HHS Public Access

Author manuscript

J Sch Health. Author manuscript; available in PMC 2017 September 29.

Published in final edited form as:

J Sch Health. 2016 November ; 86(11): 803–812. doi:10.1111/josh.12436.

Predictors of Obesity in a US Sample of High School Adolescents With and Without Disabilities*

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Abstract

BACKGROUND—Childhood obesity is a major public health concern. Children with disabilities have a higher prevalence of obesity.

OBJECTIVE—We examined factors associated with obesity within a cross-sectional study of US adolescents with and without disabilities.

METHODS—Data were obtained from the 2011 Youth Risk Behavior Survey. Logistic regression models were fitted to assess effects of dietary habits, physical activity, and unhealthy weight control behaviors on obesity. Effect modification by disability status was examined.

RESULTS—Twenty percent (1986 of 9775 participants) reported a disability. Adolescents with disabilities were more likely to be obese (odds ratio [OR] = 1.7; 95% confidence interval [CI]: 1.3–2.1) and have at least 1 unhealthy weight control behavior (OR = 2.0; 95% CI: 1.6–2.5), and were less likely to be physically active (OR = 0.5; 95% CI: 0.4–0.6). Lack of physical activity, increased television watching/video game playing, and unhealthy weight loss behaviors were significantly associated with obesity regardless of disability status (p-for-interaction >.05).

CONCLUSIONS—Successful obesity interventions should target diet, physical activity, and weight control among adolescents with disabilities. Understanding barriers to healthier diet and

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Human Subjects Approval Statement

The Institutional Review Board (IRB) at the University of Delaware determined that this project was exempt from IRB review according to federal regulations.

physical activity for this population is critical to developing effective obesity prevention programs and reducing the prevalence of unhealthy weight control behaviors.

Keywords

disability; obesity; adolescent health; unhealthy weight control behaviors; physical activity

Childhood5 obesity is a major concern in the United States and abroad.[1,2] Risk factors for cardiovascular disease, including hypercholesterolemia and hypertension, as well as diabetes, are evident among obese children.[3–5] Moreover, childhood obesity increases risk for adult obesity[6,7] and has severe morbidity and mortality consequences.[8–10] About 16% of US children and adolescents 2–19 years old and 18% of US adolescents 12–19 years old are obese.[2]

That the obesity epidemic has reached even the youngest in our population emphasizes the importance of programs directed toward healthy weight and the prevention of overweight and obesity in youth. Over 95% of children aged 5 to 18 years in the United States are currently enrolled in school,[11] making the school setting ideal for the implementation of obesity prevention programs. Schools have a unique opportunity to provide nutritious foods, offer opportunities for physical activity and deliver obesity-related health services. Given this, many obesity prevention programs targeting youth already have been delivered within the school setting.[11] Yet, most of these programs have focused on typically developing youth.[8] However, in the United States, there are 6 million school-aged children living with intellectual and/or developmental disabilities,[9] and those with disabilities have a higher prevalence of obesity when compared with typically developing peers.[10,12–16] Obesity rates among adolescents with intellectual disabilities (ID) are approximately 18% to 36%;[14,17] adolescents with autism and Down syndrome are 3 times more likely to be obese than adolescents in the general population;[15] children with limitations in physical activity are more than twice as likely to be overweight or obese when compared with peers without limitations.[18] Understanding the factors that influence obesity rates among youth with disabilities in mainstream school settings is critical to developing school-based prevention programs.

Data from the longitudinal health and intellectual disability study examined health practices of a nationally representative sample of 1450 adults (aged ≥18 years) with ID.[19] In adults with ID, nearly 60% of obese participants and more than 33% of overweight participants were trying to lose weight, using a combination of diet and exercise.[19] Yet, 28% of adults with ID within that study never or rarely engaged in moderate physical activity and 61% of such adults did not meet guidelines for duration and frequency of physical activity.[19] Adolescents with chronic illness are at greater risk for disordered eating than adolescents without chronic illness,[20] and at greater risk for body dissatisfaction and unhealthy weight control practices;[21] however, there is little research on health practices of adolescents with disabilities.

There is mixed evidence regarding relationships among demographic, behavioral, and psychosocial factors and obesity in adolescents with disabilities. Girls,[14] race/ethnic minorities,[16] and older age groups[10,14] may be at increased risk for obesity, and severity and

type of disability, as well as socioeconomic status, have not been associated with obesity in this age group.[14] A greater understanding of the determinants of obesity among adolescents with disabilities is critical given the increased obesity risk in this population. This study has 2 aims: (1) describe the health practices of high school students with and without disabilities; and (2) identify factors associated with obesity in high school students and moderation by disability status.

METHODS

Participants

Data were obtained from the 2011 US National Youth Risk Behavior Surveillance Survey (YRBS) conducted by the US Centers for Disease Control and Prevention (CDC) among high school students.[22] The 2011 data were used for this investigation because they represent the most current publically available data at the time of this analysis. The 2011 YRBS is a cross-sectional survey used to monitor and document risky behaviors that may negatively affect the health of US youth and adolescents. The survey concentrates on health-risk behaviors that may result in mortality, morbidity, disabilities, and social problems during youth and adulthood. These include, but are not limited to, behaviors such as unhealthy dietary habits, inadequate physical activity and obesity. The sampling frame includes all regular, public, Catholic, and other private school students in high school (grades 9–12) in the 50 states and the District of Columbia. Schools were selected systematically with probability proportional to enrollment in grades 9–12 using a random start. A total of 194 schools were sampled in 2011. Surveys are administered in paper format by trained staff and are completed within the school setting. The national response rate included an 81% school response rate and an 87% student response rate.[22]

To our knowledge, only 5 states (North Carolina, North Dakota, Rhode Island, Delaware, and Massachusetts) included questions on disability status as an optional module in 2011 and makeup the analytic sample for the current study. We did not include the data from Massachusetts because those data were not publically available at the time of this study. The 4 remaining states represent the Northeast (Rhode Island), Southeast (North Carolina and Delaware), and Midwest (North Dakota) US regions.

