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Original article

The Association Between Adolescent Obesity and Disability Incidence in Young Adulthood

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A B S T R A C T

Purpose: To evaluate the longitudinal relationship between obesity during adolescence and development of disability during young adulthood.
Methods: A cohort of 8,032 individuals aged 11–21 years enrolled in 1994–1995 (Wave I) of the National Longitudinal Study of Adolescent to Adult Health, followed up in 1996 (Wave II) and in 2001–2002 (Wave III). Individuals were divided into four categories based on weight and height of Wave II and Wave III: (1) developing obesity; (2) persistent obesity; (3) no obesity; and (4) obesity reversal. Disability was measured in Wave III using a measure of functional limitations and the Short Form 36 physical functioning scale. Logistic regression was used to predict the probability of disability as a function of weight category.
Results: Compared with their nonobese peers, adolescents developing obesity (adjusted odds ratio: 1.83 [95% confidence interval: 1.51–2.22]) and with persistent obesity (adjusted odds ratio: 2.09 [95% confidence interval: 1.64–2.67]) had a higher odds of having a functional limitation in Wave III.
Conclusions: Developing obesity and persistent obesity during adolescence were significantly associated with increased disability in young adulthood.

IMPLICATIONS AND CONTRIBUTION

Pediatric obesity has risen dramatically in the United States and is known to be associated with many chronic conditions in adulthood. Cross-sectional work has shown higher disability among obese young adults. This longitudinal study examines the relationship between obesity in adolescence with disability onset in young adulthood.

The rise in pediatric obesity in the United States has been dramatic, with one in three adolescents now classified as overweight (body mass index [BMI] ≥ 85th percentile) or obese (BMI ≥ 95th percentile) [1]. Numerous studies have highlighted the short- and long-term adverse health consequences of adolescent obesity, including elevated risks of chronic diseases such as asthma, diabetes, and early signs of heart disease, as well as premature mortality [2].

Less well studied is the long-term impact of obesity on functional impairment and disability in early adulthood. Both cross-sectional and longitudinal studies in older adults (>40 years) suggest that excess weight increases the risk of developing functional limitations and disability in late adulthood [3–16], with important consequences for workforce participation [17] and profound societal costs [18].

Disability is defined as "a physical or mental impairment that substantially limits one or more major life activities" [19].

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Disability is defined differently across surveys and research studies capturing varying degrees of limitations in a person's activities and actions, both social and physical [20]. There is currently no "universally accepted and understood terms and concepts with which to describe and discuss disability" [20]. Similar to the World Health Organization, we use disability as an umbrella term for activity limitations, impairments, and participation restrictions [20].

Only a limited number of studies have evaluated the relationship between obesity and disability in younger adulthood. Cross-sectional studies have found higher rates of disability for obese individuals aged 18–29 years compared with their normal weight peers, although a direct association was not definitive [21]. Being overweight in adolescence has been linked with poor physical functioning in late adulthood [22]. We are unaware of longitudinal studies that have analyzed the association between obesity in adolescence with development of disability in young adulthood. Therefore, our objective was to examine the relationship between obesity in adolescence (ages 12–19 years) with disability onset in young adulthood (ages 18–26 years), using a nationally representative longitudinal sample of U.S. adolescents.

Methods

National Longitudinal Study of Adolescent Health

We used the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative cohort of adolescents in Grades 7–12. Eighty high schools and 52 middle schools in the United States were selected using a stratified cluster design and a subsample of individuals (n = 20,745) and their parents (n = 17,713) participated in the Wave I (WI) in-home interview (1994–1995). Individuals were reinterviewed in Wave II (WII: 1996), Wave III (WIII: 2001–2002), and Wave IV (WIV: 2007–2009). WI seniors were not selected to be interviewed in WII but were selected for WIII and WIV. More than 70% of the schools sampled participated; 78.9%, 88.2%, 77.4%, and 80.3% of adolescents sampled completed interviews in WI, WII, WIII, and WIV, respectively, with 85% parent participation. Written informed consent was obtained for all WI participants. Survey procedures were approved by the institutional review board at the University of North Carolina at Chapel Hill. Additional details of survey procedures and research design are described elsewhere [23].

