Association of childhood and teen school performance and obesity in young adulthood in the US National Longitudinal Survey of Youth

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ABSTRACT

Background. The literature suggests an association between poor school performance and obesity. However, little is known about academic achievement and behavior as possible risk factors for future obesity.

Method. The analysis was based on data from 3172 participants aged 6 to 25 years from the US National Longitudinal Survey conducted 1986 to 2010. Academic achievement, behavior problems and body mass index (BMI) were assessed at childhood (6–9) and teenhood (10–14). Height and weight were self-reported at pre-young adulthood (15–18) and young adulthood (19–25).

Results. Based on logistic regression stratified by sex and race/ethnicity, academic and behavioral deficiencies during childhood and teenhood were risk factors for young adult obesity with some sex and ethnic/racial differences. The highest prevalence rates of obesity by race/ethnicity and sex are as follows: black/Hispanic females, those in the lowest quartile of teen reading and math (32.8%); black/Hispanic males, those in lowest quartile of teen reading (26.1%); white males, those in the highest quartile of behavioral problems (21.9%); and white females, those in the lowest quartile teen math (23.2%).

Conclusion. Poor school performance in childhood and teenhood is associated with an increased risk of adult obesity. Prospective studies should further examine the association of school performance and adult obesity and whether programs directed at improving school performance may have secondary gains in preventing obesity.

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1. Introduction

Obesity is an important public health challenge. The prevalence of obesity is expected to reach 50% by 2030. Obesity increases morbidity and mortality and is a major determinant for a number of chronic conditions including cardiovascular diseases, type 2 diabetes mellitus, and some types of cancer (OECD). There are large racial, ethnic and sex disparities in obesity (Chang et al., 2009; Orr et al., 2014) with disproportionately higher rates of obesity among Africans and Hispanics than whites. Moreover, males are at higher risk of obesity than females (Ogden et al., 2012).

The literature suggests that poor school performance is associated with obesity (Alatupa et al., 2010). Although the association could be bi-directional, research has mostly focused on childhood obesity as the cause of poor academic achievements and behavior problems in school (Caird et al., 2011; Gable et al., 2012; Latzer and Stein, 2013). One suggested explanation for this association is that obese children tend to experience psychosocial stress to a greater extent than their non-obese counterparts, which may lead to poor school performance (Young-Hyman et al., 2006). However, little is known about academic achievements and behavior problems as possible risk factors for future obesity. The association of poor academic achievements and later obesity was examined and confirmed in only four studies (Alatupa et al., 2010; Gable et al., 2012; Mikkila et al., 2003; Wang and Veugelers, 2008), though in one study the findings did not reach statistical significance (Wang and Veugelers, 2008). Of those studies, only two (Alatupa et al., 2010; Gable et al., 2012) examined the association using a longitudinal design, and only one (Alatupa et al., 2010) had follow-up from teen to adulthood. That study of 732 participants found that academic achievements of teenagers predicted adult obesity in females only. They concluded that low achievements in school could lead to emotional distress which in turn may result in over eating as a coping strategy (Alatupa et al., 2010). None of these studies, except for one (Gable et al., 2012) took racial and ethnic differences into account.

A growing body of evidence suggests a positive association between obesity in childhood and behavior problems (Anderson et al., 2006; Franko et al., 2005; Hasler et al., 2005; Mamun et al., 2009; Pine et al., 1997; Pine et al., 2001; Richardson et al., 2003; White et al., 2012). Though behavior problems cover a range of emotional and behavioral disorders, studies of the association between childhood behavior problems and obesity in adulthood have focused mainly on the association between childhood depression and adult obesity (Anderson et al., 2006; Franko et al., 2005; Hasler et al., 2005; Pine et al., 2001; Richardson et al., 2003). Some of these studies had limited follow-up

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periods (3–8 years) (Franko et al., 2005; Pine et al., 1997), others had only a single observation during childhood (Hasler et al., 2005; Pine et al., 1997; Pine et al., 2001), one used an epidemiologic sample (Pine et al., 2001), another relied on retrospective recall of childhood symptoms (Hasler et al., 2005), yet others had only one assessment in adulthood (Mamun et al., 2009; Pine et al., 1997) and some were limited in sample size (n = 90 to 700) (Anderson et al., 2006; Hasler et al., 2005; Pine et al., 1997; Pine et al., 2001). Here too, studies have found a positive association between depression and later obesity mainly among females (Anderson et al., 2006; Franko et al., 2005; Hasler et al., 2005; Richardson et al., 2003) and only two studies (Franko et al., 2005; Pine et al., 1997) examined this by racial and ethnic differences.

Though childhood and teenhood appear to be critical periods in the timing and risk of obesity onset (Albrecht and Gordon-Larsen, 2013; Gordon-Larsen et al., 2004; Rzehak and Heinrich, 2006; Walsemann et al., 2012), school performance and its association with obesity has generally not been taken into consideration in school obesity prevention programs. These programs focus mainly on healthy eating and promoting physical activity (Foss and Dyrstad, 2011). Examining associations between children's school performance and later obesity across multiple developmental stages could help identify risk factors.