Instrumentation

Disability status—Students were asked 2 disability-screening questions consisting of: “Do you have any physical disabilities or long-term health problems (long-term means 6 months or more)” or “Do you have any long-term emotional problems or learning disabilities (long-term means 6 months or more)?” Disability status was recoded as a dichotomous variable. Students were considered to have a disability if they responded “yes” to 1 or both of these questions. Students were considered to have no disability if they responded “no” or “not sure” to both questions. Those with missing responses for both questions were excluded from analysis.

Demographics—Data were collected on age category (<12, 13, 14, 15, 16, 17, and ≥18 years), grade (9th, 10th, 11th, 12th, or other), sex (boy or girl), race (American Indian,

Asian, black, Native Hawaiian/other Pacific Islander, or white), and ethnicity (Hispanic/Latino or not Hispanic/Latino).

Physical activity—Three physical activity questions were asked to all study participants across the 4 states. First, respondents were asked how many days per week they were physically active for at least 60 minutes/day. Responses included 1 = 0 days, 2 = 1 day, 3 = 2 days, 4 = 3 days, 5 = 4 days, 6 = 5 days, 7 = 6 days, and 8 = 7 days. For consistency with recommended guidelines,[23] 60 minutes of activity per day was recoded into 0 times per week; 1 to 4 times per week; 5 or more times per week. Next, participants were asked how many hours per day they watched television or played video/computer games. Responses included 1 = do not watch, 2 = less than 1 hour/day, 3 = 1 hour/day, 4 = 2 hours/day, 5 = 3 hours/day, 6 = 4 hours/day, 7 = ≥ 5 hours/day. Again, for consistency with guidelines,[24] these 2 variables were dichotomized into "<2 hours/day" or "≥ 2 hours/day."

Dietary consumption—The YRBS includes 5 questions that ask about the consumption of 100% fruit juice (not including punch, Kool-Aid, or sports drinks), fruit, green salad, other vegetables, and soda/pop (not including diet drinks). For each item, individuals responded: never, 1 to 3 times per week, 4 to 6 times per week, once per day, 2 times per day, 3 times per day, and 4 or more times per day for the frequency of intake. Responses for each food/drink item were recoded into a dichotomous variable with 0 = never or 1 = at least 1 time in the past week to be consistent and comparable to national YRBS data.[25]

Body weight perception—Two questions focused on body weight or body weight perception. The first question was "How do you describe your weight"? Responses included 1 = slightly underweight, 2 = about the right weight, 3 = slightly overweight, and 4 = very overweight. Replies were dichotomized to compare adolescents who felt they were "slightly/very overweight" to those who felt they were "underweight/just right." They also were asked what they were trying to do about their weight with the following options: 1 = lose weight, 2 = gain weight, 3 = stay the same, and 4 = not trying to do anything about weight. Answers were dichotomized to examine those trying to lose weight vs not trying to lose weight.

Unhealthy weight control behavior risk index—Three questions asked about unhealthy weight control behaviors over the past 30 days: (1) fasting for 24 hours or more; (2) taking diet pills, powders or liquids; and (3) vomiting or taking laxatives. Responses were "yes" or "no." An unhealthy weight control behavior risk index was computed by combining positive responses to the 3 questions. Scores on this index ranged from 0, those who responded no to all 3 questions, to 3, those who responded positively to all 3 questions.

Obesity status—We assessed obesity status by computing the body mass index (BMI) from self-reported height and weight. Adolescent self-reported height and weight have been found to be a valid measurement of anthropometry.[26] We computed sex- and age-specific BMI percentiles based on reference data from the 2000 CDC growth tables.[27] We categorized youth as either normal/overweight (BMI ≥ 5th percentile and BMI < 95th percentile) or obese (BMI ≥ 95th percentile). Underweight adolescents (N = 448) were not included in the current analysis because those who are underweight may have chronic illness

or disease not captured by the YRBS which might result in selection bias; therefore they were excluded from the data set.

Data Analysis

Descriptive statistics were employed to describe the characteristics of adolescent study participants. Chi-square analyses were conducted to examine differences in demographic risk factors, physical activity participation, dietary consumption, body weight perception, disordered eating behaviors, and obesity by disability status. Logistic regression models were fitted to determine associations between demographic risk factors, physical activity participation, dietary consumption, body weight perception, and unhealthy weight control behaviors and the odds of obesity. Effect modification by disability status was explored by including an interaction term between disability and each predictor variable within the model. Two models were fitted with obesity as the dependent variable including: (1) a base model with each individual dietary, physical activity, body weight perception, and disordered eating behavior adjusted for demographic covariates; and (2) a final model that includes all study variables along with disability and the interaction between disability and all study variables. Odds ratios (OR) and 95% confidence intervals (CIs) were computed. Only those participants with complete data were included in the analysis. All analyses were conducted using the weighted data to account for the complex sampling design. Data were analyzed using Stata Version 12.0 (StataCorp, College Station, TX) and a p-value <.05 was used to indicate statistical significance.

