Parental Overweight, Adolescent Overweight, and Adult Overweight

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Abstract
Concern about the adolescent obesity epidemic in the United States has increased rapidly over recent years. This concern largely rises from the health consequences of obesity and overweight; however, more research is needed to investigate the social and behavioral causes and consequences of overweight throughout the life course. We use the National Longitudinal Study of Adolescent Health (Add Health) Waves I-III to explore the early life course trajectory of being overweight by examining the pathways through which individual and family characteristics influence adolescent and early adult weight. Given that many people who are overweight as young adults were also overweight as adolescents, we estimate the direct and indirect connections between adolescent and early adult overweight. We also estimate the influence of family background, e.g., parental overweight, and whether its influence on weight decreases while other environmental factors gain importance as individuals grow older.

Extended Abstract
Concern about the adolescent obesity epidemic in the United States has increased rapidly over recent years. This concern largely rises from the health consequences of obesity and overweight, i.e., their connections to diabetes, heart disease, and other medical conditions. Overweight and obesity, however, also have other effects on individuals' lives that are not well-studied or understood. Further, many of the causes of overweight are social and behavioral factors. The population has not genetically transformed in the past several years to become more inclined to be overweight. Instead individual's behaviors and environments have led to the activation of genes that may lead to a greater incidence of both adolescent and adult overweight. Consequently, more research must investigate the social and behavioral causes and consequences of overweight throughout

the life course. This line of study will lead to better information about the dimensions of this major public health problem.

We use the National Longitudinal Study of Adolescent Health (Add Health) Waves I-III to explore the early life course trajectory of being overweight by examining the pathways through which individual and family characteristics influence adolescent and early adult weight. Given that many people who are overweight as young adults were also overweight as adolescents, we estimate the direct and indirect connections between adolescent and early adult overweight. We also estimate the influence of family background, e.g., parental overweight, and whether its influence on weight decreases while other environmental factors gain importance as individuals grow older.

Background and Significance

Obesity rates among American youth have reached staggering proportions. In 1999-2000, 15.5% of adolescents (ages 12-19) were overweight and an additional 14.9% were at risk of being overweight (Ogden et al. 2002). Research also suggests that the prevalence of overweight continues to increase. The increase during the 1990s is similar to that of the 1980s, the decade previously heralded as experiencing the greatest increase (Ogden et al. 2002; Troiano & Flegal 1998). Although adolescent boys and girls are equally likely to be overweight (Anderson, Butcher, and Levine 2003), the risk of overweight is not equally shared across racial and ethnic groups. African Americans and Mexican-Americans are more likely to be overweight, and incidence of overweight among these groups increased by more than 10 percentage points during the 1990s (Ogden et al. 2002). Despite differences in individuals' genetic predispositions toward overweight, the obesity epidemic is not caused by genetic factors, but instead by social or environmental factors (Dietz 1990; French et al. 2001; Hill et al. 2003; Kumanyika 2001).

The Add Health data provide an opportunity to observe changes in overweight over a six-year period from the first waves of data collection in 1994-1996 to the third wave of data collection in 2002. Although there have been a number of studies investigating changing weight across the life course, few have used nationally representative data from the United States (Dietz 1997; Whitaker et al. 1997). Much of what we know about what might happen across the life course among Americans is based on data from the National Health and Nutrition Examination Studies (NHANES) and prevalence comparisons across age groups. These data show that there is an association between age and Body Mass Index (BMI): In the 1999-2000 NHANES, BMI and the proportion of Americans who were overweight or obese was lowest among those aged 2-5 and highest among those aged 56-70 (Anderson, Butchler, and Levine 2003). Relative to children aged 2-5, the prevalence of overweight for youth aged 12-19 was about 4 percentage points higher among both boys and girls. Work with the NHANES data also suggests that the increase in BMI over the past few decades has been primarily concentrated among those in the upper end of the BMI distribution, i.e., the heavier have gotten heavier (Cutler, Glaeser, and Shapiro 2003). There has been little change at the lower tail of the distribution.

