Journal of Safety Research xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

Special report from the CDC

School transportation mode, by distance between home and school, United States, *ConsumerStyles* 2012☆

Laurie F. Beck, [a,*] Daniel D. Nguyen [b]

[a] *Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 4770 Buford Hwy NE, MS F62, Atlanta, GA 30341, USA*
[b] *Emory University Rollins School of Public Health, 1518 Clifton Rd NE, Atlanta, GA 30322, USA*

ARTICLE INFO

Article history:
Received 25 March 2017
Accepted 6 April 2017
Available online xxxx

Keywords:
Motor vehicle
Child passenger safety
Children
Pedestrians
Bicyclists

ABSTRACT

Introduction: Motor-vehicle crashes are a leading cause of death among children in the United States, and almost one-fourth of all trips by school-aged children are trips to and from school. This study sought to determine how children (5–18 years) travel to and from school and, among those living ≤1 mile of school, to explore the role of school bus service eligibility on school travel mode. *Methods:* We used national 2012 survey data to determine prevalence of usual school travel mode, stratified by distance from school. For those living ≤1 mile of school, multivariable regression was conducted to assess the association between bus service eligibility and walking or bicycling. *Results:* Almost half (46.6%) of all children rode in passenger vehicles (PV) to school and 41.8% did so for the trip home. Results were similar among those living ≤1 mile (48.1%, PV to school; 41.3%, PV to home). Among those living ≤1 mile, 21.9% and 28.4% of children walked or bicycled to and from school, respectively. Ineligibility for school bus service was strongly associated with walking or bicycling to school [adjusted prevalence ratio (aPR: 5.36; $p < 0.001$)] and from school (aPR: 5.36; $p < 0.001$). *Conclusions:* Regardless of distance from school, passenger vehicles were a common mode of travel. For children who live close to school, the role that school bus service eligibility plays in walking or bicycling deserves further consideration. *Practical applications:* Given the large proportion of children who use passenger vehicles for school travel, effective interventions can be adopted to increase proper child restraint and seat belt use and reduce crash risks among teen drivers. Better understanding of conditions under which bus service is offered to children who live close to school could inform efforts to improve pedestrian and bicyclist safety for school travel.

1. Introduction

Motor-vehicle crashes are a leading cause of death among children in the United States. In 2014, there were 2,401 traffic crash-related deaths and 395,000 traffic crash-related emergency department-treated injuries among children aged 5–18 years (Centers for Disease Control and Prevention and National Center for Injury Prevention and Control, 2016). School travel is of special interest because it represents a significant proportion (22%) of total travel among school-aged children in the United States (McDonald, Brown, Marchetti, & Pedroso, 2011) and because recent efforts to increase children's physical activity have included programs to promote walking or bicycling to school [e.g., Safe Routes to School (SRTS)] (National Safe Routes to School Task Force, 2008).

Historically, walking and bicycling (i.e., active transportation) were common methods by which children traveled to school. Data from the first National Personal Travel Survey (NPTS) in 1969, now known as the National Household Travel Survey (NHTS), revealed that 41% of children aged 5–18 years usually walked or bicycled to school, with a higher percentage of younger children (aged 5–14 years) walking or bicycling to school (48%; McDonald, 2007; McDonald et al., 2011). By the early 2000s, estimates of usually walking or bicycling to school ranged from 13% to 14%

☆ Declaration of interest: We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. The Journal of Safety Research has partnered with the Office of the Associate Director for Science, Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control at the CDC in Atlanta, Georgia, USA, to briefly report on some of the latest findings in the research community. This report is the 47th in a series of "From the CDC" articles on injury prevention. Submission declaration: We confirm that no papers have been published or are under review in other journals that are based on similar methods or data. Funding sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. CDC provided salary support for L. Beck. Rollins School of Public Health provided financial support via a work–study program for D. Nguyen.

* Corresponding author.
E-mail address: LDF8@cdc.gov (L.F. Beck).

http://dx.doi.org/10.1016/j.jsr.2017.04.001
0022-4375/

among children aged 5–14 years (Beck & Greenspan, 2008; McDonald et al., 2011). In contrast, use of passenger vehicles for the trip to school has increased from 12% in 1969 to almost half in the 2000s (Beck & Greenspan, 2008; McDonald et al., 2011).

One well-documented predictor of using active transportation is the distance from one's place of origin to the destination. For example, Ham, Macera, and Lindley (2005) reported that 21% of adults walked to destinations within 1 mile, whereas only 9% of all trips were made by walking (Hu & Reuscher, 2004). Since the mid-1900s, the distance between home and school has increased in the United States (Environmental Protection Agency, 2003; Federal Highway Administration, 2008). McDonald (2007) has found that this increased distance likely accounts for a large proportion, but not all, of the shift from active transportation to travel via motorized vehicle (e.g., passenger vehicles or school buses) in recent decades. While 86% of U.S. children living within 1 mile of school walked or biked in 1969, only 50% did so in 2001 (McDonald, 2007).

The purposes of this investigation were to determine how children aged 5–18 years usually travel to and from school and, among those who live within 1 mile of school, to explore the role that school bus service eligibility plays in travel mode used. Findings can inform ongoing efforts at the federal, state, and local levels to improve school transportation safety.

