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Childhood obesity and maternal education in Ireland

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ABSTRACT

This paper analyses the socioeconomic gradient of childhood obesity in Ireland using the Growing Up in Ireland data with three innovations compared to previous work in the area. A different measure of socioeconomic status, maternal education, is employed. In addition, the depth and severity of obesity are examined as well as the incidence. Finally, the use of two waves of longitudinal data permits the analysis of the persistence of obesity. Results show that overall childhood obesity stabilised between the two waves. However the socioeconomic gradient becomes steeper in wave 2 for girls and in particular when depth, severity and persistence of obesity are accounted for. Girls whose mothers fail to complete secondary education are shown to be at a particular disadvantage.

1. Introduction

There has been much concern in recent years about rates of obesity and overweight among children and adolescents, in Ireland and abroad.[1] Ireland for example has seen an ongoing campaign entitled *Let's Take On Childhood Obesity, One Step at a Time*, co-ordinated between the *safe*food organisation and the Department of Health, while international concern is reflected in the review by Han et al. (2010). There is also evidence that, in some countries at least, rates may have plateaued (Keane et al., 2014; Olds et al., 2011).

Childhood obesity is a cause for concern as it may be linked to a variety of serious conditions including cardiovascular dysfunction, type 2 diabetes, pulmonary, hepatic, renal and musculoskeletal complications. There are also likely to be adverse effects on health related quality of life and emotional states (Olds et al., 2011). In addition should obesity continue into adulthood, then there are increased risk factors for further serious conditions.

In this paper we examine the trend in obesity amongst a group of Irish children using a nationally representative data source, *Growing Up in Ireland (GUI)*. GUI follows the same children over time, and not only are we able to provide a snapshot of obesity at two different points in time for a cohort of nine year olds and then the same cohort of 13 year olds, in addition, since it is the same children in these cohorts, we are able to account for persistence vin obesity over this period. In carrying out this analysis we apply techniques employed in the economics literature on poverty and mobility. Recent research in these areas has moved on from just analysing snapshots at a given point in time and attention is now paid to examining persistence of poverty for the same cohort of people (see for example Jenkins and van Kerm, 2006; Grimm, 2007; Gradín et al., 2012). Similarly, in our analysis of obesity below, we incorporate measures which explicitly take account of persistence between periods.

A critical feature of our analysis is that we go beyond measuring the mere incidence or prevalence of obesity. We also measure what we term the *depth* of obesity i.e. the extent to which obese children exceed the obesity thresholds, and also what we term the *severity* of obesity, which takes account of the distribution of obesity amongst obese children. These additional measures are particularly relevant if risk ratios for an obese individual increase the higher above the obesity threshold they are.

There is considerable evidence that obesity, both for children and adults exhibits a socioeconomic gradient (McLaren, 2007; Chung, 2016), whereby obesity tends to be higher amongst those with lower socioeconomic status (SES). SES can be measured using a variety of indicators, including income, social class or education. In this paper we examine the gradient of childhood obesity with respect to maternal education levels (specifically, the highest level

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[1] For the sake of brevity we will use the generic term "children" to indicate anyone aged less than 18, while fully acknowledging that height and weight differ systematically by age. The two waves of data which we will be analysing include children aged 9 and 13, the latter age being more accurately described as early adolescence.

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of education achieved by the mother, or in her absence, the principal care-giver).

We have a number of reasons for choosing this particular measure of SES. First of all, in large survey-based datasets, it is likely to be measured with reasonable accuracy, more so than, for example, disposable income. Secondly, between the two waves of our data (when children are aged nine and thirteen) maternal education remains virtually unchanged. Finally, there is a long-established literature, dating from the seminal work of Grossman (1972) outlining the link between education levels and health. One of the proposed pathways whereby education may affect health is via decisions regarding diet and lifestyle and this would seem to be of particular importance with respect to obesity. It seems plausible that for most children decisions regarding diet would be made by the principal caregiver (in almost all cases the mother) and hence maternal education rather than child education may exert the more significant impact on childhood obesity.

It is also possible that paternal education could influence child health outcomes. However in our dataset paternal education is missing for a non-trivial number of observations and it seems likely that such observations are not missing at random. Hence we choose to concentrate on maternal education.

The remainder of the paper is laid out as follows. In Section 2 we discuss the measurement of obesity for children and review other work in this area for Ireland. We also refer to some of the literature on the socioeconomic gradient of childhood obesity. In Section 3 we discuss our data and also provide an analysis of obesity using the snapshot method i.e. we treat the data as if it were two cross-sections and do not exploit its panel nature. In Section 4 we take account of the panel nature of the data. In both Sections 3 and 4 we employ some of the techniques of the inequality/poverty literature. Section 5 provides discussion and concluding comments.