Our sample included individuals who participated in WI–WIII and measured height and weight by trained interviewers at WII and WIII, resulting in an 8-year observation period of the transition from adolescence to young adulthood covering ages 11–22 years. Because height and weight were self-reported at WI, obesity was only evaluated at WII and WIII. We excluded individuals who were pregnant at WI, WII, or WIII (n = 261) to minimize misclassifying a female due to pregnancy-related weight gain. We excluded individuals who were seriously disabled at WI (n = 219), as defined by an affirmative response to any of the following questions (do you use a cane, crutches, walker, medically prescribed shoes, wheelchair, or scooter to get around because of a permanent physical condition; do you use a brace for your hand, arm, leg, or foot because of a permanent physical condition; or do you use an artificial hand, arm, leg, or foot?) because we were interested in the incidence of disability over time, rather than the worsening of disability. A final sample of 8,032 individuals remained.

Compared with individuals not included, the sample had a larger proportion of whites (.71 [.03] vs. .63 [.03]; $p < .001$) and females (.49 [.01] vs. .64 [.01]; $p < .001$) and a smaller proportion of blacks (.13 [.02] vs. .19 [.03]; $p < .001$) and were less likely to have a highest educated parent with a high-school degree or less (.43 [.02] vs. .51 [.02]; $p < .001$). The sample had a slightly lower proportion to become obese (.15 [.01] to .20 [.02]; $p < .01$) and a slightly higher proportion to stay nonobese (.76 [.01] vs. .69 [.03]; $p < .01$).

Measures

Individuals were classified as obese if their BMI fell at or above the age- and sex-specific International Obesity Task Force obesity cut points in adolescence (for respondents aged <20 years) or the adult BMI cut point of 30 kg/m^2 in adulthood (for respondents aged ≥20 years) [24]. We grouped individuals into four different groups based on their weight trajectory during WII (adolescence) and WIII (early adulthood): (1) *developing obesity* (nonobese in WII to obese in WIII); (2) *persistent obesity* (obese to obese); (3) *no obesity* (nonobese to nonobese); and (4) *obesity reversal* (obese to nonobese). No obesity was used as the referent category.

Add Health asked different disability-related questions at each wave. Our analysis used two different measures of disability: the presence of functional limitations using a comprehensive measure of health-related quality of life (HRQL) [25] and the Short Form 36 (SF-36) measure of physical functioning [26,27].

Swallen et al. [25] developed a comprehensive measure of HRQL at WII which indicated the absence or presence of functional limitations constructed from answers to four yes or no questions about limitations attending school, difficulty performing household chores, limitations doing strenuous acts, and difficulty with personal care and hygiene. Individuals were classified as having a functional limitation if they responded yes to any of the questions.

These questions were not available at WIII, and we adapted this measure using five questions. Similar to Swallen et al. [25], we classified individuals as limited if they answered any of these questions as "limited a little" or "limited a lot" versus "not limited at all". Add Health replaced the question about limitations doing strenuous activities in WII with a question about limitations doing "vigorous activities, such as running, lifting heavy objects, participating in strenuous sports" in WIII. The question about limitations doing household chores in WII was replaced with whether limitation was reported for either "moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, playing golf" or "lifting or carrying a bag of groceries" at WIII. The difficulties with personal hygiene question in WII was replaced with the question about limitations "bathing and dressing yourself" at WIII. The question on limitations attending school at WII was replaced with the question, "In the past month, how often did a health problem cause you to miss a day of school or work" at WIII; individuals were coded as having a limitation if they missed school "about once a week or more" in the past month (reference category was missed school a few times or never).

WIII includes all 10 items used for the SF-36 measure of physical functioning; whether an individual was limited in or