

Overweight Among High School Children: How Does Wisconsin Rank?

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ABSTRACT

Background: The rate of childhood overweight is increasing among our nation's youth. This epidemic has led to an increase of comorbidities such as high blood pressure and diabetes being treated in the pediatric population. This paper analyzes self-reported heights and weights to determine trends in the prevalence of overweight among US students in grades 9-12.

Methods: Data from the Youth Risk Behavior Surveillance System from 1999 to 2003 were used to determine the prevalence of overweight—which is defined as a BMI \leq 85th percentile for age and gender—in 41 participating states. (Data from the “at risk of overweight” group [defined as BMI \geq 85 percentile and $<$ 95 percentile] and the “overweight” group [defined as BMI \geq 95 percentile] were combined and labeled as “overweight” [BMI \geq 85 percentile] to make communication of results more clear.)

Results: The prevalence of overweight adolescents in Wisconsin increased slightly during the past 4 years, from 22.6% in 1999 to 24.1% in 2003, with adolescent males 50% more likely than females to be overweight. In 2003, Wisconsin's rate of overweight was the 14th lowest among 41 states reporting to the Centers for Disease Control and Prevention. (Colorado is lowest at 15.7% and Mississippi is highest at 31.4%.) When examining races separately, Wisconsin's ranking decreases slightly, but remains in the top half of all states reporting.

Conclusions: The prevalence of childhood overweight in Wisconsin appears to be rising, following the national trend. The prevalence of overweight among high school students is lowest in the Rocky Mountain states. Understanding reasons for these differences may shed light on strategies to decrease overweight in Wisconsin.

INTRODUCTION

It is well known that obesity among children has been declared a national epidemic. Unfortunately, obesity has become the most prevalent nutritional disease of American children,¹ with the prevalence doubling in the past 20 years. Body Mass Index (BMI) specific for age and gender is used to assess the weight of children (BMI = weight in kilograms/height in meters²). Currently, 15.5% of our nation's 12 to 19 year olds are now considered overweight, defined as a BMI at or above the 95th percentile for age and gender.² The numbers are even higher among subgroups of minority and economically-disadvantaged youth. For example, one study examining the data through 1998 found that more than 20% of both African American and Hispanic children are overweight.³

The increase in childhood overweight will lead to an increase in associated comorbidities seen in the pediatric population. Overweight and obese children are at greater risk of developing hypertension, diabetes, hyperlipidemia, orthopedic complications, infertility, and depression.¹ In addition, childhood overweight is strongly correlated with adult obesity. In a study that followed children for an average of 17 years, 77% of those who were overweight as children reportedly remained obese as adults, compared with 7% who were normal weight as children and became obese in adulthood.⁴

It is important to understand the nature of the obesity epidemic among Wisconsin's children, as health care professionals and policy makers ponder solutions. The purpose of this paper is to review recent trends in obesity and to define where Wisconsin ranks for childhood overweight and obesity as compared with other states.

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METHODS

Data on weights and heights of school students in the United States and Wisconsin were obtained from the Youth Risk Behavior Surveillance System (YRBSS) study's Web page.⁵ The YRBSS system screens 6 categories of health risks among American youth: (1) self-reported behaviors that lead to unintentional injury and violence; (2) tobacco use; (3) alcohol and other drug use; (4) sexual behaviors; (5) dietary behaviors, weight and height; and (6) physical activity. This surveillance system is a compilation of a nationally conducted school-based survey by the Centers for Disease Control and Prevention (CDC), as well as state and local school-based surveys conducted by education and health agencies. The survey is carried out every 2 years among a representative sample of students in grades 9-12. The most recent survey, conducted in 2003, included over 15,000 students from 32 states.

The YRBSS first began recording weight and height information as part of the 1999 survey (based on self-reports from children). To include as many states as possible, we included all states with data from 2003, 2001, or 1999. Data were also included from states with unweighted data (weighting is done for surveys with sufficient response rates) if no weighted results were available. When ranking the states, we defined number 1 as the state with the least amount of overweight and at risk for overweight children. A higher prevalence of childhood overweight is represented by a higher number ranking (i.e. the most overweight state is number 41).

We also calculated percent overweight for whites only (rates for other minorities are not uniformly available). We then ranked states for whites only to determine the effect of racial and ethnic diversity on states' rankings. Since nationally the prevalence of overweight is higher in minority children,³ some states may have a higher prevalence of overweight as a result of having a large minority population. Finally, age, gender, and year-specific data were compiled for Wisconsin to identify any significant trends particular to the state.