2. The measurement of obesity in children and adolescents

The most common measure of obesity for adults is derived from body mass index (BMI). BMI is obtained by dividing weight (in kilos) by height (in metres) squared. The World Health Organisation suggests a threshold BMI of 25 for "overweight", a threshold of 30 for "obesity" and a threshold of 40 for "severely obese".

It is worth noting that there is criticism of BMI as a measure of obesity with some authors suggesting that other measures such as total body fat, percent body fat and waist circumference are superior measures of fatness (see Burkhauser and Cawley, 2008). However, most of the alternative measures suggested are typically not available in large-scale, nationally representative datasets. Thus we will use BMI as our indicator for obesity in this paper, while bearing in mind that the nature of the analysis presented here could also be applied to alternative measures of obesity.

There is, however, an additional issue which must be taken into account when using BMI to measure obesity in children. While the BMI thresholds for adults have general acceptance and do not change with age, the same is not true for children, where BMI can change substantially with age and gender. For example, at birth median BMI is around 13, this increases to 17 at age 1, decreases to 15.5 at age 6 and increases to 21 at age 20 (Cole et al., 2000). Cole et al. (2000) provide a set of cutoff points for BMI for childhood based upon international data and which they suggest should be used for international comparisons. They obtain these by drawing centile curves which pass through the adult cut-off points at age 18 and which then can be traced back to provide "equivalent" cut-off points for different ages and genders. The cutoffs are obtained by averaging data from large nationally representative surveys from Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the US, with in total nearly 200,000 observations aged from birth to 25.

The cutoffs are provided at half-yearly intervals. Thus for the first wave of our data, the vast majority of children are aged 9. Assuming that age is distributed uniformly within the cohort of nine year olds, it seems appropriate to take the cut-off for age 9.5. Similarly for the second wave of our data (who are mostly 13 year olds) we use the cut-off for age 13.5. For the very small number of children aged 8 and 10 we use the 8.5 and 10.5 cutoffs respectively and similarly for the second wave we use the 12.5 and 14.5 cut-offs for those aged 12 and 14. The age and gender specific cutoffs are provided in Table 1. These cutoffs have also been used in previous studies which have analysed child obesity using GUI e.g. Layte and McCrory (2011).

We now briefly review some of the evidence concerning childhood obesity and its socioeconomic gradient in Ireland and elsewhere. Perry et al. (2009) showed that weight for children in Ireland had increased disproportionately compared to height, thus leading to a rise in BMI, over the period from the late 1940s to the mid 2000s. Keane et al. (2014) provide a comprehensive review of more recent evidence concerning trends and prevalence of obesity among primary school aged children in Ireland, covering the period from 2002 to 2012. After carefully reviewing a number of studies, they confined their analysis to 14 studies which met their inclusion criteria. Sample sizes ranged from 204 to 14036 and the setting was either the home or the school. They detected a small significant declining trend in obesity prevalence over time when national and regional studies were combined. However, neither national nor regional studies on their own revealed a declining trend and no trend was evident either in studies of overweight. They also detected a consistently higher prevalence of obesity amongst girls compared to boys. Overall, the study concluded that while rates of childhood obesity and overweight in Ireland were high, they did appear to be stabilizing.

These findings are consistent with results from a number of other developed countries. Olds et al. (2011) present evidence from nine countries (Australia, China, England, France, Netherlands, New Zealand, Sweden, Switzerland and the US) suggesting no change in the unweighted average of obesity prevalence in these countries over the period 1995 to 2008. Within this overall average however, rates of change differed by gender, age, socioeconomic status and ethnicity.

With respect to the socioeconomic gradient of childhood obesity, Chung et al. (2016) provide a recent comprehensive review of childhood and adolescent obesity across a number of economically advanced countries, paying particular attention to differing prevalence by SES (this was measured by a variety of indicators including parental education in some studies). Their conclusion is that childhood obesity remains a serious issue in these countries, even allowing for some recent findings that it is stabilizing. Evidence regarding the socioeconomic gradient is mixed. Differences in childhood obesity by SES remain. In some cases these differences appear to have stabilized, or may even be declining, but in other countries the gradient appears to be increasing.

Table 1
Age and Gender Specific Cutoffs for Overweight and Obesity from Cole et al. (2000).

Age	Male		Female	
	Overweight	Obese	Overweight	Obese
8.5	18.76	22.17	18.69	22.18
9.5	19.46	23.39	19.45	23.46
10.5	20.20	24.57	20.29	24.77
12.5	21.56	26.43	22.14	27.24
13.5	22.27	27.25	22.98	28.20
14.5	22.96	27.98	23.66	28.87