This study examined possible associations between school performance – academic achievement and behavioral problems – assessed twice prior to age 14 at childhood (6–9) and teenhood (10–14), and young adult obesity assessed at two time-points, pre-young adulthood (15–18), and young adulthood (19–25), in a large longitudinal cohort, while accounting for sex and race/ethnicity.

2. Methods

2.1. Sample

Data were drawn from the National Longitudinal Survey of Youth (NLSY), a multipurpose survey sponsored by the US Department of Labor. The survey originally included 12,600 individuals aged 14 to 25 years, who were living in the United States and have been interviewed annually since 1979. Since 1986, biennial follow up assessments were administered to the children of women in the original cohort (called NLSY79 Child and Young Adult Cohort) and they constitute the sample for this analysis.

A battery of child assessments, cognitive, socio-emotional, and physiological measures were administered. There were 11,512 children in the original cohort of children. Complete data on academic achievements (math and reading), and behavioral problems in childhood and teenhood were available for 6800 children. Body mass index for all four periods covered in this study: childhood (6–9), teenhood (10–14), pre-young adulthood (15–18) and young adulthood (19–25) was available for 3172 responders. Survey participants were born between the years 1978–1991 and screened between 1986 and 2010. Sample design, instrument selection and psychometric properties and study implementation validity and reliability of assessments have all been extensively documented (Center for Human Resource Research at Ohio State University, 2012).

2.2. Measures

2.2.1. Academic achievements

Academic achievement was measured with the Peabody Individual Achievement Tests (PIAT) of Math, Reading Recognition, and Reading Comprehension assessments which yielded age standardized scores. We created a composite reading score by combining means of recognition and comprehension scores for each child. The School achievements were available for each respondent at childhood (6–9) and teenhood (10–14) (Center for Human Resource Research at Ohio State University, 2012).

2.2.2. Behavioral problems in school aged children

Behavior Problems Index (BPI) (Peterson and Zill, 1986) measures frequency, range, and type of childhood behavioral problems for children as reported by their mothers. It was administered during childhood (6–9) and teenhood (10–14). BPI has 6 subscales: antisocial ("Does not seem to feel sorry after misbehaving"), anxious/depressed ("Sudden changes in mood/feeling"), dependent ("Demands a lot of attention"), headstrong ("Is rather high strung, tense, and nervous"), hyperactive ("Has difficulty concentrating/paying attention"), and peer conflicts/withdrawn ("Does not get involved with others"). Scale, as used in the survey, yielded a dichotomous response for each area examined ("often or sometimes true" or "not true") and reported in the dataset as age and sex standardized scores. The scale ranges from 75 to 150.

2.2.3. School discipline/school adjustment

Data reported by mothers were available on two measures of school adjustment among teens (10–14) 'was the parent called to the school because of child's behavioral problems' and 'was the child suspended from school'. Both items were combined into one dichotomous variable indicating presence or absence of school adjustment difficulties.

2.2.4. Body mass index (BMI)

Body mass index was assessed at childhood (6–9), teenhood (10–14), pre-young adulthood (15–18) and young adulthood (19–25). By design height and weight were to be measured for children and teens as part of the survey and for adults to be self-reported. For technical reasons, 10% of the child and 21% of teen height and weight measurements included were based on mother's reporting. Child and teen BMI was categorized based on CDC BMI-for-age growth charts percentile by sex as follows: underweight (less than 5th percentile), normal (5th to less than 85th percentile), overweight (85th to less than 95th percentile) and obese (95th percentile or greater). BMI from age 18 and above was categorized based on World Health Organization's guidelines as follows: underweight (<18.5, n = 150), normal (18.5–25, n = 2134), overweight (25–30, n = 549) and obesity (≥30, n = 339). Excluded from analysis were 5.7% (n = 182) of the subjects who were underweight as pre-young adults and young adults as this group was too small for meaningful analysis.

2.3. Statistical analyses

Binary logistic regression models were used to examine the relationship between a set of observed key variables in school as possible risk factors for obesity at pre- and young adulthood. The association between obesity and each of the independent variables – academic achievements (PIAT math and reading scores), behavioral problems and school adjustment difficulties – were tested separately while controlling for childhood BMI. Variables that were found to be significantly associated with obesity at the bivariate level were then examined using CHAID (Chi Squared Automatic Interaction Detector) to identify optimal combinations of risk factors for adult obesity while controlling for multiple comparisons using Bonferroni correction. Odd ratios for combinations of variables identified in CHAID were computed using logistic regression controlling for childhood BMI.

Next, three mutually exclusive groups were defined representing weight change across time: never obese (persons who did not meet criteria for obesity at all 4 time points), late onset obesity (persons who were not obese as children but met criteria for obesity as pre- and young adults) and persistent obesity (persons who met criteria for obesity at all 4 time points). This variable was then used as the dependent variable in a third set of multinomial logistic regression models. These models included a sub-sample of study participants who met criteria for inclusion in one of the four groups (n = 2503). As noted earlier, obesity risk varies greatly between racial/ethnic groups and between males and females. Given our objective of developing a set