Statewide Prevalence and Correlates of Walking and Bicycling to School

Kelly R. Evenson, PhD; Sara L. Huston, PhD; Bradley J. McMillen, PhD; Philip Bors, MPH; Dianne S. Ward, EdD

Background: Travel to and from school can be an important and regular source of physical activity for youth. Few US studies have documented the prevalence and correlates of walking and bicycling to school.

Objective: To examine the prevalence and correlates of walking and bicycling to school among middle and high school youth.

Design: Cross-sectional survey.

Setting: Sixty middle schools and 62 high schools selected in North Carolina.

Participants: Students in 6th through 8th grades (n=2151) and in 9th through 12th grades (n=2297) during the spring of 2001.

Main Outcome Measures: Walking or bicycling to school in a usual week.

Results: Among middle school students, 9.4% usually walked to school and 4.1% usually bicycled to school at least 1 day per week. Among high school students, 4.9% usually walked to school and 2.8% usually bicycled to school at least 1 day per week. For middle school youth, walking or bicycling to school was more prevalent among boys and among nonwhites. For high school youth, walking or bicycling to school was also more prevalent among nonwhites. For middle school youth (but not high school youth), a higher body mass index (85th to less than 95th percentile) was associated with a reduced odds of walking to school. For high school youth (but not middle school youth), participating in physical education 1 to 4 days per week or never having an adult at home immediately after school was associated with walking or bicycling to school. Higher parental educational level was associated with a reduced odds of walking to school among high school youth.

Conclusions: The descriptive information provided by this study broadens our limited understanding of the prevalence and correlates of walking and bicycling to school in the United States. Further qualitative and quantitative descriptive data are needed to develop successful interventions to increase walking and bicycling to school.


A recent expert consensus conference recommended 60 minutes per day of at least moderate-intensity activity for all youth. Despite these recommendations, the 1999 US Youth Risk Behavior Survey (YRBS) indicated that 35% of US high school youth do not participate in regular vigorous physical activity. Cross-sectional comparisons noted a steady decline in leisure activity with advancing grade levels. In addition, one quarter of high school youth were overweight or at risk for becoming overweight. The lower prevalence of activity during youth, coupled with the alarming rise in type 2 diabetes mellitus and the risk of becoming obese as adults, contributes to future preventable health problems.

Travel to and from school can be an important and regular source of physical activity for youth. This becomes especially important as time spent on physical activity in school declines. Moreover, if physical activity habits track from youth into adulthood, then encouragement of physical activity as a mode of transportation in youth would be important. Despite the potential importance of walking and bicycling to school for physical activity, however, there are few US studies that explore their use and correlates. This study examined the prevalence and correlates of walking and bicycling to school among middle and high school youth.

Methods

The YRBS was begun in 1990 to monitor adolescent health risk behaviors by the Centers for Disease Control and Prevention, Atlanta, Ga, in collaboration with state health depart-
ments and departments of education. The survey gathers self-reported information from youth on behaviors associated with the leading causes of morbidity and mortality among young people and is administered at the state and national levels in odd-numbered calendar years. For the individual states that administer their own surveys, a 2-stage cluster sample design is used to produce a representative sample of students. The first stage of the sampling frame selects primary sampling units, consisting of schools. These primary sampling units are selected with probability proportional to the total school enrollment. The second stage consists of randomly selecting a certain number of classes (eg, English or second-period classes) from grades 6 through 8 or 9 through 12 at each selected school, with the number of classes selected proportional to the school enrollment (ie, the larger the school, the greater the number of classes sampled). All students in the selected classes are eligible to participate in the survey, if they are able to comprehend and respond to the multiple-choice items in a paper-and-pencil format. Once the data are collected and compiled, a weighting factor is applied to each student record to adjust for varying probabilities of selection at each stage of sampling, student nonresponse, sex representation, and race/ethnicity representation. Further detail on the YRBS sampling procedures is available elsewhere.

