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The impact of childhood overweight and obesity on healthcare utilisation

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ABSTRACT

Rising levels of childhood overweight and obesity represent a major global public health challenge. A number of studies have explored the association between childhood overweight and obesity and healthcare utilisation and costs. This paper adds to the literature by estimating the causal effect of child overweight and obesity status on use of general practitioner (GP) and hospital inpatient stays at two time points using instrumental variable (IV) methods The paper uses data from two waves of the Growing Up in Ireland survey of children when they are 9 and 13 years respectively and uses the biological mother's body mass index (BMI) as an instrument for the child's BMI. Our results demonstrate that child overweight and obesity status do not have a significant effect on healthcare utilisation for children when they are 9 years, but do have a large and significant effect at 13 years. Across all our models, the effects on both GP and hospital inpatient stays are found to be larger when endogeneity in childhood BMI status is addressed. Previous studies that did not address endogeneity concerns are likely to have significantly underestimated the impact of child overweight and obesity status on healthcare utilisation.

1. Introduction

The rising trends in overweight and obesity have been described as a global epidemic that represents a major challenge for health care systems (World Health Organization, 2016), both in terms of their current and projected future demands on already resource-constrained healthcare budgets. The prevalence of childhood overweight and obesity worldwide increased over 47% between 1980 and 2013 (Ng et al., 2014). In 2014, an estimated 41 million children under 5 years of age were affected by overweight or obesity (World Health Organization, 2016). While there is some evidence that prevalence rates are stabilising in developed countries, they are doing so at a very high rate of well over 20% and there is no evidence that the prevalence in children is decreasing (Rokholm et al., 2010; Skinner et al., 2016). Against this backdrop of high prevalence rates and the subsequent implications for health outcomes, economic outcomes and healthcare budgets, there have been calls to urgently reverse the trends in childhood overweight and obesity (World Health Organization, 2016).

Childhood overweight and obesity is accompanied by a number of adverse consequences for physical and mental health in both the short- and long-term (Llewellyn et al., 2016). Much of the focus in the literature has been on the long-term effects of childhood overweight and obesity as it manifests into adulthood, as there was a perception that many of the adverse consequences occur later in adulthood (see Llewellyn et al. (2016) for a review). However, overweight and obesity in childhood leads to many acute health problems and much suffering during childhood. In some cases children are now displaying what were once thought to be "adult diseases related to obesity", such as non-alcoholic fatty liver disease (Uppal et al., 2016) and hypertension (Rosner et al., 2013), as a result of childhood obesity.

Furthermore, from a policy perspective, the burden to the health care system is of particular interest considering the existent projections of increasing health care expenditure in western countries. Relative to overweight and obesity in adulthood, there is limited published evidence on the economic burden associated with child or adolescent overweight and obesity. The earliest studies seeking to assess this burden date back only to 2006 and they do not provide a clear picture, with much ambiguity surrounding the impact of childhood obesity on healthcare costs for children (John et al., 2010, 2012). For example, some of those studies reported a positive relationship between childhood overweight and obesity and healthcare usage and/or costs (Hampl et al., 2007; Finkelstein and Trogdon, 2008; Trasande and Chatterjee, 2009; Au, 2012; Lynch et al., 2015; Bianchi-Hayes

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et al., 2015; Hayes et al., 2016; Carey et al., 2015), while other studies reported to the contrary (Skinner et al., 2008). Some studies did not focus specifically on the burden arising during childhood, but the overall lifetime excess costs associated with childhood obesity (Finkelstein et al., 2014; Sonntag et al., 2016).

A crucial limitation of these studies, however, is that they provide estimates of the association between BMI status and healthcare usage or costs rather than estimates of the causal effect.[1] This is a subtle but critical point for the analysis of obesity and its impacts. For example, if a child becomes obese as a result of an accident that impairs their mobility and the accident also leads to greater healthcare utilisation, then failing to adequately control for this will lead to an overestimate of the causal effect. On the other hand, if children from certain categories of households are more likely to be obese and also have poorer access to health care services, then this could lead to an underestimate of the true effect. In both examples (and there are likely many more), failure to adequately control for factors that impact healthcare utilisation and that are also correlated with child BMI status leads to omitted variable bias. A second endogeneity concern relates to potential reverse causality in the relationship between utilisation and BMI. For example, if children who have more contact with healthcare professionals receive more advice about their weight status, diet, exercise, etc. and react accordingly, then analysing the correlation between utilisation and BMI may also pick up this effect. Thus, in order to correctly estimate the causal effect of BMI on utilisation, an identification strategy is required that appropriately addresses these concerns. In fact, Pelone et al. (2012) note that most of the research designs cannot state with confidence that overweight and obesity are the underlying causes of higher healthcare usage and costs for children.