The CDC and several expert committees have declared BMI-for-age as the most useful measure of overweight in children and adolescents.⁶ Standard measures by the CDC define a gender-specific BMI-for-age from the 85th-94th percentile as "at risk for overweight," comparable to a BMI of 25-29 in adults (defined for adults as "overweight"). A gender-specific BMI-for-age at or above the 95th percentile is considered "overweight" (or in the past obesity) in children and is comparable to a BMI of 30 or greater in adults (defined for adults as obesity).

For this study, and to improve communication of the

Table 1. Characteristics of Overweight High School Students (Based on Self-Reported Height and Weight), Wisconsin and United States, 1999-2003*

	% Overweight [†]	Total Estimated No. Overweight Children [‡]	Approx. 95% CI
Wisconsin Data			
Gender [§]			
M	28.2	47,102	25.4, 31.0
F	19.6	31,112	17.2, 22.0
Grade [§]			
9	23.0	18,731	19.3, 26.7
10	23.4	19,057	20.1, 26.7
11	27.0	21,989	23.1, 30.9
12	23.0	18,731	18.9, 27.1
Race [§]			
White	23.1	66,897	21.1, 25.1
Other	32.5	12,547	23.7, 41.3
Year			
1999	22.6	73,621	20.3, 24.9
2001	23.9	77,856	22.1, 25.7
2003	24.1	78,507	22.2, 26.0
United States Data			
1999	25.1	4,060,154	24.4, 25.8
2001	24.1	3,898,395	23.4, 24.8
2003	26.9	4,351,321	26.2, 27.6

*Youth Risk Behavior Surveillance System Data

[†]Includes overweight and at risk for overweight (BMI $\geq 85\%$)

[‡]Numbers calculated from 2000 census data

[§]2003 Data

results, we defined "overweight" to include those children with a BMI ≥ 85 th percentile (including both "at risk for overweight" and "overweight"). A study by Brener found that by combining the at risk for overweight and overweight groups there was higher correlation between classifications based on self-reported BMI and measured BMI than when classifying students as either at risk for overweight or overweight.⁷ Combining was also done based on a literature review examining the large proportion of both overweight and at risk for overweight children who become obese adults. One study found that only 10% of children with a BMI-for-age < 85 th percentile were obese at age 25, whereas 75% and 80% of those with a BMI-for-age ≥ 85 th percentile and ≥ 95 th percentile, respectively, were obese as adults.⁶ The combined prevalence was calculated by adding together the prevalence of overweight and at risk for overweight groups. The 95% confidence interval for the prevalence was estimated based on the relevant YRBSS sample size using the standard estimate for the variance of a proportion.