The present study used data from the 2001 state-level YRBS conducted in North Carolina and administered by the Department of Public Instruction. The questionnaire was designed at a seventh-grade reading level and given in English only. Between February and April of 2001, North Carolina administered the survey to 60 middle schools and 62 high schools. The response rate for middle schools was 83% (60/72), with a student response rate of 90%, for an overall response rate of 75%. The response rate for high schools was 86% (62/72), with a student response rate of 84%, for an overall response rate of 73%. This secondary data analysis was approved by the University of North Carolina Institutional Review Board.

MEASUREMENT OF PHYSICAL ACTIVITY

Although the national 2001 YRBS questionnaire did not contain indicators specifically related to walking and bicycling to school, North Carolina added items to the YRBS to measure these behaviors in 2001. To assess walking and bicycling to school, students were asked: “When the weather permits, on how many days per week do you usually walk to school?” and “When the weather permits, on how many days per week do you usually ride a bicycle to school?” (response options, 0-5 days). The validity and reliability of this question are not known. Vigorous activity was determined by the question: “On how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?” (response options, 0-7 days). Moderate activity was determined by the question: “On how many of the past 7 days did you participate in physical activity for at least 30 minutes that did not make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors?” (response options, 0-7 days). Physical education participation was assessed with the following question: “On an average week when you are in school, on how many days do you go to physical education (PE) classes?” (response options, 0-5 days).

MEASUREMENT OF OTHER FACTORS

Body mass index (BMI) was calculated from self-reported height and weight, calculated as weight in kilograms divided by the square of height in meters. The reference data from the Centers for Disease Control and Prevention growth charts were applied to obtain percentiles for determining overweight status. Body mass index was used to define risk for becoming overweight (BMI at or above 85th and less than 95th percentile by age and sex) and overweight (BMI at or above 95th percentile by age and sex).

The highest educational level of the parents or adults the student lived with was self-reported by the student and categorized as “less than high school,” “high school,” or “more than high school” for analysis purposes. Students were also asked: “Is there usually an adult at your home in the afternoon when you return from school?” (response options, “never,” “sometimes,” or “always”). Whether they participated in any extracurricular activities at school (such as sports, band, drama, and clubs) was only asked of high school students and was self-reported as yes or no. The complete North Carolina YRBS 2001 questionnaires can be obtained elsewhere.

STATISTICAL ANALYSIS

In the 2001 YRBS, 4745 youth living in North Carolina participated. We excluded 46 middle school and 251 high school youth with missing information on items pertaining to walking and bicycling to school, leaving 4448 for the analysis. These questions were placed at the end of the survey because these items were state-added questions, and it is likely that missing data on these 2 questions were due to running out of time to complete the survey during the class period. There were more missing data on these items on the high school survey, as this survey was longer (86 questions) compared with the middle school survey (63 questions).

Unconditional logistic regression was used to calculate odds ratios and 95% confidence intervals (CIs), predicting walking or bicycling to school separately for middle school and high school youth. The following independent variables were used in our multivariable models: sex, grade in school, race, BMI, days of physical education class per week, parental educational level, and how often an adult was home after school. The goal in statistical modeling was not to obtain the most parsimonious model, but rather to conduct parallel analyses so that associations could be compared between middle school and high school youth and between walking and bicycling. We used commercially available statistical software (SAS version 8.01 and SAS-callable SUDAAN version 7.5.2; SAS Institute, Cary, NC) for all analyses to calculate weighted prevalences and logistic regression models that account for the complex sampling scheme.

RESULTS

PREVALENCE OF WALKING AND BICYCLING TO SCHOOL

The prevalence of walking and bicycling to school was low among middle school youth and lower for high school youth (Table 1). Overall, 12.1% (95% CI, 8.9%-15.2%) of middle school and 6.4% (95% CI, 5.1%-7.8%) of high school youth reported 1 or more days (ie, any) bicycling or walking to school in a usual week.