RESULTS

Participant Characteristics

Most (90%) of the respondents had complete data on disability and obesity and make up the analytic sample. The total number of participants included in this analysis was 9327. There were no statistically significant differences (p-values >.05) in demographic characteristics (age, sex, race/ethnicity, and grade) for those who did (N = 9327) and did not (N = 1122) have complete data on disability and obesity. Nineteen percent of adolescents were from North Carolina, 20% from North Dakota, 22% from Delaware, and 38% from Rhode Island. There were no statistically significant state level differences in sample characteristics, obesity, physical activity, diet attributes, and weight perception. Therefore, data from all 4 states were merged and weighted percentages and 95% CI were computed to examine demographic characteristics for the overall sample and by disability status (Table 1). Approximately half (51%) of the respondents were girls, 55% in the 9th or 10th grade, 63% were white, 20% were black, 10% were of Hispanic or Latino descent, and the majority (75%) were between 15 and 17 years of age. Twenty-two percent (95% CI: 21–24%) of adolescents responded “yes” to at least 1 of the disability questions. There were no differences in sex, grade level, race, and ethnicity between adolescents with and without a disability. Adolescents with a disability were slightly older than those without a disability; 67% of adolescents with a disability were ≥ 16 years compared with 64% of those without a disability ($p < .05$).

Health practices of adolescents by disability status—Next, we examined differences in obesity, physical activity, dietary consumption, weight perceptions, and unhealthy weight control behaviors between adolescents with and without a disability. Weighted percentages and 95% CI as well as crude OR and 95% CI can be found in Table 2. There was a 1.7-fold increase in the odds of obesity (BMI ≥ 95th percentile) among adolescents with a disability compared with those without a disability (prevalence = 16% vs 10%, respectively; OR = 1.7; 95% CI: 1.3–2.1). Youth with a disability were also less likely to participate in 60 minutes of physical activity at least 5 out of 7 days/week (prevalence = 38% vs 52%, respectively; OR = 0.5; 95% CI: 0.4–0.6) and less likely to watch ≥2 hours of television per day (51% vs 57%, respectively; OR = 0.8; 95% CI: 0.7–0.9). There was no difference in the amount of time spent playing video games by disability status ($p > .10$). More than half (55%; 95% CI: 52–58%) of all adolescents spent ≥ 2 hours/day playing video games (data not shown).

Poor dietary habits were also evident for adolescents with a disability; they were less likely to consume green salads (57% vs 61%, respectively; OR = 0.8; 95% CI: 0.7–1.0), vegetables (78% vs 85%, respectively; OR = 0.7; 95% CI: 0.5–0.9), fruit (81% vs 88%, respectively; OR = 0.6; 95% CI: 0.5–0.7), and 100% fruit juices (71% vs 76%, respectively; OR = 0.8; 95% CI: 0.6–0.9) at least once in the past week compared with those without a disability.

Slightly less than half of all adolescents stated they were actively trying to lose weight (45%; 95% CI: 43–47%). There was a 1.4-fold increase in the odds of trying to lose weight for adolescents with disabilities compared with those without disabilities (50% vs 43%, respectively, OR = 1.4; 95% CI: 1.0–2.0). The prevalence of unhealthy weight control behaviors was also greater among adolescents with disabilities. They were 3 times more likely to have fasted within the past 24 hours (20% vs 9%, respectively, OR = 2.7; 95% CI: 2.2–3.4); taken diet pills, powders, or liquids (11% vs 4%, respectively, OR = 3.0; 95% CI: 2.1–4.4); or vomited or taken laxatives to try to lose weight (12% vs 3%, respectively, OR = 3.8; 95% CI: 2.5–5.7) when compared with adolescents without disabilities. When the summary score was examined, 4% (95% CI: 3–5%) of adolescents with a disability attempted to try all 3 unhealthy weight control behaviors compared with less than 1% (95% CI: 0.4–1%) of adolescents without a disability.

Factors Associated With Obesity and Moderation by Disability Status

To explore the moderating effect of disability on obesity, we first examined associations among demographic characteristics and prevalence of obesity. Obesity was more prevalent among girls compared with boys (14%; 95% CI: 12–17% vs 9%; 95% CI: 7–12%, respectively; $p < .05$) and less prevalent among non-Hispanic whites compared with blacks or other racial groups (10%; 95% CI: 8–12% vs 16%; 95% CI: 12–21% vs 15%; 95% CI: 12–18%, respectively; $p < .05$). These associations persisted regardless of disability status (p-for-interaction >.05). Age, grade level, and ethnicity did not differ by obesity status ($p > .05$). Because there were statistically significant differences in the prevalence of obesity by sex and race, all additional models included these variables as covariates.

When body weight perception was examined, after adjusting for race and sex, obese youth were 23 times more likely to state they were overweight (95% CI: 17.8–29.5) and 9 times

more likely to try to do something about their weight (95% CI: 7.0–12.1) compared with nonobese youth. Disability did not modify the associations between the 2 body weight perception variables and obesity (p-value-for interactions >.05).

Additionally, within the fully adjusted models, those who watched television or played video games for ≥2 hours/day had a greater odds of obesity (OR = 1.2; 95% CI: 1.0–1.4 and OR = 1.4; 95% CI: 1.1–1.7, respectively) compared with those who did so less than 2 hours/day. Participating in 60 minutes of physical activity at least once per week (OR = 0.6; 95% CI: 0.7–1.2) or 5 out of 7 days (OR = 0.5; 95% CI: 0.4–0.7) compared with not at all, decreased the odds of obesity among all adolescents (p-for-trend <.01). Obese adolescents were also more likely to participate in unhealthy weight loss strategies such as fasting within the past 24 hours (OR = 1.7; 95% CI: 1.3–2.3) and taking diet pills, powders or liquids (OR = 1.6; 95% CI: 1.1–2.4). When the summary score combining all 3 unhealthy weight loss strategies was examined, there was a dose-response relationship in that the more unhealthy weight loss strategies tried, the increase in the odds of obesity (p-for-trend <.01) (data not shown).

