Eating Behaviors 20 (2016) 43–47

Contents lists available at ScienceDirect

Eating Behaviors

Maternal correlates of body mass index in American Indian/Alaska Native and White adolescents: Differences between mother/son and mother/daughter pairs

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ARTICLE INFO

Article history:
Received 11 March 2015
Received in revised form 3 October 2015
Accepted 9 November 2015
Available online 14 November 2015

Keywords:
Obesity
Adolescents
American Indian/Alaska Native
Body mass index

ABSTRACT

Introduction: Obesity rates for American Indian and Alaska Native (AI/AN) adolescents are among the highest in the US. However, little is known about the influence of maternal correlates on adolescent body mass index (BMI), and the extent to which the size and significance of these correlates vary by adolescent sex and race.
Methods: We conducted a cross-sectional analysis with a sample of 531 AI/AN and 8896 White mother/adolescent pairs from Wave 1 of the National Longitudinal Study of Adolescent to Adult Health. We used generalized estimating equations to measure the association of maternal educational attainment, marital status, employment status, obesity status, and adolescent BMI of AI/AN and White adolescents, while controlling for adolescents' demographic and behavioral covariates. We sought to determine whether the size and statistical significance of maternal correlates differed by race, and between mother/son and mother/daughter pairs.
Results: The strength and statistical significance of maternal correlates varied between mother/son and mother/daughter pairs in both races. However, we did not find effect modification by race.
Maternal obesity showed the strongest effect on adolescent BMI in all mother/adolescent pairs.
Conclusion: Our findings suggest that maternal factors are critical in the transmission of obesogenic behaviors from one generation to the next, and their effects vary between mother/son and mother/daughter pairs, and are similar for AI/ANs and Whites. We encourage future work aimed at preventing adolescent obesity to investigate causal pathways between maternal correlates and adolescent BMI.

1. Introduction

Adolescent obesity is a pressing public health concern, especially for minority populations. Compared to other racial and ethnic groups, American Indian and Alaska Native (AI/AN) adolescents exhibit a worrisome prevalence of obesity. Twenty percent of AI/ANs aged 10–17 years are obese, compared to 12% of non-Hispanic Whites in the same age range (Lau, Lin, & Flores, 2012). Adolescent obesity is a multifactorial disorder (McLaren, 2007), and parental factors have been found to play a critical role in adolescent obesity outcomes (Garasky, Stewart, Gundersen, Lohman, & Eisenmann, 2009; Halliday, Palma, Mellor, Green, & Renzaho, 2014). Given parents' role in establishing dietary habits (Ricci et al., 2012; Jollie-Trottier, Holm, & McDonald, 2009; Arcan et al., 2013), sedentary behaviors (Holm, Lilienthal, Poltavski, & Vogeltanz-Holm, 2013; Adams & Prince, 2010; Robinson et al., 1993; Barr-Anderson et al., 2011), and distorted perceptions of body mass index (BMI) (Ricci et al., 2012; De Long et al., 2008; Arcan et al., 2012), interventions to prevent obesity in AI/ANs have often included parents (Arcan et al., 2013; Caballero et al., 2003; Gittelsohn & Rowan, 2011). However, previous studies examining parental factors associated with adolescent BMI in AI/ANs have used primarily regional samples with limited generalizability. Only two studies have investigated these factors in large, nationally-representative samples. Both found statistically significant associations between parental obesity, household composition, parental education, and adolescent BMI (Crossman, Anne Sullivan, & Benin, 2006; Singh, Siahpush, & Kogan, 2010). Other studies found that parental employment and marriage were protective factors against adolescent obesity (Costa-Font & Gil, 2013; Mauskopf, O'Leary, Banihashemi, Weiner, & Cookston, 2015), but AI/ANs were not included in the study samples.

Previous studies have used sex concordance between parents and their adolescent children to explain health outcomes ranging from mental health conditions (Friedman & Friedman, 1972) to alcohol consumption (Windle & Windle, 2012). Research on obesity outcomes, however, has returned mixed results. Some studies found that obesity is transmitted from mothers to daughters and from fathers to sons (Perez-Pastor

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http://dx.doi.org/10.1016/j.eatbeh.2015.11.002
1471-0153/

et al., 2009). Another study found that an intervention targeting weight loss in overweight parents and their children was more effective in sex discordant parent/child pairs than in sex concordant ones (Temple, Wrotniak, Paluch, Roemmich, & Epstein, 2006). Given the lack of consensus, the prevalence of adolescent obesity in AI/ANs, and the likely role of parental factors in children's BMI, clarifying the role of sex concordance in the intergenerational transmission of obesogenic behaviors should be a high priority.

The present study contributes to the field by estimating the role of maternal correlates in the BMI of 531 AI/AN and 8896 White participants in Wave 1 of the National Longitudinal Study of Adolescent to Adult Health (Add Health). We measured the associations between maternal educational attainment, marital status, employment status, obesity status, and adolescent BMI, and estimated whether the strength and statistical significance of these coefficients differed by adolescent sex and race. Specifically, we aimed to test the following hypotheses:

H1. Adjusting for age, sex, and race, maternal correlates of body mass index will be stronger for daughters than for sons.