CORRELATES OF WALKING AND BICYCLING TO SCHOOL

We explored the prevalence and independent predictors of any walking (Table 2) and bicycling (Table 3)
to school separately for middle and high school youth. For middle school youth, walking or bicycling to school was more prevalent among boys and nonwhites. For high school youth, walking or bicycling to school was also more prevalent among nonwhites. Middle school youth in the 85th to less than 95th percentile for BMI were less likely to report any walking to school, but not bicycling to school. However, BMI categories were not significantly associated with report of walking or bicycling to school for high school youth. For high school (but not middle school) youth, participating in physical education 1 to 4 days per week and never having an adult at home immediately after school were associated with report of walking or bicycling to school. Walking to school for middle school youth or bicycling to school for middle school and high school youth was not associated with parental educational level. However, among high school youth, having parents with more than a high school education was associated with a lower odds of walking to school.

Participation in extracurricular high school activities was explored only among high school youth (because it was not asked of middle school youth). Those who did not participate in extracurricular activities had a higher prevalence of walking to school (5.7%; 95% CI, 3.6%-7.7%) vs 3.7%; 95% CI, 2.5%-4.9%) and bicycling to school (3.2%; 95% CI, 2.0%-4.4% vs 1.5%; 95% CI, 0.8%-2.1%) compared with those who participated in extracurricular activities. For high school youth, we added this variable to the adjusted logistic regression models and found that the odds ratios remained nonsignificant and the addition of the variable did not significantly change the point estimates of the other variables. High school youth who did not participate in extracurricular activities were no more likely to walk to school (adjusted odds ratio, 1.43; 95% CI, 0.87-2.33) or bicycle to school (adjusted odds ratio, 1.59; 95% CI, 0.72-3.50) than high school youth who participated in extracurricular activities.

Because transportation activity could contribute to overall moderate or vigorous activity, we examined this variable separately in our statistical modeling. The addition of vigorous and moderate activities (0, 1-4, and 5-7 days for each) to the adjusted models shown in Tables 2 and 3 were not significantly associated with walking or bicycling to school among middle school or high school youth (data not shown).

### COMMENT

This survey, conducted in 2001 among 4448 North Carolina youth in 6th through 12th grades found that only 12.1% of middle school and 6.4% of high school youth reported bicycling or walking to school 1 or more days in a usual week. Only 3.5% of middle school and 1.6% of high school youth in North Carolina walked to school 5 days per week. Healthy People 2010 includes 2 developmental objectives (items 22.14 and 22.15) on transportation: to increase the proportion of trips made by walking and by bicycling. The 1995 National Personal Transportation Survey indicated that, for children aged 5 to 15 years living up to 1.6 km (1 mile) from school, 28% of trips to school were made by walking, with a 2010 goal of increasing this to 50%. Furthermore, for children living up to 3.2 km (2 miles) from school, only 2% of trips to school were made by bicycling, and the 2010 goal is to increase this to 5%.

To date, we are aware of 3 other studies documenting the prevalence of walking or bicycling to school in the United States. First, a national survey of parents with children aged 5 to 18 years reported that 19% of children walked and 6% bicycled to or from school at least once a week in the previous month in 1999. Second, a parent survey conducted in Georgia in 2000 found that only 4% of children 5 to 15 years of age walked to school most days of the week, with a higher prevalence (19%) among those who lived 1.6 km or less from school. Third, a study of 24 schools in Baltimore found considerably higher rates of walking to and from school: 63% of boys and 68% of girls 6 years of age walked to school, while 76% of boys and 70% of girls 9 years of age walked to school. In contrast, the prevalence of biking to or from school remained close to 0% among boys and girls aged 6 and 9 years. This study of North Carolina youth also found a low prevalence of walking and bicycling to school. We were unable to consider distance to school, which could be an important factor, especially in rural areas of the state and for high school youth who may have farther distances than middle school youth to travel to school. The prevalence of walking and bicycling to school appears to be much higher in studies conducted in other countries, such as Canada, Australia, Sweden, New Zealand, and the United Kingdom, compared with North Carolina.

### CORRELATES OF WALKING AND BICYCLING TO SCHOOL

We found that the prevalence of walking and bicycling to school was lower among high school youth compared with middle school youth. However, the recent national par-
ent survey found that the prevalence of walking and bicycling to school was similar between primary and secondary school-age children, and the survey in Georgia found that, among children who lived 1.6 km or less from school, those who were older were somewhat more likely to walk compared with younger children. These studies varied in the way walking and bicycling to school were ascertained and in whether distance was considered, which may have contributed to some of these differences.