This paper directly addresses this gap in the literature by employing an instrumental variable (IV) approach to identify the causal effect of child overweight and obesity on healthcare utilisation in Ireland. More specifically, it analyses data from two waves of the Growing Up in Ireland (GUI) study, a nationally representative survey collecting information from families of children when they are 9 years and 13 years respectively and uses the BMI of the biological mother as an instrument for child BMI. This approach is based on previous studies that have exploited the use of a biological relative's BMI as an instrument for adult BMI status, albeit in different contexts (Cullinan and Gillespie, 2016; Cawley and Meyerhoefer, 2012; Cawley, 2004; Kline and Tobias, 2008; Smith et al., 2009).

An accurate assessment of the causal pathways between child BMI status and healthcare usage is important given the rise in childhood overweight and obesity worldwide. Within Europe, Ireland along with the United Kingdom are projected to have the highest rates of overweight and obesity by 2025 (Ng et al., 2014). Moreover, with some exceptions (Breitfelder et al., 2011; Wenig, 2012; Sonntag et al., 2016, 2015; Hayes et al., 2016; Batscheider et al., 2014), many of the previous studies examining childhood obesity and healthcare utilisation or costs are US-based and questions arise as to their generalisability to countries with different prevalence rates of overweight and obesity, as well as different healthcare systems and treatment structures. Within this context, Ireland is a noteworthy case study given its mix of public and private healthcare finance and provision. While predominantly a taxation-financed public healthcare system requiring the majority of the population to pay out of pocket for GP care, voluntary private health insurance is typically used to pay for acute care in both public and private hospitals (Nolan and Smith, 2012).

In addition to being one of the first studies to causally infer the relationship between child BMI status and healthcare usage, this paper adds to the literature in a number of other ways. For example, we use independently measured BMI for mothers and children rather than measures based on self-reported weight and height. We also examine healthcare utilisation at two points in time for children (at 9 and 13 years) to explore how the patterns of usage may differ by BMI status and age. This allows us to examine whether patterns of utilisation differ by overweight or obese status at both ages and to compare patterns of utilisation for those who were overweight or obese at both ages to those who were overweight or obese at one age only. Furthermore, we employ an extremely rich and nationally representative sample allowing us to control for many covariates and factors that may explain healthcare utilisation.

The paper is structured as follows: Section 2 presents a detailed description of the data and describes our empirical approach. Section 3 presents the main empirical results, Section 4 presents some extensions to the analysis, while Section 5 discusses the implications of our results and concludes.

2. Data and methods

The data analysed is from two waves of the GUI survey, a nationally representative face-to-face survey of children living in Ireland that also surveys their parents and the principals and teachers in the child's school. The first wave of the GUI survey collected information on 8568 nine year old children between 2007 and 2008, representing approximately 14% of all nine year olds in the Republic of Ireland in 2008 (Murray et al., 2009; McCrory and Layte, 2012). Overall 7525 of these children were interviewed again between 2011 and 2012 for the second wave of data collection. Further details of the wave one and wave two surveys, including the sampling procedures, are discussed, respectively, in Murray et al. (2010) and Thornton et al. (2016).[2]

Our primary analysis focuses on presenting results from separate binary models where the dependent variables are (1) whether the child has had contact with their GP over the previous 12 months and (2) whether the child has stayed as an inpatient in hospital over their lifetime. A key feature of the GUI data is that it contains measured weight and height (i.e. not self-reported) for both children and parents, allowing for more accurate measurements of BMI status. According to the GUI survey instrumentation, the height and weight measurements were taken at the time of interview. Weight measurements of parents and children were recorded to the nearest 0.5 kg using a SECA 761 medically approved flat mechanical scales which graduated in one-kilogram increments and had an upper capacity of 150 kg. Parents and children were asked to wear light clothing for weight measurement. Height was recorded to the nearest millimetre using a Leicester portable height stick (Layte and McCrory, 2011: p.10–11). We present models with child BMI included as a continuous variable and also undertake additional analyses with children categorised as non-overweight, overweight or obese, based on the BMI cut-offs in Cole et al. (2000).[3] Specifically, for wave 1, since all children are aged 9 years, we use the 9 years and 6 months cut-offs for girls and boys, which are 19.45 and 19.46 for overweight and 23.46 and 23.39 for obese, respectively. For wave 2 we use the 13 years and 6 months cut-offs for girls and boys, which are 22.98 and 22.27 for overweight and 28.20 and 27.25 for obese.

[1] See Cawley and Meyerhoefer (2012) for a discussion of this issue in the context of adult obesity.

[2] For a recent application of this data examining socioeconomic gradients in childhood obesity, see Walsh and Cullinan (2015). The data was also recently used to analyse the impact of obesity on self-rated health in Cullinan and Gillespie (2016).

[3] These cut-offs were also used in Walsh and Cullinan (2015) using the same data.