RESULTS

In 2003, 24.1% of Wisconsin high school children were

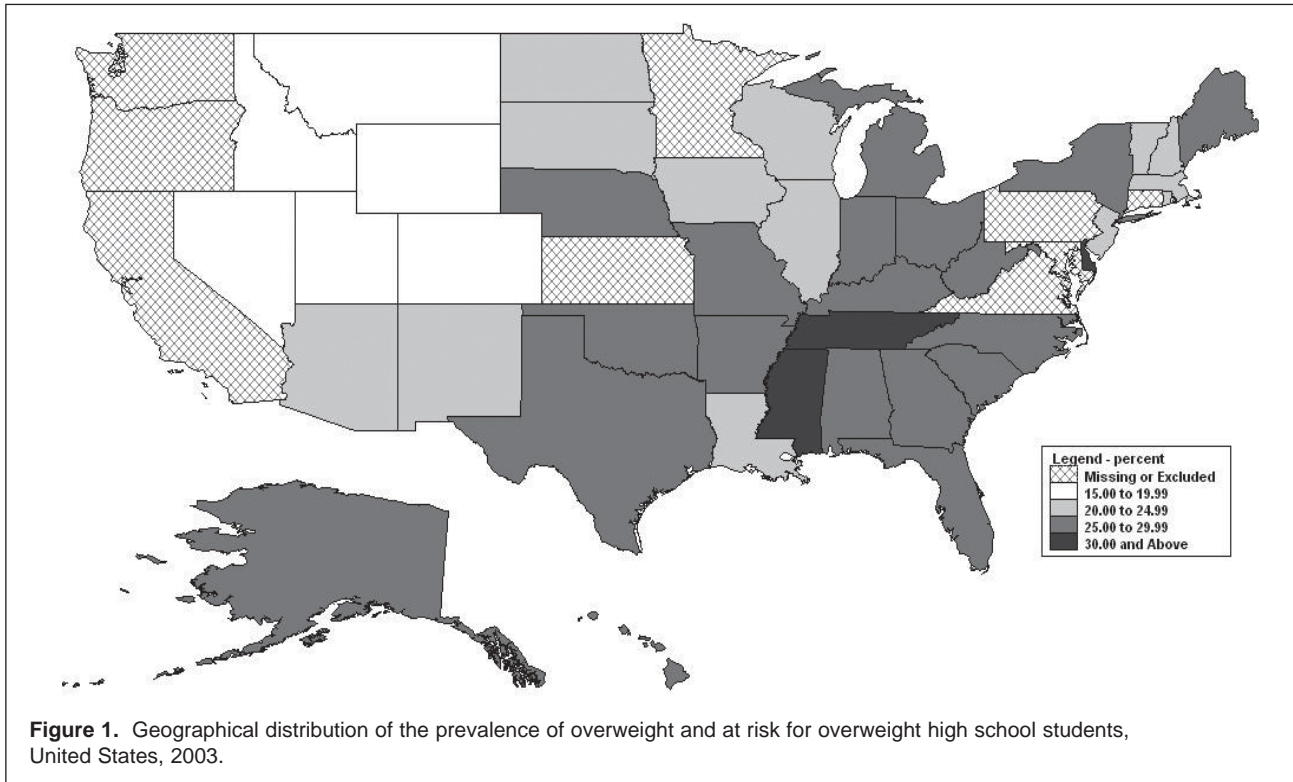


Figure 1. Geographical distribution of the prevalence of overweight and at risk for overweight high school students, United States, 2003.

considered overweight. A significantly greater proportion of Wisconsin males (28.2%) compared to females (19.6%) were overweight; thus high school males were almost 1.5 times more likely to be overweight than were high school females (Table 1). Although about 23% of Wisconsin 9th, 10th, and 12th grade students sampled were overweight compared to the 27% seen among high school juniors, the differences in prevalence among the grades is not significant.

Looking specifically at Wisconsin data, one can see that the trend in childhood overweight is increasing similarly to the nationwide trend, which showed an increase from 25.1% in 1999 to 26.9% in 2003. The prevalence of childhood overweight among Wisconsin high school students has increased from 22.6% in 1999 to 24.1% in 2003 (Table 1). Although this difference is not statistically significant, it parallels national trends. Based on this YRBSS data, approximately 4900 additional high school children in Wisconsin have been classified as overweight in the past 4 years.

Rates of overweight vary from state to state (Figure 1, Table 2). Wisconsin ranks 14th among 41 states with available data in prevalence of childhood overweight. When separating states into quartiles based on ranking, Wisconsin children are in the second quartile. Colorado has the least amount of childhood obesity (15.7%), and Mississippi has the highest amount (31.4%). Wisconsin was also better than the national average, which was

26.9% for the 2003 survey. Most of the states with the lowest rates of childhood overweight are located in the Western and Rocky Mountain regions.

Finally, to minimize potential bias associated with race, we calculated the percent overweight among white children and ranked the states that reported race specific data (n=36). In general, rates are lower among white children than in the general population of each state, reflecting higher rates of overweight among minorities. In this comparison, Wisconsin drops slightly, to a rank of 17th, although it still remains in the top half of states with available data. Other states such as Arizona, Georgia, Hawaii, and South Carolina move from the third to the first quartile. The opposite is true for New Hampshire and Vermont, which move into less desirable quartiles.

DISCUSSION

Nationally, almost 27% of America's high school students were found to be overweight or at risk for overweight in 2003. Wisconsin children are slightly better than average, ranking 14th least overweight among 41 states where data are available. Yet Wisconsin still has a rate of childhood overweight that appears to be increasing. Based on these trends, approximately 1200 more high school children each year would become overweight in Wisconsin. Interestingly, when looking at race-specific data, the rankings change significantly for

some states. Unfortunately, the data are limited because there are only 36 states that reported race-specific data. When dividing the states into quartiles, Wisconsin remains in the second quartile, but moves from 14 of 41 to 17 of 36 for whites only.