2. Materials and methods

Data used in our study came from the first summer wave of Porter Novelli's 2012 *ConsumerStyles* database (Weber, 2012). The survey was fielded from June 19 to July 3, 2012 and was sent to a random sample of 6,402 adults (ages 18 years or older) drawn from approximately 50,000 panel members who consented to participate in the panel and were representative of the U.S. population. In total, 4,170 adults completed the survey with a response rate of 65%. Data were weighted to match the 2012 U.S. Current Population Survey (CPS) proportions for gender, age, household income, race/ethnicity, overall household size, level of education, census region, metropolitan status, and access to the Internet prior to joining the panel. The Centers for Disease Control and Prevention (CDC) licensed the de-identified results of the 2012 *ConsumerStyles* survey from Porter Novelli. CDC determined the analysis to be exempt from human subject regulations because existing data were used for secondary analysis and information was recorded in such a way that participants could not be personally identified.

A total of 1,170 adult respondents reported that they had at least one child aged 5–18 years enrolled in school in the previous year. Those with more than one enrolled child were instructed to answer a series of questions about school transportation for their youngest child (5–18 years) enrolled in school. School transportation characteristics included self-reported usual mode of travel to and from school, distance from home to school, and school bus eligibility. Usual modes of travel to and from school were categorized as walking or bicycling, school bus, passenger vehicle, or other (including public transportation). Walking and bicycling were combined for analyses because small numbers, especially for bicycling, prevented reporting these two modes separately. Distance from home to school was categorized as less than or equal to 1 mile or greater than 1 mile. School bus service eligibility was defined as eligible or ineligible. Sociodemographic and geographic variables were selected on the basis of previous research on active transportation. These variables included child's age group, annual household income, type of residence, census region, and metropolitan status. Children's ages were categorized as 5–11, 12–14, or 15–18 years. Annual household income was categorized as less than $25,000, $25,000–$49,999, $50,000–$74,999, or $75,000 or more. Type of residence was defined as single or multiple family residence. Census region was categorized as Northeast, Midwest, South, or West. Metropolitan status was categorized as metropolitan or non-metropolitan residence using the U.S. Census Bureau standards (Zients, 2013).

Weighted proportions and standard errors (SEs) were calculated for categorical variables and stratified by distance between home and school. Data were suppressed when based on sample counts less than twenty respondents. Due to the small numbers of children who lived more than 1 mile from school and walked or bicycled to or from school, all subsequent analyses focused on children who lived within 1 mile of school (sample $n = 365$). Crude analyses estimated associations between school bus service eligibility, as well as selected sociodemographic and geographic characteristics, and walking or bicycling to school. Results that had a p-value <0.05 were considered statistically significant. Multivariable regression was performed using a modified Poisson regression model with robust error variances and the log link function to estimate the adjusted prevalence ratio (aPR) and 95% confidence interval (CI) (Deddens & Petersen, 2008; Petersen & Deddens, 2008) for school bus service eligibility and walking or bicycling to school, adjusting for those characteristics that were significantly associated with walking or bicycling in crude analyses. The same crude and multivariable analytic strategy was conducted for walking or bicycling home from school. All analyses were conducted using Statistical Analysis Software (SAS) version 9.3 (SAS Institute, Inc., Cary, North Carolina).

3. Results

In 2012, approximately one-third (35.2%) of children aged 5–18 years lived within 1 mile of school (Table 1). For children who lived within 1 mile, the most common mode of travel to school was by passenger vehicle (48.1%), followed by school bus (23.9%) and walking or bicycling (21.9%). For children who lived within 1 mile of school, the most common mode of travel home from school was by passenger vehicle (41.3%), followed by walking or bicycling (28.4%) and school bus (24.2%; Table 1). The proportion of children who traveled by passenger vehicle was similar among those who lived within 1 mile of school (48.1% to school and 41.3% from school) and those who lived more than 1 mile from school (45.9% to school and 42.4% from school). Eligibility for school bus service was less common among those who lived within 1 mile of school (41.8%) than among those who lived more than 1 mile from school (74.1%).

Among children who lived within 1 mile of school, crude analyses revealed that ineligibility for school bus service and region were the only variables that were significantly associated with walking or bicycling to school (Table 2). In the multivariable regression model, these variables remained significantly associated with walking or bicycling to school. Children who were ineligible for school bus service were 5.36 times more likely to walk or bicycle to school than those who were eligible ($p < 0.001$). Those who lived in the Northeast (aPR 2.04, $p < 0.05$) were more likely to walk or bicycle to school than those who lived in the South. Differences in walking or bicycling to school between children in the Midwest or West, compared to those in the South, were no longer significant after controlling for school bus service eligibility (Table 2).

Results of regression models for walking or bicycling home from school among those who lived within 1 mile of school were very similar to those for walking or bicycling to school. In crude analyses, the only variables that were significantly associated with walking or bicycling home from school were ineligibility for school bus service and region (Table 3). In the multivariable regression model, ineligibility for school bus service remained a strong predictor of walking or bicycling home from school (aPR 5.36, $p < 0.001$). Residents of the Northeast and West were more likely to walk or bicycle home from school than those in the South (aPR 1.97, $p < 0.05$; and aPR 2.00, $p < 0.05$; respectively).

Please cite this article as: Beck, L.F., & Nguyen, D.D., School transportation mode, by distance between home and school, United States, *ConsumerStyles* 2012, *Journal of Safety Research* (2017), http://dx.doi.org/10.1016/j.jsr.2017.04.001