Studies that follow a group of individuals over the life course have found that certain key factors during childhood and adolescence are associated with adult overweight. Recent

examination of obesity (based on International Obesity Task Force guidelines) during the transition to adulthood using the Add Health study shows that 9.4% of the sample were obese as adolescents and remained so as young adults, 12.7% of non-obese adolescents in 1996 became obese by 2002, and only 14.7% of obese adolescents (or 1.6% of the total sample) became non-obese young adults (Gordon-Larsen et al. 2004). Upon extensive review of the literature, Dietz (1997) identifies three critical life stages prior to adulthood when weight is an important predictor of later adult weight—before birth (prenatal), during the period of adiposity rebound between ages 4 and 6 when BMI begins to increase after a period of decline lasting from infancy to age 4, and most importantly for our study, during adolescence. In fact, adolescent overweight is the biggest childhood risk factor associated with adult overweight. Adolescence is a critical period—especially for girls—and it is also a period when the location of body fat changes. This change in body fat location is probably associated with the connection between adolescent and adult overweight.

To fully trace the life course origins of obesity during young adulthood, one must examine the sources of both adolescent and adult obesity. One key context for the development of overweight and obesity is the family. Families organize the two behaviors implicated in the obesity epidemic - eating and physical activity (Dietz & Gortmaker, 2001; French et al., 2001). Characteristics of families, such as their socioeconomic status and social norms regarding physical activity and eating, have important implications for adolescent energy expenditure and intake and, therefore, overweight. As such, risk factors for obesity cluster within families (Davison & Birch, 2001a). The mechanisms through which families influence adolescent overweight are numerous and include genetics, socialization, direct parental behaviors, and parents' social and economic resources. Most epidemiological research on adolescent overweight is limited to one factor within each of these domains (Davison & Birch, 2001b). Our project breaks from this piecemeal pattern and holistically considers the multiple features of family life important for adult overweight. In addition, we consider both the direct and indirect influences of familial characteristics on adult overweight. Adolescent overweight could partially or fully mediate the effect of family characteristics on adult overweight. Therefore, our research links intergenerational processes with life course patterns to examine the development of obesity in early adulthood.

Data and Methods

The National Longitudinal Study of Adolescent Health is a nationally representative school based sample of adolescents in grades 7-12 in 1994. The sample features an over-sample of ethnic minorities and a sibling/sibling-like pair sub-sample. These individuals participated in in-home interviews in 1995 (Wave I), as well as follow-up interviews in 1996 (Wave II) and 2002 (Wave III). The median age of the sample in Wave III was 22 (minimum age = 18, maximum age = 28). In addition, parent interviews were conducted in 1995.

The Add Health survey design is invaluable in its collection of detailed information on family background characteristics and individual health and lifestyle characteristics over the transition from adolescence to young adulthood. Included in our analysis are: (1)

family & individual (young adult) social and economic status, (2) parents' obesity status, (3) the child's early life conditions, (4) mealtime behavior, (5) physical activity and inactivity, (6) employment/school conditions related to physical activity, and (7) neighborhood conditions related to physical activity. All survey waves contain self-reported height and weight; however, Waves II and III also contain physical measurements of height and weight which allow us to create multiple measures of Body Mass Index (BMI) over the early life course.

In this study, we aim to test the following hypotheses:

H1: Parental overweight is strongly associated with early adult overweight.

H1a: The relationship between parental overweight and adult overweight is weaker than the relationship between parental overweight and adolescent overweight.

H2: Adolescent overweight is strongly associated with adult overweight. Previous research suggests that adolescent overweight will have the strongest association among the family and individual factors associated with adult overweight.

The data provide multiple indicators of body mass index (BMI) at some ages so we plan to take advantage of statistical techniques that incorporate multiple indicators. We will examine obesity, overweight, and BMI. We will begin our analyses by looking at the connections among parental, adolescent, and early adult overweight and obesity for individuals in the regular Add Health sample. This will replicate some of the work of Gordon-Larsen et al. (2004) but will use multiple indicators. In addition to looking at these commonly used designations, we will also look at BMI as a continuous variable. Once we have resolved some of the measurement and modeling issues, we will use the siblings and sibling-like pairs to model similarities between these pairs and control for both observed and unobserved family characteristics contributing to overweight. By accounting for the unmeasured family social and genetic characteristics influencing differences in BMI across families, the estimated associations among parental, adolescent, and young adult BMI, obesity, and overweight will be more informative than those obtained from a model of individual data.

