Obesity and children's exam results

The excess body weight of many children in Britain is a major health concern. But according to research by *Stephanie von Hinke Kessler Scholder* and colleagues, which combines genetics and economic analysis, obesity does not seem to have damaging educational consequences.

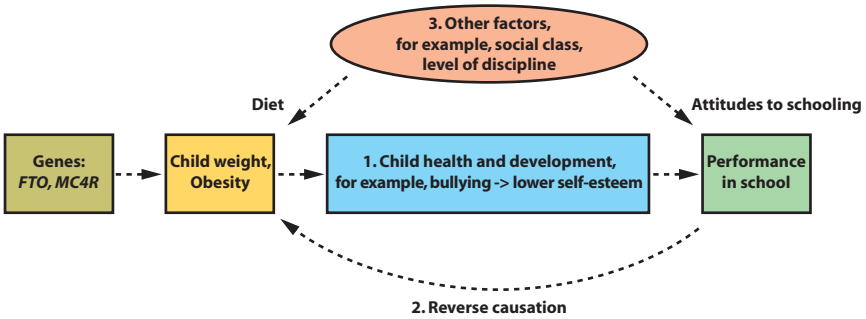

Figure 1: Potential interactions between children's weight and educational outcomes

Two thirds of adults and one third of children in Britain are currently overweight or obese. If nothing is done, these proportions are expected to rise to 90% of adults and two thirds of children by 2050. The trend affects everyone, causing ill health, such as diabetes and heart disease, and a financial cost to society that includes both direct costs to the NHS and indirect costs, such as lost earnings from sickness or early death.

In addition to these health and financial consequences, obesity may be linked to worse economic outcomes for individuals, such as wages in adulthood or the educational performance of children. Our research focuses on the question of whether obesity affects children's exam results.

There are three possible reasons for an association between children's obesity and their exam results. First, obesity could cause worse results by affecting children's health and development. For example, research shows that sleeping problems are more common among overweight children. Insufficient sleep can in turn affect children's concentration in class and hence their exam results.

Similarly, obese children may be bullied by their classmates, lowering their confidence and hence their performance (number 1 in Figure 1). But being treated differently may mean that instead of taking part in social activities such as sport, these children spend more time studying and preparing for school, improving their exam results.

Second, there may be 'reverse causation' with children's exam results affecting their body weight. For example, children may over-eat to compensate for doing poorly at school (number 2 in Figure 1). Conversely, any stress caused by low exam results may reduce children's appetites and lead to weight loss.

Third, rather than a causal relationship, the association may be driven by other factors that affect both weight and exam results in school. For example, a family's socio-economic position will shape children's diet and attitudes to school, affecting both their weight and exam results (number 3 in Figure 1). Similarly, rather than playing sport, some children may have an (unobserved) preference for using this time to study, which in turn improves their exam results.

Our research focuses on the first point: whether there is a causal effect of children's obesity on their performance in school. But simply measuring the correlation between obesity and school performance does not necessarily answer the question since the correlation will combine all three elements into one estimate.

To quantify the actual *causal* effect, we combine the latest developments from genetic epidemiology with statistical methodologies applied in economic and econometric research. More specifically, we use two carefully chosen 'genetic markers' (specific locations on children's DNA), which are known to predict variation in children's weight.

Medical and epidemiological research has shown that genes are spread randomly from parents to children. This randomness implies that they are not related to other factors, such as social class. (Note there is no link between genes and other factors in Figure 1.)

Findings from medical and epidemiological research show that certain sections of both the *FTO* and *MC4R* gene increase children's and adults' weight. We therefore use the

Obesity is not a major factor affecting children's exam results

variation in weight that is explained by these specific genes and relate *that* to children's performance in school. The idea is that this correlation measure excludes any confounding due to other factors as well as any possible reverse causation. It therefore gives an estimate of the *causal* effect of obesity on academic performance.

We analyse data on almost 4,000 members of the 'children of the 1990s' birth cohort, who were born in and around Bristol in 1991/92. These young people are now in their late teens but they continue to be followed up by this long-running study.

The data are very rich. For example, the measure of excess body weight commonly used in research is 'body mass index' or BMI, which is calculated as an individual's weight in kilograms divided by their height in meters squared. Specific points in the BMI distribution categorise people into underweight, healthy weight, overweight and obese groups. But the BMI measure does not distinguish between different types of body mass, such as fat, lean and bone mass.

The 'children of the 1990s' data do make these distinctions: they include a direct measure of the amount of fat mass carried by each child, as measured by a so-called DXA scan. So rather than using the standard BMI, we use a direct measure of children's fat mass, taken at age 11, to examine the effect on children's educational outcomes. More specifically, we focus on children's results at key stage 3, the nationally set exam taken at age 14 in state schools in England.

The results can be described in two stages. First, the simple correlation between children's obesity (as measured by their fat mass) and their exam results shows that heavier children do worse in school. But this association is small: heavier children only do slightly less well.

Second, using children's genetic markers to look at this finding in more detail and specifically explore the *causality*, we find no evidence that obesity causally affects exam results. We therefore conclude that obesity is not a major factor affecting children's educational outcomes.

These findings suggest that the previously found negative relationship is driven by other factors that affect both weight and educational attainment. These could include such factors as social class, but they may also simply represent individual preferences that are not directly observed by researchers.

This article summarises 'Genetic Markers as Instrumental Variables: An Application to Child Fat Mass and Academic Achievement' by Stephanie von Hinke Kessler Scholder, George Davey Smith, Debbie Lawlor, Carol Propper and Frank Windmeijer, CMPO Working Paper No. 10/229 (http://www.bristol.ac.uk/cmpo/publications/papers/2010/wp229.pdf)

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