Disability modified the effect of juice intake on obesity (p-value for interaction <.05). Compared with no juice intake, consuming fruit juice at least one time in the past week decreased the odds of obesity for those adolescents with no disability (OR = 0.8; 95% CI: 0.7–0.9), whereas there was no association between juice intake and obesity for adolescents with disabilities (OR = 1.1; 95% CI: 0.9–1.6). The associations between all other diet, physical activity. and unhealthy weight loss behaviors and obesity did not differ by disability status (all p-for-interaction >.10).

DISCUSSION

This investigation revealed a higher prevalence of obesity among adolescents who self-identified as having a physical and/or emotional/learning disability in a large, representative sample of adolescents from 4 states. This finding is consistent with literature demonstrating disparities in obesity prevalence among adults[28] and children[17] with disabilities. This increase in obesity prevalence not only has been documented for children and adolescents with disabilities as a group[17,28] as in this study, but also for specific disability types such as ID,[14,29] Down syndrome,[15] autism,[30] learning disabilities,[30] asthma,[30] and hearing/vision conditions.[30] School health professionals, as well as teachers and school staff, need to be trained to understand the unique physical, behavioral, and nutritional needs of children with specific disabilities,[31] and the health behaviors practiced by adolescents with disabilities. As schools become primary settings for interventions focused on obesity prevention and increasing physical activity among youth, particular attention needs to focus on the inclusion of youth with disabilities within these programs.

The first objective of the study elucidated the factors that were associated with obesity within this sample. First, higher rates of obesity among youth with disabilities coincided with lower rates of physical activity participation. Only one third of adolescents with disabilities in this study met the recommended physical activity guidelines of 60 minutes/day 5 days/week compared with half for adolescents without disabilities. This is

consistent with evidence documenting low physical activity levels among children with special health care needs.[32–34]

Several reasons exist for lower rates of physical activity participation among youth with disabilities. Individuals with disabilities face physical, social, environmental, and policy barriers to physical activity both within community and school settings.[35] Physical barriers include lack of individual skills (physical and social), preference for activities other than physical activities, and a lack of knowledge about exercise.[35] Lack of finances for specialized equipment, lack of knowledgeable professionals, such as school staff or trained adaptive physical educators, and lack of accessible exercise facilities, are factors that may prevent or reduce participation.[33,34] Additionally, many youth with disabilities have limitations in balance, strength, coordination, power, and aerobic fitness and often struggle to compete in competitive sports programs and physical education classes with their peers; and a lack of success in physical activity programs often leads to sedentary behavior.[36] Social barriers include parental behavior and concerns, a lack of friends to participate in activity with, and negative societal attitudes to disability.[35] Psychosocial attributes such as coping ability,[37] adaptive behavior,[38] social acceptance, and emotional functioning,[39] have also been found to impact participation in physical activity in children with disabilities. Parents have general time constraints and also need to balance the needs of their children with and without disability.[40,41] Environmental barriers to physical activity in individuals with disability may also include availability of handicap accessible facilities and the location of such facilities.[35,42–44] Finally, there are policy and program barriers that exist such as lack of physical activity programs, staff, and cost.[35] There is a clear need for both schools and community organizations to increase the availability of quality physical activity opportunities for youth with disabilities. Organizations such as the Public Health Institute of the Center on Disability and the National Center on Health, Physical Activity and Disability have published guidelines for achievement of programs, policies, and educational information that support inclusion within the school and community settings.[45,46]

Within this large sample of adolescents, sex and race/ethnicity were associated with obesity. Similar to previous studies, girls[14] and non-Hispanic blacks[16] had a higher prevalence of obesity both for adolescents with and without disabilities. Additionally, known obesity risk factors including screen time,[16,47] physical inactivity,[33] and unhealthy weight loss behaviors[48] were associated with obesity among all adolescents. The strength of these relationships did not differ by disability status. These factors are critical targets of subsequent obesity prevention programs. The higher prevalence of these factors among adolescents with disabilities intensifies the need for targeted interventions to increase healthy behaviors among these youth.

The second objective of the study examined health practices of adolescents with disabilities. Unlike other studies,[16,47] we did not find evidence for increased television or video game playing among adolescents with disabilities. In fact, adolescents with disabilities watched less television compared with those without disabilities, although the reduction was slight with 51% of youth with and 57% of youth without disabilities watching ≥2 hours of television per day. About half of all adolescents, regardless of disability status, did however play ≥2 hours of video games per day. Due to the fact that decreased physical activity and

increased screen time were both significant predictors of obesity within this study, additional research is needed to investigate screen time use and the relationship between screen time use and physical activity among adolescents with disabilities.

Adolescents with disabilities also displayed worse dietary habits. Youth with disabilities were less likely to consume fruits and 100% fruit juices as well as vegetables and green salads. Although the current study is limited with respect to dietary consumption, poor dietary quality and nutritional deficits are evident among adolescents with physical and emotional/learning disabilities.[49–51] More research is needed to investigate the development of healthy eating and food selectivity to develop successful dietary interventions targeting healthy dietary habits for adolescents with disabilities.