The Georgia survey also found that boys and non-Hispanic black children were more likely to walk than girls or children of other racial/ethnic groups, which is also supported in this study. The Baltimore study found that not owning a car was associated with a higher prevalence of walking to or from school. In addition, this study found that, for middle school youth, higher BMI (85th to less than 95th percentile) was associated with a reduced odds of walking to school. For high school youth, participating in physical education 1 to 4 days per week and never having an adult at home immediately after school were also associated with walking and bicycling to school. The choice to participate in physical education in high school might indicate a youth who is more likely to be physically active, in physical education and in transportation activity.

There are other correlates of walking and bicycling to school that were not measured in this study. In North Carolina, from 1997 to 1998, the mean annual number of child pedestrian fatalities was the fourth highest in the US (1.63 per 100000 children). Perceived and actual safety likely influences the decision on travel choice to school. Other studies have reported on barriers to walking and bicycling to school, and these include long distances, traffic, weather, crime, and opposing school policies. Of further concern, some schools are isolated from the communities they serve, located on the fringe of the community, well beyond walking or bicycling distance for most. Despite the presence of these barriers, the prevalence of walking and bicycling to school can provide valuable information to health and education professionals, particularly when added to a surveillance system.

**STUDY LIMITATIONS**

The findings of this study are subject to several limitations. Transportation activity was assessed by only 2 ques-
tions, and their validity and reliability have not been established. Although the questionnaire was designed for a seventh-grade reading level, a prior reliability study\(^7\) of the YRBS indicated reduced reliability for 7th graders compared with 8th through 12th graders. Of the 53 items that were tested, for 7th graders, 40% of the items fell within substantial to almost perfect agreement (ie, \(\kappa = 61\%\) to \(\kappa = 100\%\)), while for 8th through 12th graders, 62% of the items fell within substantial to almost perfect agreement. This also highlights the limitations of self-report among this population.

This study design did not allow contact with some youth, such as those who were homeschooled, those who had dropped out of school, and those attending private schools. There may have been important confounders, such as distance from home to school and safety, that were not measured. Instead, our prevalence estimate is for all middle and high school youth, regardless of whether it was safe or reasonable for them to walk or bicycle to school. Unfortunately, we were not able to examine the data by geographic location to compare rural and urban residences, because those data are not available. We also do not know how our results might have changed if the questionnaire had been given in another season, rather than in the spring. Finally, we do not know if the prevalence of walking and bicycling home from school may have differed from walking and bicycling to school.

**CONCLUSIONS**

Travel to and from school can be an important and regular source of physical activity for youth. Much work is needed to improve pedestrian and driver safety, locate new schools in or near neighborhoods rather than in more remote locations, and change norms on walking and bicycling to school\(^2\) to increase the low prevalence reported in this study. In local support of this, recently the North Carolina Healthy Weight Initiative included strategies to participate in safe walk-to-school programs and facilitate safe walking and bicycling in the state’s plan *Moving Our Children Toward a Healthy Weight: Finding the Will and the Way*\(^2\). The descriptive information provided by this study broadens our limited understanding of the prevalence and correlates of walking and bicycling to school. Despite the low prevalence of walking and bicycling to school, the prevalence varied by several factors. Further qualitative and quantitative descriptive data, driven by a theoretical framework around these issues, are needed to develop successful interventions to increase walking and bicycling to school.
In 2001, the North Carolina Department of Public Instruction, in collaboration with the Department of Health and Human Services, was the first state to add items to the statewide Youth Risk Behavior Survey on walking and bicycling to school. This study documents the prevalence and correlates of walking and bicycling to school. This information can motivate more health promotion professionals to advocate for safe walking and bicycling routes to school. In addition, these data provide further rationale for parents, school officials, planners, and transportation professionals regarding active forms of transportation to school.

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Corresponding author and reprints: Kelly R. Even-son, PhD, Department of Epidemiology, School of Public Health, University of North Carolina at Chapel Hill, 137 E Franklin St, Suite 306, Chapel Hill, NC 27514 (e-mail: kelly_evenson@unc.edu).

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