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Peer effects in adolescent bodyweight: Evidence from rural China

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ABSTRACT

Peer effect is a potential determinant of individual weight gain that has drawn considerable attention recently. The presence of peer effect implies that policies targeted at changing bodyweight can have enhanced effectiveness through a multiplier effect.

This study aims to measure the peer effects on adolescent bodyweight in China. Using the small community nature of the rural sample of the wave 2000 of the China Health and Nutrition Survey, we define plausible peer groups and assess the effect of the average BMI of his/her peer group on the BMI of an adolescent. An instrumental variable (IV) approach is applied to control for potential endogeneity of the peer group's BMI.

We find evidence supporting peer effect on BMI in general. The peer effect is around 0.3 with slight variation between two alternative peer definitions. Split sample analysis shows that the peer effect is significant for females (0.32–0.37), and insignificant for male adolescents. Furthermore, we find strong influence of same-gender peers (0.34–0.42) for female adolescents. Conditional quantile regressions show that the peer effect in weight gain is mainly present at or below the median in the conditional BMI distribution for girls, and at the higher end of the BMI distribution for boys. Multiple tests show strong identification, and strong instruments in our IV estimation. Placebo tests suggest that our results are reasonably robust to the correlated effect, due to unobserved community- and province-level factors.

Introduction

The recent rise in rates of overweight and obesity in adolescents in many developed countries has drawn considerable attention from the public health community. Given that adolescent obesity can lead to persistent overweight or obesity in adulthood, and the known association between obesity and other long-term health problems such as cardiovascular disease, diabetes, etc., it is crucial to identify contributing factors for health policy considerations. Weight gain, however, is not only a 'rich country' phenomenon. In developing economies with improved nutrition, sanitation, and economic conditions, weight gain lifts the population from a state of underweight to normal weight, before the concern of overweight steps into the spotlight. The weight gain in the former case has positive implications for the population health and the long-term human capital accumulation of these countries. Understanding the causes of weight gain at the lower end of the body weight distribution is also of equal importance.

It is commonly agreed that weight gain is associated with increased consumption of calories and lack of exercise. It is much less clear about the causes of these behaviors associated with weight gain. It has been suggested that parental influence, food prices, access to fast food, environment, opportunity for physical activities, and school nutrition policies have important roles. (Kaestner & Xu, 2006; Koplan, Liverman, & Kraak, 2005; Powell, Auld, Chaloupka, O'Malley, & Johnston, 2007) One determinant of individual weight gain that has drawn more attention recently is peer influence. Influence from peers may come in various forms. The bodyweight of peers may affect a person psychosocially by changing his/her norms about acceptable weight (For a theoretical model, see Burke and Heiland (2007)). The peer group may also influence a person through affecting weight-related behavior such as food consumption and exercise. The presence of the peer effect implies that a multiplier effect exists, and so policies targeting bodyweight have the potential for greater influence than intended (Christakis & Fowler, 2007; Glaeser et al., 2002).

This study aims to assess the peer effects on adolescent bodyweight in China. Two definitions of peer group are considered – one based on the age range for the same level of school, the other based on the age within an interval of ±2 years from the age of the

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adolescent. Using the small community nature of a rural sample in the Wave 2000 of the China Health and Nutrition Study (CHNS), we form plausible empirical peer groups, and estimate the effect of the average BMI of the peer group on the BMI of an adolescent. To control for the potential endogeneity of the peer group's BMI, an instrumental variable approach is applied. We consider as instruments the average BMIs of peers' mothers and fathers, and the proportion of peers' parents born during the years of the Great Famine (1959–1961). Our econometric specification also controls for correlated effects using community-level covariates. Possible correlated effects due to unobserved community-level factors are addressed using several falsification tests.

We find evidence supporting the presence of peer effect in general. When peers are defined based on the age range for the same level of school (Peer Definition 1), the peer effect on the BMI is significant for males (around 0.3), but not for female adolescents. When the peer is defined based on the interval of ± 2 years from the age of the adolescent (Peer Definition 2), the peer influence appears significant for females (0.32–0.37). Furthermore, we find that the influence of same-gender peers is stronger (0.34–0.42) and significant for female adolescents. We use conditional quantile regression to show that the peer effect in weight gain is mainly present at or below the median in the conditional BMI distribution for girls, and at the higher end of the BMI distribution for boys. Test results show strong identification in our instrumental variable estimation. Placebo tests suggest that our results are robust to the correlated effect due to unobserved community- and province-level factors under Peer Definition 1, but less so under Peer Definition 2.

The rest of the paper is arranged as follows. Section 2 provides an overview of the trends in underweight and overweight in China in recent years. Section 3 reviews the literature on peer effect in weight gain. Section 4 discusses the data and methodology. Section 5 presents the results. Section 6 presents conclusions on the work.