Table 1 shows the mean change in BMI between waves from adolescence to young adulthood for 10,502 Add Health respondents.[1] On average, BMI increased over this time period. While some of this increase is likely due to normal development, BMI change over time seems to increase with parental obesity status. That is, the average change in BMI over time is consistently greater for those with one or both obese parents. Moreover, differences in the mean change in BMI across parental obesity status (no parents obese v. one parent obese; one parent obese v. two parents obese) are statistically significant ($p < .05$). This finding is consistent with Martin and Sandefur's (2004) research, which has demonstrated that increases in BMI between Add Health Waves I and II are significantly different for adolescents who have two obese parents compared to adolescents with one obese parent, even when individual and family-level characteristics are controlled.

[1] Sample restricted to respondents with BMI at all three waves plus parent obesity status.

Based on previous literature and preliminary analysis of the Add Health data, we find that our hypotheses warrant further exploration. The Add Health data provide a unique opportunity to examine these questions, and the proposed sibling model design will improve our estimates about the relative importance of various individual and family characteristics for adult obesity. By examining both the intergenerational and life course patterns contributing to adult obesity, the analysis will uncover the processes underlying the documented patterns of increasing prevalence across age groups and, thereby, contribute to our understanding of the recent obesity epidemic.

Table 1. Mean change in Body Mass Index (BMI) between Add Health waves, by parental obesity status

	Mean Change in BMI		
	Wave I[a] to Wave II	Wave II to Wave III	Wave I to Wave III
No parents obese	.49 (2.19)	3.29 (3.46)	3.78 (3.77)
One parent obese	.78* (2.76)	3.68* (4.03)	4.47* (4.23)
Both parents obese	1.17* (2.77)	4.55* (4.60)	5.72* (4.78)
Total sample	.59 (2.37)	3.43 (3.70)	4.02 (4.00)

Standard deviations in parentheses
[a]Wave I BMI construction based on self report while Wave II and III BMI are constructed from actual measurements
*Statistically significant difference in mean change in BMI from above parental obesity status category

References

Anderson, P. M., Butcher, K. F., & Levine, P. B.. 2003. Economic perspectives on childhood obesity. *Economic Perspectives* 30, 30-48.

Cutler, D., Glaeser, E. L. & Shapiro, J. M. 2003. Why have Americans become more obese? *National Bureau of Economic Research Working Paper*.

Davison, K. K. & Birch, L. L. (2001a). Child and parent characteristics as predictors of change in girls' body mass index. *International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity, 25*(12), 1834-1842.

Davison, K. K. & Birch, L. L. (2001b). Childhood overweight: a contextual model and recommendations for future research. *Obesity Reviews, 2*(3), 159-171.

Dietz, W. H. 1997. Periods of risk in childhood for the development of adult obesity—What do we need to learn?" *Journal of Nutrition* 127, 1884S-1886S.

Dietz, W. H. & Gortmaker, S. L. (2001). Preventing obesity in children and adolescents. *Annual Review of Public Health, 22*, 337-353.

French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22*, 309-335.

Gordon-Larsen, P., Adair, L. S., Nelson, M. C., & Popkin, B. M. (2004). Five-year obesity incidence in the transition period between adolescence and adulthood: the National Longitudinal Study of Adolescent Health. *American Jo Clinical Nutrition*, 80, 569-575.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science, 299*, 853-855.

Martin, M. A. & Sandefur, G. D. (2004). Family background and adolescent weight: An examination of social and genetic influences. Paper presented at the Annual Meetings of the Population Association of America, Boston.

Ogden, C. L., Flegal, K. M., Carroll, M. D., & Johnson, C. L. (2002). Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA, 288*(14), 1728-1732.

Troiano, R. P. & Flegal, K. M. (1998). Overweight children and adolescents: description, epidemiology, and demographics. *Pediatrics, 101*(3 Pt 2), 497-504.

Whitaker, R. C., Wright, J. A., Pepe, M. S., Seidel, K. D., & Dietz, W. H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *The New England Journal of Medicine, 337*(13), 869-873.