The result of objective 2 revealed that 100% fruit juice intake was associated with a decreased chance of obesity among youth without disabilities, but not associated with obesity among youth with disabilities. The association between 100% fruit juice intake and obesity among children remains controversial. Frequent consumption of 100% fruit juice before the age of 2 years old has been associated with increases in risk of obesity at ages 4 and 5 years.[52] Yet, in a review of this association for children ages 1 to 18 years of age, researchers found no evidence of a positive association between increased intake of 100% fruit juice and increased likelihood of obesity.[53] Data from the current investigation for individuals with disabilities are consistent with this finding of a lack of association. For those without disabilities, intake of 100% fruit juice might actually be a marker of healthier dietary choices leading to a decreased association with obesity for this group. Additional studies should attempt to elucidate the patterns of beverage intakes among adolescents and their association with diet quality and obesity.

This investigation is one of the first to document the strong desire to lose weight among adolescents with disabilities, highlighting the importance of providing effective healthy weight promotion and weight loss strategies. These adolescents were more likely to state they were overweight, be actively trying to lose weight and participated in more unhealthy weight loss behaviors such as taking diet pills, powders or liquids, fasting, and vomiting or taking laxatives. Poor dietary habits coupled with unhealthy weight control practices are especially troubling as these may worsen the adverse health outcomes associated with the underlying disability among these youth. Access to healthy weight loss strategies such as increased physical activity might be denied to youth with disabilities given the social, environmental, and physical barriers to participation in physical activity. In addition, youth with disabilities might be less likely to make independent dietary choices, with a greater proportion of their diet controlled by a parent or caregiver. This lack of independent dietary choice coupled with barriers to physical activity, might make adolescents with disabilities more likely to then turn toward unhealthy weight loss strategies such as fasting, diet pills, and anorexia/bulimia, as is evident in these results.

Our results document the continued need for research focused on obesity prevention strategies for adolescents with disabilities. We found consistent evidence for an increase in the prevalence of obesity among youth with disabilities. In addition, there was recognition among these youth of their weight status and a strong desire to lose weight. A lack of

healthy dietary habits and limited physical activity was also evident among youth with disabilities possibly leading to the increased prevalence of unhealthy weight loss strategies. Given the wide variation in function among youth with disabilities, intervention research should be tailored to the functional and cognitive level of the youth and address not only the physical barriers to activity, but also the psychosocial barriers. School-based prevention programs might be most effective in targeting youth with disabilities, because all the study participants were attending high schools in the United States. These programs should work toward eliminating some of the barriers to physical activity and participation in sports and recreation activities, provide effective strategies to prevent obesity, and also appropriately address issues related to body image, self-esteem, and healthy weight loss.[48]

Limitations

This study had limitations that may impact the interpretation of these findings. Underweight youth were removed from the analysis due to concern that they might have underlying health conditions. Removal of these youth might have limited the generalizability of these findings to those without major chronic health conditions. Youth with incomplete data also were not included in this study, possible leading to selection bias if those with incomplete data were systematically different than those with complete data. Although those with and without complete data were similar with respect to age, sex, race/ethnicity, and grade level. Additionally, BMI may not be accurate for some youth with disabilities, such as those with spinal cord injury or other forms of paralysis.[54] Wheelchair scales are often not available in schools and homes and many youth with physical disabilities may not know their weight. Also, adolescents with emotional/learning disabilities and those with physical disabilities were included in one group limiting the generalizability of these data to specific disability groups. Additionally, due to the design of the YRBS, the full range of adolescents with developmental and/or cognitive disabilities (eg, autism, Down syndrome, ID, and traumatic brain injury) may not be captured because youth had to have the cognitive ability to answer the survey without assistance. This limits the generalizability of these findings to adolescents with mild cognitive disabilities. The YRBS sample included participants from only 4 states; other regions of the country such as states on the west coast were not represented which also limits the generalizability of the findings. Because the entire survey is based on self-report, there is the potential for measurement error in the diet, physical activity, and weight measures. It is unclear whether the misclassification that results from this measurement error would be nondifferential; that is similar for those with and without disabilities. The survey used has been validated and most questions have high sensitivity and specificity rates. Additional work should be done to examine validation by disability status. Finally, the cross-sectional nature of the data limits our ability to make any causal inferences. Additional longitudinal investigations should be conducted to examine associations between obesity, health habits, and disability among adolescents.

IMPLICATIONS FOR SCHOOL HEALTH

School health professionals, as well as teachers and school staff, need to be trained to understand the unique physical, behavioral, and nutritional needs of children with specific disabilities,[31] and the health behaviors practiced by adolescents with disabilities. As schools

become primary settings for interventions focused on obesity prevention and increasing physical activity among youth, particular attention needs to focus on the inclusion of youth with disabilities within these programs. In addition, school based physical activity policies can be modified to increase the amount of physical activity students are participating in during school. These policies can include the provision of adaptive physical education as a means of including youth with disabilities in school-based physical activity programs. Additionally, school health professionals and school based wellness programs should be aware of the increased risk of eating disordered behaviors found among youth with disabilities. Finally, for many children with disabilities, parents take a more active role in their every day care.[55] Therefore, school-based interventions should not only focus on physical activity and dietary intake behaviors of youth, but should also provide greater involvement of family members in incorporating healthy weight control behavioral strategies in their adolescent child.