Variation in the proportion of minorities living in each state contributes to the observed variation in overweight, since minorities have higher rates of obesity. However, examining only whites controls for this, and wide variation is still observed. The variation in state rates may reflect socioeconomic or environmental differences such as access to healthy foods, safe walking/bike paths, recreational opportunities, etc.

In Wisconsin, males are 50% more likely to report being overweight than females. Further research could help explore the reasons for this and help target appropriate interventions. Some factors to consider may be the impact of video games and computers on adolescent males vs adolescent females. Interestingly, this trend is not seen in adults. A limitation of our study is that the BMI data used were based on self-reported height and weight, which could underestimate the prevalence of overweight among adolescents. The reliability and validity of these measures in children and adolescents has been examined extensively and remains questionable. Some studies^{8,9} have found adolescents under-report their weight and height, leading to an underestimation of the overweight classification by up to 50%. Yet, another study looking at overweight adolescents found that more than 96% of participants were correctly classified as “overweight” or “not overweight” using self-reported data.¹⁰ Although the validity of self-reported weight and height is questionable, reliability appears strong. Brener’s study showed that among high school students, self-reported height and weight measurements were highly correlated between 2 different time periods ($r = 0.93$).⁷ There are many possible reasons for the discrepancies between self-reported and measured values, including societal influences on body stature and the fact that adolescents are growing rapidly and may truly not know their actual weight and height. However, most studies show that self-reported data underestimate the prevalence of childhood obesity, yet they are reliable to compare across different age-matched populations and to evaluate trends. Therefore, our data may not represent the exact prevalence, but the trends are likely significant and comparisons across states can still be made.

This rising rate of overweight children is alarming and is raising concerns as to where our children’s future will lead. Nationally, overweight in adolescents has dou-

Table 2. Prevalence of Childhood Overweight and at Risk for Overweight (Based on Self-Reported Height and Weight) and Rank Across the United States, Total and White Only, 2003*

State	% Overweight†	Rank (n=41)	% Overweight† (White only)
Colorado‡§	15.7	1	—
Utah	18.3	2	17.3
Idaho	18.7	3	17.6
Wyoming	18.9	4	18.3
Nevada¶	19.5	5	15.0
Montana	19.7	6	18.4
North Dakota	20.3	7	19.2
New Mexico§¶	21.3	8	—
Illinois‡§	22.4	9	—
New Hampshire	23.3	10	23.2
Massachusetts	23.7	11	22.0
Iowa§	23.8	12	—
South Dakota	23.9	13	22.2
Wisconsin	24.1	14	23.1
Rhode Island	24.3	15	22.7
Arizona	24.4	16	18.3
Louisiana‡§	24.4	16	—
New Jersey‡	24.7	18	21.8
Vermont	24.9	19	24.7
Nebraska	25.1	20	23.2
Hawaii¶	25.3	21	13.1
Oklahoma	25.3	21	22.9
South Carolina¶	25.3	21	19.4
Alaska	25.4	24	24.5
Indiana	25.7	25	23.8
Georgia	26.2	26	21.5
Florida	26.4	27	23.6
Missouri	27.0	28	26.7
Ohio	27.0	28	26.1
North Carolina	27.2	30	24.0
Maine	27.4	31	27.4
Michigan	27.4	31	25.1
Alabama	28.0	33	26.2
New York	28.3	34	25.1
Texas‡	28.8	35	22.4
West Virginia	28.8	35	28.6
Arkansas‡	29.7	37	27.1
Kentucky	29.9	38	29.4
Tennessee	30.0	39	27.4
Delaware	30.2	40	27.0
Mississippi	31.4	41	26.6

*Youth Risk Behavior Surveillance System Data

†Includes overweight and at risk for overweight

‡2001 data

§Unweighted data

¶1999 data

bled during the past 20 years. Our study results show a continuing rise of 1.5% since 1999. In Marshfield, Wis, where measured height and weights have been recorded in schools since 1982, the prevalence of overweight (BMI \geq 95th percentile) children age 5 to 15 years has more than doubled from 6% in 1982 to 14% in 2003.¹¹

Similarly, when looking at both overweight and at risk for overweight 5 to 15 year olds, the prevalence has increased from 18% to 31% during this 22-year period.

