Socio-economic differentials in early childhood growth trajectories

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INTRODUCTION

The dynamic processes that drive the development of childhood overweight and obesity are not completely understood. Yet, by age 5, over 20% of British children are already classed as overweight or obese, and these trends have a strong socio-economic patterning. Therefore, early childhood growth may be important in understanding recent increases in the prevalence childhood overweight, and increasing socio-economic inequalities in overweight. In this paper, we identify latent trajectories of early childhood growth from infancy through age 11, and we examine the interplay between these trajectories and the early socio-economic context.

CONTEXT

Childhood body mass index (BMI) predicts adulthood obesity (Guo et al., 2002) and other long-term health outcomes (Barker et al., 2005). Recent population-based surveys across developed countries have shown a marked increase in overweight and obesity prevalence in both children and adults in the past two decades (Hedley et al., 2004; MORE REFS). In England, while overall prevalence rates of childhood obesity and overweight among school-age children appears to stabilize in recent years, children from lower socio-economic strata have not benefited from this trend, and the socioeconomic gradient in overweight and obesity appears to have increased in recent years in this age group (Stamatakis et al., 2010).

The developmental trajectories of overweight during childhood and adolescence are not well understood, and especially little is known about the developmental trajectories of overweight in early childhood. Such research is however important because it can enhance our understanding of the mechanisms underlying trends in overweight prevalence and help to identify different pathways of overweight onset and development during childhood. Furthermore, little research has attempted to identify differences in these trajectories across socio-economic groups.

As suggested by the foetal origins hypothesis (Barker, 1998; Oken and Gillman, 2003), growth in utero, feeding practices in infancy, and growth in early childhood may play a role in the development of obesity and obesity-related diseases in adult (Gillman et al., 2001; Li et al., 2005). However, few

studies have examined whether certain early life factors predispose children to certain trajectories in the development of overweight. When early life factors have been examined, they are often limited to physical marker. For example, Li and colleagues (2007) found that factors such as maternal weight gain during pregnancy, birthweight and black ethnicity predicted certain overweight trajectories. The interplay with the early life socio-economic background is often ignored. Yet, this interplay may be crucial to better understanding the growing gap in overweight and obesity prevalence across socio-economic groups.

To address these issues, we attempted to identify possible trajectories in the development of overweight and to assess the associations of early childhood socio-economic characteristics with overweight trajectory membership. To identify trajectories, studies have often used BMI at fixed ages or change in BMI between fixed ages as predictors. This fixed-age approach assumes that individuals in the sample belong to a homogeneous group with similar developmental patterns, which seems unrealistic for childhood BMI (Li et al., 2007). Instead, a more appealing way of examining childhood BMI is to model trajectories based on repeated BMI measures throughout childhood. One way to do so is generating several groups or classes that share overall patterns of changes in BMI (Pryor et al., 2011; Smith et al., 2011; Li et al., 2007) across childhood, using methods such as latent growth mixture modelling. Looking at age-define overweight/obesity flags across ages using a latent class methods may also a useful approach. Both methods allows summarizing overall patterns in a data driven manner, a more objective way to grouping trajectories. These methods do imply some subjective decision-making, especially on the number of groups, guided by a number of fit statistics. Modelling childhood overweight or BMI trajectories may reveal longitudinal patterns in growth from early childhood, leading to more focused rationales for childhood interventions to prevent obesity and other health outcomes in adulthood.

Our aims therefore are: 1) to use latent class analysis and latent growth models to fit, respectively, overweight/obese and BMI trajectories throughout childhood; and 2) to examine socio-demographic predictors of these trajectories.