References

1. Wang Y, Lobstein T. World-wide trends in childhood overweight and obesity. Int J Pediatr Obes. 2006; 1:11–25. [PubMed: 17902211]
2. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. JAMA. 2012; 307(5):483–490. [PubMed: 22253364]
3. Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics. 1999; 103:1175–1182. [PubMed: 10353925]
4. Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. Int J Obes. 2011; 35:891–898.
5. Raitakari OT, Juonala M, Viikari JSA. Obesity in childhood and vascular changes in adulthood: insights into the Cardiovascular Risk in Young Finns Study. Int J Obes. 2005; 29:s101–s104.
6. Craigie AM, Matthews JNS, Rugg-Gunn AJ, Lake AA, Mathers JC, Adamson AJ. Raised adolescent body mass index predicts the development of adiposity and a central distribution of body fat in adulthood: a longitudinal study. Obes Facts. 2009; 2:150–156. [PubMed: 20054219]
7. Taskar-Deshmukh P, Nicklas TA, Morales M, Yang SJ, Zakeri I, Berenson GS. Tracking of overweight status from childhood to young adulthood: the Bogalusa Heart Study. Eur J Clin Nutr. 2006; 60:48–57. [PubMed: 16132057]
8. McPherson AC, Keith R, Swift JA. Obesity prevention for children with physical disabilities: a scoping review of physical activity and nutrition interventions. Disabil Rehabil. 2014; 36(19):1573–1587. [PubMed: 24308905]
9. US Department of Education (USDOE). Twenty-fifth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act. Washington, DC: USDOE, Office of Special Education and Rehabilitative Services; 2005.
10. Mikulovic J, Marcellini A, Compte R, et al. Prevalence of overweight in adolescents with intellectual deficiency: differences in socio-educative context, physical activity and dietary habits. Appetite. 2011; 56(2):403–407. [PubMed: 21146573]
11. Story M, Kaphingst KM, French S. The role of schools in obesity prevention. Future Child. 2006; 16(1):109–142. [PubMed: 16532661]
12. Reinehr T, Dobe M, Winkel K, Schaefer A, Hoffmann D. Obesity in disabled children and adolescents: an overlooked group of patients. Dtsch Arztebl Int. 2010; 107(15):268–275. [PubMed: 20458368]
13. Stewart L, Van de Ven L, Katsarou V, Rentziou E, Doran M, Jackson P. Brief report: high prevalence of obesity in ambulatory children and adolescents with intellectual disability. J Intellect Disabil Res. 2009; 53(10):882–886. [PubMed: 19674243]

14. Maïano C. Prevalence and risk factors of overweight and obesity among children and adolescents with intellectual disabilities. Obes Rev. 2011; 12(3):189–197. [PubMed: 20406413]
15. Rimmer JH, Yamaki K, Lowry B, Wang E, Vogel LC. Obesity and obesity-related secondary conditions in adolescents with intellectual/developmental disabilities. J Intellect Disabil Res. 2010; 54(9):787–794. [PubMed: 20630017]
16. Minihan PM, Must A, Anderson B, Popper B, Dworetzky B. Children with special health care needs: acknowledging the dilemma of difference in policy responses to obesity. Prev Chronic Dis. 2011; 8(5):A95. [PubMed: 21843425]
17. Rimmer JH, Yamaki K, Davis BM, Wang E, Vogel LC. Obesity and overweight prevalence among adolescents with disabilities. Prev Chronic Dis. 2011; 8(2):A41. [PubMed: 21324255]
18. Bandini LG, Curtin C, Hamad C, Tybor DJ, Must A. Prevalence of overweight in children with developmental disorders in the continuous National Health and Nutrition Examination Survey (NHANES) 1999–2002. J Pediatr. 2005; 146:738–743. [PubMed: 15973309]
19. Hsieh K, Rimmer JH, Heller T. Obesity and associated factors in adults with intellectual disability. J Intellect Disabil Res. 2014; 58(9):851–863. [PubMed: 24256455]
20. Neumark-Sztainer D, Story M, Falkner NH, Beuhring T, Resnick MD. Disordered eating among adolescents with chronic illness and disability: the role of family and other social factors. Arch Pediatr Adolesc Med. 1998; 152(9):871–878. [PubMed: 9743032]
21. Neumark-Sztainer D, Story M, Resnick M, Garwick A, Blum RW. Body dissatisfaction and unhealthy weight-control practices among adolescents with and without chronic illness: a population-based study. Arch Pediatr Adolesc Med. 1995; 149:1330–1335. [PubMed: 7489069]
22. Eaton DK, Kann L, Kinchen SA, et al. Youth risk behavior surveillance system - United States 2011. MMWR Morb Mortal Wkly Rep. 2012; 61(SS–4):1–162.
23. US Department of Health and Human Services. [Accessed March 26, 2015] Physical Activity Guidelines for Americans. 2008. Available at: http://www.health.gov/paguidelines/guidelines
24. American Academy of Pediatrics. Committee on Public Education. Children, adolescents, and television. Pediatrics. 2001; 107(2):423–426. [PubMed: 11158483]
25. US Center for Disease Control (CDC). [Accessed April 15, 2015] Trends in the Prevalence of Obesity, Dietary Behaviors and Weight Control Practices National YRBS: 1991–2013. Available at: http://www.cdc.gov/healthyyouth/yrbs/pdf/trends/us_obesity_trend_yrbs.pdf
26. Goodman E, Hinden BR, Khandelwal S. Accuracy of teen and parental reports of obesity and body mass index. Pediatrics. 2000; 106(1):52–58. [PubMed: 10878149]
27. National Center for Chronic Disease Prevention and Health Promotion. [Accessed March 26, 2014] Body mass index-for-age. BMI is used differently with children than it is with adults. Available at: http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm
28. Armour BS, Courtney-Long EA, Campbell VA, Wethington HR. Disability prevalence among healthy weight, overweight, and obese adults. Obesity. 2013; 21(4):852–855. [PubMed: 23712989]
29. Frey GC, Chow B. Relationship between BMI, physical fitness, and motor skills in youth with mild intellectual disabilities. Int J Obes. 2006; 30(5):861–867.
30. Chen AY, Kim SE, Houtrow AJ, Newacheck PW. Prevalence of obesity among children with chronic conditions. Obesity. 2010; 18(1):210–213. [PubMed: 19521350]
31. Hinckson EA, Dickinson A, Water T, Sands M, Penman L. Physical activity, dietary habits and overall health in overweight and obese children and youth with intellectual disability or autism. Res Dev Disabil. 2013; 34(4):1170–1178. [PubMed: 23400004]
32. Rimmer JA, Rowland JL. Physical activity for youth with disabilities: a critical need in an underserved population. Dev Neurorehabil. 2008; 11:141–148. [PubMed: 18415819]
33. Patrick K, Norman GJ, Calfas KJ, et al. Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence. Arch Pediatr Adolesc Med. 2004; 158(4):385–390. [PubMed: 15066880]
34. Rimmer JH. The conspicuous absence of people with disabilities in public fitness and recreation facilities: lack of interest or lack of access? Am J Health Promot. 2005; 19(5):327–329. [PubMed: 15895533]
35. Shields N, Synnot AJ, Barr M. Perceived barriers and facilitators to physical activity for children with disability: a systematic review. Br J Sports Med. 2012; 46:989–997. [PubMed: 21948121]

