0.03)	(0.03)	(0.03)	(0.03)*
10b.waist	*Reference Category*		*Reference Category*	
N	5,072	5,072	5,086	5,086

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

Probability of being judged above average ability is .40 for maths, .45 for reading

Model 0 = Waist Circumference deciles

Model 1 = Model 0 + height

Table 3. Adjusted odds ratios for the likelihood of being classified as above average ability in reading ability and math ability by deciles of waist circumference, conditional upon cognitive test scores.

	Maths			Reading		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
1.waist	-0.01	-0.03	-0.05	-0.00	0.01	-0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
2.waist	0.08	0.06	0.04	0.06	0.06	0.03
	(0.04)*	(0.04)+	(0.04)	(0.04)	(0.04)	(0.04)
3.waist	-0.02	-0.05	-0.07	0.01	-0.01	-0.03
	(0.03)	(0.04)	(0.04)+	(0.04)	(0.04)	(0.04)
4.waist	0.03	0.01	-0.02	0.04	0.02	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
5.waist	0.04	0.01	-0.01	0.09	0.07	0.04
	(0.03)	(0.04)	(0.04)	(0.04)*	(0.04)+	(0.04)
6.waist	0.05	0.03	0.00	0.12	0.09	0.06
	(0.04)	(0.04)	(0.04)	(0.04)**	(0.04)*	(0.05)
7.waist	0.00	-0.02	-0.05	0.08	0.06	0.03
	(0.03)	(0.03)	(0.04)	(0.04)*	(0.04)	(0.04)
8.waist	0.03	0.01	-0.02	0.06	0.04	0.00
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
9.waist	-0.00	-0.01	-0.02	0.05	0.04	0.02
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
10b.waist	*Reference Category*			*Reference Category*		
N	5,072	5,072	5,072	5,086	5,086	5,086

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

Model 2 = Model 1 +cognitive test score,
Model 3= Model 2 + ethnicity, income + sex,
Model 4=Model 3 + month of birth, SeN+ EaL.