The morbidity formerly associated only with adult obesity is now appearing in pediatric practices nationwide. Between 40% and 50% of overweight children have features of the metabolic syndrome (hypertension, glucose intolerance, dyslipidemia, central obesity), which places them at high risk for early onset coronary artery disease and type 2 diabetes mellitus.¹² The American Academy of Pediatrics recognizes overweight and obesity as a significant need for early prevention, since it is well known that obesity, along with its comorbidities, is difficult to overcome in adulthood.²

It has been well established that obesity occurs from a calorie imbalance. Adolescents are at increased risk of high calorie diets and low physical activity due to changes in society, such as the increased marketing of fast food and sodas along with the increase in sedentary activities such as video games and the Internet. Between 1970 and the mid-1990s, Bowman reports that fast food consumption by children increased from 2% to 10%.¹³ School lunch environments have also been changing with many schools now offering ala carte (90%) and vending machine options (76% of high schools) with fewer children opting for the National School Lunch Program meals that must meet specific dietary guidelines.¹⁴

The second factor in this equation is that more children are spending time in sedentary behaviors. In fact, based on a recent report from North Carolina, obesity has increased by 10% between 1980 and 2000, while caloric intake only rose 1%, and physical activity decreased 13%.¹⁵ Gortmaker found that the average 10 to 15 year old watches almost 5 hours of television daily, leading to a risk of overweight 5 times that of non-television viewers.¹⁶ In Wisconsin, almost 32% of high school students do not participate in sufficient physical activity.⁵ This number ranges from 28.1% of 9th grade students to 40.2% of high school seniors. The large difference in these numbers could be related to decreased physical education requirements for upper classmen or decreased participation in sports as non-varsity juniors and seniors may choose not to play.

What can be done? A large push in the recent literature has been to decrease access to unhealthy high-sugar, high-fat foods in America's schools. Although this idea is enticing, it is full of roadblocks. Most food service industries are self-supporting and need to offer these less healthy choices in order to bring in sufficient revenue to balance their costs. Other schools

use the revenue to provide funding for athletics, clubs, and school field trips. It is difficult to pass a policy that would decrease the funds available for these programs. In addition, childhood overweight is seen even before adolescence. In most elementary schools, where the prevalence of childhood overweight is 15.3%, only National School Lunch Program Meals are provided, which must follow strict dietary guidelines.² Imposing healthier food policies in schools could be beneficial for promoting healthier lifelong habits, but unfortunately it cannot overcome the enticing options children are exposed to outside of school. Additionally, as noted above in the North Carolina study, food consumption has not changed as dramatically as physical activity in the past 20 years. Therefore, it is proposed that the more beneficial policy would be to increase physical activity during the school day.

The recommended guidelines for adolescents include at least 20 minutes of moderate to vigorous activity 3 days a week.¹⁷ Unfortunately, 32% of Wisconsin adolescents do not meet this recommendation. Interestingly, this number is very similar to the prevalence of overweight and at risk of overweight Wisconsin adolescents. The Task Force on Community Preventive Services recommends enhancing physical education classes as one of the most effective means to increase physical activity in children.¹⁸ In its review of schools that increased the amount of time spent performing moderate or vigorous activity, an 8% increase in aerobic fitness level occurred. In schools where increased time is not possible, the option of physical education homework in order to earn an "A" could be considered, in which students are required to perform 30 minutes of physical activity at home and have a note signed by their parent stating this was done. Another Task Force finding was that increasing access to places for physical activity will increase the amount of physical activity. Of the studies reviewed, there was a 25% increase in the number of those who exercised 3 times weekly as a result of creating trails, building facilities, or providing access to nearby facilities such as school gyms. Community-wide campaigns that involve multimedia messages, improved environments, health fairs, and policy change have resulted in a 5% increase in physical activity and 16% increase in energy expenditure.¹⁸

Where should we head in the fight against childhood obesity? The goal, as stated in *Healthiest Wisconsin 2010*, is to decrease adolescent overweight by 20%. First, communities should establish methods to measure and monitor trends in overweight among school children.¹¹ This study demonstrates that communities in

the western United States already have rates at or below Wisconsin's target. Understanding reasons for these differences between communities may shed light on strategies to decrease overweight in Wisconsin. Ultimately, the goal is to form healthy habits early, which involves a combination of increased nutritional education and a larger push towards increasing access to, and interest in, physical activity.

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