36. Rimmer JH, Marques AC. Physical activity for people with disabilities. Lancet. 2012; 380:193–195. [PubMed: 22818934]
37. Lindwall JJ, Russell HF, Kelly EH, et al. Coping and participation in youth with spinal cord injury. Top Spinal Cord Inj Rehabil. 2012; 18(3):220–231. [PubMed: 23459106]
38. Palisano RJ, Chiarello LA, Orlin M, et al. Determinants of intensity of participation in leisure and recreational activities by children with cerebral palsy. Dev Med Child Neurol. 2011; 53(2):142–149. [PubMed: 20964676]
39. King G, Law M, Petrenchik T, Hurley P. Psychosocial determinants of out of school activity participation for children with and without physical disabilities. Phys Occup Ther Pediatr. 2013; 33(4):384–404. [PubMed: 23713883]
40. Menear KS. Parents' perceptions of health and physical activity needs of children with Down syndrome. Down Syndrom Res Prac. 2007; 12:60–68.
41. Yazdani S, Yee CT, Chun PJ. Factors predicting physical activity among children with special needs. Prev Chronic Dis. 2013; 10:e119. [PubMed: 23866163]
42. Wilkinson PF. Disabled children and integrated play environments. Rec Res Rev. 1983; 10:20–28.
43. Levinson LJ, Reid G. Patterns of physical activity among youngsters with developmental disabilities. CAHPER J. 1991; 57(3):24–28.
44. Jones DB. 'Denied from a lot of places' barriers to participation in community recreation programs encountered by children with disabilities in Maine: perspectives of parents. Leisure/Loisir. 2003/2004; 28(1–2):49–69.
45. Center on Disability at The Public Health Institute. [Accessed June 23, 2015] Guidelines for disability inclusion in physical activity, nutrition, and obesity programs and policies. Available at: http://centerondisability.org/docs/Guidelines_Disability_Inclusion_Physical_Activity_Flyer.pdf
46. National Center on Health, Physical Activity and Disability. [Accessed June 23, 2015] For educators: building healthy inclusive communities. Available at: http://www.nchpad.org/Educators
47. Murphy NA, Carbone PS. Promoting the participation of children with disabilities in sports, recreation, and physical activities. Pediatrics. 2008; 121(5):1057–1061. [PubMed: 18450913]
48. Jones M, Taylor Lynch K, Kass AE, et al. Healthy weight regulation and eating disorder prevention in high school students: a universal and targeted Web-based intervention. J Med Internet Res. 2014; 16(2):e57. [PubMed: 24583683]
49. Field D, Garland M, Williams K. Correlates of specific childhood feeding problems. J Paediatr Child Health. 2003; 39:299–304. [PubMed: 12755939]
50. Deckers S, De Moor J, Van der Burg J. Food preferences in young Dutch children and recommendations for feeding intervention in developmental disabilities. Res Dev Disabil. 2011; 32:630–635. [PubMed: 21227638]
51. Bertoli S, Battezzati A, Merati G, et al. Nutritional status and dietary patterns in disabled people. Nutr Metab Cardiovasc Dis. 2006; 16(2):100–112. [PubMed: 16487910]
52. Shefferly A, Scharf RJ, DeBoer MD. Longitudinal evaluation of 100% fruit juice consumption on BMI status in 2–5-year-old children. Pediatr Obes. 2016; 11(3):221–227. [PubMed: 26110996]
53. Crowe-White K, O'Neill CE, Parrott JS, et al. Impact of 100% fruit juice consumption on diet and weight status of children: an evidence based review. Crit Rev Food Sci Nutr. 2016; 56(5):871–874. [PubMed: 26091353]
54. McDonald CM, Abresch-Meyer AL, Nelson MD, Widman LM. Body mass index and body composition measures by dual x-ray absorptiometry in patients aged 10 to 21 years with spinal cord injury. J Spinal Cord. 2007; 30(S1):S97–S104.
55. George VA, Shacter SD, Johnson PM. BMI and attitudes and beliefs about physical activity and nutrition of parents of adolescents with intellectual disabilities. J Intellect Disabil Res. 2011; 55(11):1054–1063. [PubMed: 21726317]