H2. Adjusting for age, sex, and race, maternal correlates of body mass index will be different for AI/ANs and Whites.

2. Methods

We performed a cross-sectional analysis of data from Add Health, a national survey conducted by the Carolina Population Center at the University of North Carolina-Chapel Hill. Add Health collects data on a nationally representative sample of adolescents and young adults recruited from public schools across the country and followed for four waves (1994–2008). Details of the survey's recruitment and sampling strategy have been published elsewhere (Harris & Udry, 2014). The present analysis relied on data from Wave I (1994), the only wave that included both an adolescent and a parental questionnaire. Add Health requested mothers to complete the parental questionnaire, when possible. Thus, over 90% of the parental questionnaires were completed by mothers. Our work was determined to be exempt from approval by the Institutional Review Board at the University of Washington because we used de-identified data.

2.1. Inclusion criteria

We included adolescent respondents who met the following criteria: a) self-identified as either AI/AN or White, independent of ethnicity; b) their mother completed the parental questionnaire; and c) had data on height and weight available to calculate BMI. Of the original 20,745 Add Health respondents, 531 AI/ANs and 8896 Whites met our inclusion criteria (N = 9427 mother/adolescent pairs).

2.2. Measures

2.2.1. Outcome

We estimated adolescent BMI by assessing self-reported height and weight, and used BMI as a continuous variable in our statistical models. In our descriptive analysis, we also included the percentages of adolescents above the 85th and the 95th percentiles, based on CDC growth charts (CDC, 2002).

2.2.2. Exposures

We measured maternal educational attainment, marital status, employment status, and obesity status by self-report. Educational attainment was categorized as a) less than high school, b) high school graduate, or c) college graduate. Marital status was categorized as a) never married, b) married, or c) previously married (separated, divorced, or widowed). Employment status was measured with a dichotomous variable (employed/unemployed). Maternal obesity was collected by self-report, and coded categorically (obese/non-obese).

2.2.3. Covariates

For adolescents, we included demographic covariates for age, sex, and AI/AN race, as well as behavioral covariates for watching television 10 h per week or more, and weekly frequency of playing an active sport (baseball, softball, basketball, soccer, swimming, or football).

2.3. Statistical analysis

We used descriptive statistics to present the demographic, behavioral, parental, and BMI characteristics of the two racial samples. We used generalized estimating equations to estimate the association between maternal correlates and adolescent BMI, controlling for other demographic and behavioral covariates. We compared the coefficients for mother/son and mother/daughter pairs for each racial group separately. We performed a test of modification to measure differences in the effects of maternal correlates by race. Our results are reported with β coefficients, 95% confidence intervals (CI), and p-values (p). All significance testing was performed with an α-level of 0.05. All analyses were conducted with R 3.1.2 (R Development Core Team, 2013).

3. Results

3.1. Sociodemographic characteristics

We described our study sample using proportions, means, and standard deviations (Table 1). We decided not to include p-values in Table 1, as per the recommendations of a recent publication (Cummings & Rivara, 2003). We observed important racial differences in adolescent weight, maternal educational attainment, marital status, employment status, and prevalence of obesity. The average BMI for AI/AN (23.3;

Table 1
Adolescent and maternal characteristics[a].

	AI/AN (n = 531)	White (n = 8,896)
Adolescent variables		
Demographic variables		
Age, mean (SD)	15 (1.7)	15 (1.7)
Female adolescent, n (%)	291 (54.8)	4,655 (52.3)
Weight variables		
BMI, mean (SD)	23.3 (5.1)	22.2 (4.2)
Overweight (85th percentile), n (%)	185 (35.0)	2,411 (27.0)
Obese (95th percentile), n (%)	95 (18.0)	985 (11.0)
Behavioral variables, n (%)		
TV watching more than 10 h/wk	322 (60.6)	5,038 (56.6)
Playing sports: Never	131 (30.3)	2,406 (27.0)
Playing sports: 1 or 2 times per week	145 (27.3)	2,522 (28.3)
Playing sports: 3 or 4 times per week	103 (19.4)	1,714 (19.3)
Playing sports: 5 or more times per week	121 (22.8)	2,254 (25.3)
Maternal variables		
Educational attainment, n (%)		
Less than high school	125 (23.5)	1,267 (14.2)
High school graduate	315 (59.3)	5,551 (62.4)
College graduate	91 (17.1)	2,073 (23.3)
Marital status, n (%)		
Never married	38 (7.2)	166 (1.9)
Married	354 (66.7)	6,961 (78.2)
Previously married	139 (26.2)	1,766 (19.9)
Employment status, n (%)		
Employed	341 (64.2)	6,486 (72.9)
Unemployed	190 (35.8)	2,410 (27.1)
Obesity status, n (%)		
Obese mother	135 (25.4)	1,602 (18.0)

Source: National Longitudinal Study of Adolescent to Adults Health, 1994.
Notes: (a) Totals and percentages might not add to 100%, because of missing cases.