Overview of the change in the bodyweight in China

For China, a transition economy that underwent rapid and uneven growth in the past few decades, the body-weight problem is two-tailed. On the one hand, a significant proportion of the population, particularly those of lower socioeconomic status, remains underweight (de Brauw & Mu, 2011). There is evidence that the rate of those underweight fell, although the changes seem small when compared to the increase in the overweight rate according to data spanning 1989–2000 (Wang, Du, Zhai, Popkin, 2007).

One the other hand, the problem at the high end of the weight distribution began to emerge. Although the prevalence rate of overweight and obesity in China seems modest relative to those rates for developed economies, the sheer size of the overweight and obese population dwarfs many countries. It is estimated that, in 2002, 26 million people were obese and 169 million overweight by WHO standards, or 60 million obese and over 20 million overweight by some alternative Chinese standards (Zhang, Dagevos, He, van der Lans, & Zhai, 2008). There has also been a sharp increase in the prevalence of obesity. Wang, Du, et al. (2007) reported a substantial increase in the rate of overweight since 1989 in both men and women, and in both urban and rural areas. The changes in the overweight rate are larger for men than for women. Between 1992 and 2002 the obesity rate rose from 16% to 26%, and such an increase appears across the board, regardless of gender, age, and region (Wang, Mi, et al. (2007)). Some argue that the rate may have risen to 40% in more recent years (Streib, 2007). The rapid rise in prevalence of obesity and overweight is also found among pre-school children, especially in urban areas. Between 1989 and 1997, the prevalence rate of obesity increased from 1.5% to 12.6% and the rate of overweight from 14.6% to 28.9% for pre-school children (Luo & Hu, 2002).

For adolescents, the obesity problem is also on the rise. In 1997, the child overweight rate in China was slightly below 10% (Du, Mroz, Zhai, & Popkin, 2004). Based on a publicly administered study "Supervision and Study of the Health Condition of Chinese Children", Sun (2003) points out that there was considerable gain in the weights of children during the rapid development in the 1990s, and that the gains appear to be greater for children in rural areas than for the urban ones. There is also an increasing concern of child obesity. A national study in 1995 documents that while there had been a high malnutrition rate among Chinese children (22.5% and 40.8% for boys and girls, respectively) there was also a high over nutrition rate (6.4% for boys and 8.8% for girls) (Sun, 2003). The author suggests that erroneous nutrition concepts are to blame. Research studies based on the western economy have established that parental influence, food prices, access to fast food, opportunities for physical activities, and school nutrition policies are strong determinants on childhood obesity (Kaestner & Xu, 2006; Koplan et al., 2005; Powell et al., 2007). Echoing evidence of the impact of these factors on Chinese children have also gradually entered the literature recently (e.g. Lu & Goldman, 2010). Overweight in early childhood, parental overweight, high income, and residence in urban areas are all found to be associated with adolescent overweight (Luo & Hu, 2002).

Reasons of the rapid increase in weight gain in China include the living environment becoming "obesogenic". The obesogenic environment leads to people eating more and exercising less (Mendez & Popkin, 2004; Zhang et al., 2008); increasing consumption of high fat, animal-sourced foods such as meat, eggs, and milk and decreasing reliance on vegetables and cereals (Wang, Du, et al. (2007); Du et al., 2004; Popkin, 1999); a shift in occupation types from farming and fishing to manufacturing and service (Wang, Du, et al. (2007)). Smoking is found to be negatively associated with body weight, but only within the healthy weight range, and does not contribute to the prevalence of obesity (Fang, Ali, & Rizzo, 2009).

Existing literature on peer effect in weight gain

There is a growing literature on identifying the influence that peer groups or social networks have on individual health behaviors. While many earlier studies examine the peer effect on drug use, alcohol consumption, or tobacco consumption (e.g. Clark & Loheac, 2007; Gaviria and Raphael, 2008), increasingly more attention has been given to such effects on body weight or related outcome in recent years (Carrell, et al., 2011; Christakis & Fowler, 2007; Cohen-Cole & Fletcher, 2008a, 2008b; Fowler & Christakis, 2008; Halliday & Kwak, 2007; Halliday & Kwak, 2009; Trogdon, Nonnemaker, & Pais, 2008;).

In pioneering work in this area, Christakis and Fowler (2007) identified a detailed network including spouse, siblings, neighbors, and friends (one-way and two-way) using the Framingham Heart Study. They reported evidence of network effects on the likelihood of becoming obese. Specifically, same-sex friends and same-sex siblings were found more influential than friends and siblings of different gender from the affected individual, and the effect seemed stronger for males than for females.

Cohen-Cole and Fletcher (2008a, 2008b) argued that Christakis and Fowler's work suffered from failure to control for factors affecting both the individual and his/her social network group and that being lack of proper control for self-selection of friendship. Conceptually, both of these shortcomings could have considerably overstated the peer effect. Using a sample of high school children from the National Longitudinal Study of Adolescent Health dataset