Table 1

Demographic Characteristics of 9775 Adolescent Study Participants by Disability Status

	Total Sample (N =9775) % (95% CI)	Disability (N =1986) % (95% CI)	No Disability (N =7789) % (95% CI)
Age (years *)			
12–13	1 (0.4–1.2)	1 (0.4–2)	0.1 (0.0–0.3)
14	9 (8–11)	8 (6–11)	10 (8–12)
15	25 (22–29)	25 (21–28)	26 (23–30)
16	27 (24–30)	31 (27–35)	26 (23–29)
17	23 (20–26)	21 (18–24)	23 (20–26)
≥18	15 (12–18)	15 (11–19)	15 (12–18)
Gender			
Male	49 (47–52)	50 (47–53)	49 (45–52)
Female	51 (49–53)	50 (47–53)	51 (48–55)
Grade			
9th	29 (23–35)	30 (24–37)	29 (23–35)
10th	26 (22–31)	28 (23–34)	26 (21–32)
11th	24 (19–29)	22 (18–27)	22 (18–27)
12th	21 (17–27)	19 (15–25)	23 (18–25)
Race			
American Indian/Native Hawaiian	3 (1–6)	4 (3–8)	3 (1–7)
Asian	1 (1–2)	1 (0.5–2)	2 (1–2.5)
Black	20 (15–26)	19 (14–26)	20 (15–26)
White	63 (56–69)	61 (54–69)	63 (56–70)
Hispanic/multiple Hispanic	10 (9–12)	11 (8–14)	9 (7–10)
Multiple non-Hispanic	3 (2–4)	4 (2–6)	3 (2.8–4)
Ethnicity			
Hispanic/Latino	10 (8–12)	11 (8–14)	9 (7–11)
Not Hispanic/Latino	90 (88–91)	89 (86–92)	91 (89–93)

* $p < .05$.

Table 2

Obesity, Physical Activity, Dietary Habits, Body Perception, Unhealthy Weight Control Behaviors, and Odds Ratios (OR) by Disability Status for 9775 US Adolescent Study Participants

	Disability (N =1986) % (95% CI)	No Disability (N =7789) % (95% CI)	OR (95% CI)
Obesity **			
No	84 (79–88)	90 (88–91)	1.0 (ref)
Yes	16 (12–21)	10 (9–12)	1.7 (1.3–2.1)
Physical activity			
Days per week active at least 60minutes **			
0days	20 (16–24)	13 (11–15)	1.0 (ref)
≥1day and <5days	42 (38–45)	35 (34–37)	0.8 (0.6–1.0)
≥5days	38 (34–43)	52 (49–54)	0.5 (0.4–0.6)
Hours per day watch television **			
<2hours	49 (45–54)	43 (40–46)	1.0 (ref)
≥2hours	51 (46–55)	57 (54–60)	0.8 (0.7–0.9)
Hours per day play video games			
<2hours	46 (40–51)	45 (42–48)	1.0 (ref)
≥2hours	54 (49–60)	55 (52–58)	1.0 (0.9–1.3)
Dietary consumption			
Fruit juice (100%fruit juice) **			
Never	29 (25–33)	24 (21–26)	1.0 (ref)
≥1 time in the past week	71 (67–75)	76 (74–79)	0.8 (0.6–0.9)
Soda (not including diet soda)			
Never	24 (21–27)	21 (18–23)	1.0 (ref)
≥1 time in the past week	76 (73–79)	79 (77–82)	0.8 (0.7–1.1)
Fruit **			
Never	19 (16–23)	12 (11–14)	1.0 (ref)
≥1 time in the past week	81 (77–84)	88 (86–89)	0.6 (0.5–0.7)
Green salad **			
Never	43 (38–48)	39 (35–42)	1.0 (ref)
≥1 time in the past week	57 (52–62)	61 (58–65)	0.8 (0.7–1.0)
Other vegetables **			
Never	22 (17–27)	15 (13–18)	1.0 (ref)
≥1 time in the past week	78 (73–83)	85 (82–87)	0.7 (0.5–0.9)
Weight perception			
Description of weight status **			
Underweight/just right	67 (65–70)	74 (71–76)	1.0 (ref)
Slightly/very overweight	33 (30–35)	26 (24–28)	1.4 (1.2–1.6)
What are you doing about your weight? **			
Not trying to lose weight	50 (46–53)	57 (54–59)	1.0 (ref)

	Disability (N =1986) % (95% CI)	No Disability (N =7789) % (95% CI)	OR (95% CI)
Trying to lose weight	50 (47–54)	43 (41–46)	1.3 (1.1–1.6)
Unhealthy weight control behaviors			
Not eat for 24hours **			
No	80 (77–82)	91 (90–92)	1.0 (ref)
Yes	20 (18–23)	9 (8–10)	2.7 (2.2–3.4)
Take diet pills/powders/liquids **			
No	89 (86–92)	96 (95–97)	1.0 (ref)
Yes	11 (8–14)	4 (3–5)	3.0 (2.1–4.4)
Vomit/take laxatives **			
No	88 (84–91)	97 (96–98)	1.0 (ref)
Yes	12 (9–16)	3 (2–4)	3.8 (2.5–5.7)
Summary score **			
None	74 (71–78)	88 (87–89)	1.0 (ref)
One factor	16 (13–18)	9 (8–10)	2.0 (1.6–2.5)
Two factors	5 (5–7)	2 (1–3)	3.1 (2.1–4.6)
Three factors	4 (3–5)	0.6 (0.4–1)	7.8 (4.6–13.1)

** $p < .01$.

CI, confidence interval.