DATA AND METHODS

The Millennium Cohort Study is a representative birth cohort of 19,244 UK children born in 2000-2002. Four sweeps of data, at 9 months, 3, 5, and 7 years, are archived; age 11 will be available imminently. We propose to use two methods: Longitudinal Latent Class methods to identify groups

allow us to group individuals according to their categorization into an overweight or obese group at each data point, taking into account of the dependent nature of these data series. International overweight and obesity cut off points by age and sex will be used at ages 3, 5, 7 and, when available, 11. Latent growth mixture models fit multiple growth curves based on the distinct (but latent) profiles of growth. We will employ these models to track BMI from age 3 to 11. The two methods allow answering slightly different but complementary questions. Birthweight and measurements at 9 months will also be added to models, and retained if significant. The associations between these latent trajectories with early life socio-economic characteristics will be explored.

Early results use only single births and cases with complete data, future work will include considering how to best model missing data within these latent methodologies.

RESULTS

By age 7, 20.7% of our sample was classed as obese or overweight. Of these, about half was already classed as obese or overweight at ages 3 and 5. For the Latent Class Analyses, a 4 class model was chosen. This model suggests that 62% of children are always a "**normal**" weight from age 3 to 7. At the other end of the spectrum 5% are always obese. While some of children in the **obese** group start at a normal weight at age 3 (though the majority are already obese), by age 7 80% are obese. Two intermediate classes are also identified. In the **overweight to obese** group (which accounts for 8% of our sample), at age 3 children look slightly lighter than the "obese" group. But instead of becoming obese, most of this group tend to stay overweight, with 80% overweight by age 7. Finally, in the "**normalising**" group (25% of the sample), over half of children are overweight or obese at age 3, but they tend towards a normal weight over time, with 85% ending up in the "normal" category by age 7.

Table 1: Latent Class Analysis of overweight/obese, ages 3 to 7

	Normal	Normalising	Overweight to Obese	Obese
	61.73%	25.12%	8.56%	4.59%
Normal BMI, age 3	0.9957	0.4647	0.327	0.1331
Overweight, age 3	0.0043	0.4658	0.521	0.3508
Obese, age 3	0	0.0695	0.152	0.5161
Normal BMI, age 5	0.9953	0.6957	0	0
Overweight, age 5	0	0.2938	0.9592	0.0228
Obese, age 5	0.0047	0.0105	0.0408	0.9772
Normal BMI, age 5	0.9447	0.8513	0.007	0.0093
Overweight, age 5	0.0517	0.1366	0.7972	0.1902
Obese, age 5	0.0036	0.0121	0.1958	0.8005

In the Latent Trajectory analyses, a four group model was chosen. The two largest groups are those that maintain a stable BMI of around 15 or 16 (group 1 – 45.5%) and 17/18 (group 2 – 43.1%) from ages 3 to 7. A further 9% of children have a BMI over 18 that gradually rises across the sweeps (group 3) and a small proportion of children have a consistently high BMI of over 21 and rising (group 4). These trajectories do seem to suggest is that all children are maintaining a stable BMI, or it is increasing. There isn't a sizeable proportion with a decreasing BMI.

Early analyses should that, for both the groups identified through LCA and Latent Trajectories, lower SES categorization (so far identified by poverty flag) at 9 months only increases the odds of membership of the "obese" group in the LCA analyses, and the rising BMI group (group 3) in the Latent Trajctories analyses, but not the others groups.

CONCLUSIONS

According to the foetal origins hypothesis, foetal and early life factors have influences on the development of overweight. There have been few longitudinal studies to test or provide direct support for this hypothesis in the research on childhood overweight. There is even less longitudinal work on how the development of overweight may interact with socio-economic characteristics. Our study sheds new light on the role of the early socio-economic context on the development of overweight in early childhood. Using a large, nationally representative cohort study, we aim to identify latent trajectories of growth of British children from infancy through age 11. Such work will highlight whether the early years are a significant period during which growth patterns are established and therefore whether they are an attractive window to intervene to modify future risk of overweight. We will examine whether the early socio-economic context predicts these latent trajectories. Early results suggest that suggest that, while overweight probably may not be function of socio-economic class, obesity/high and rising BMI appears to be.

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