



## Influence of the social environment on children's school travel

Noreen C. McDonald<sup>a,\*</sup>, Elizabeth Deakin<sup>b</sup>, Annette E. Aalborg<sup>c</sup>

<sup>a</sup> University of North Carolina at Chapel Hill, 317 New East Bldg, CB 3140, Chapel Hill, NC 27599-3140, USA

<sup>b</sup> University of California, Berkeley, Berkeley, CA, USA

<sup>c</sup> Kaiser Permanente, Division of Research, Oakland, CA, Touro University, Vallejo, CA, USA

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### ABSTRACT

**Objectives.** To analyze the association between parental perceptions of the social environment and walking and biking to school among 10–14-year-olds.

**Methods.** Surveys were conducted with 432 parents of 10–14-year-olds in the San Francisco Bay Area during 2006 and 2007; the final sample size was 357. The social environment was measured with a 3-item scale assessing child-centered social control. Unadjusted and adjusted differences in rates of active travel to school were compared between families reporting high levels of social control in their neighborhood and those reporting low or neutral levels of social control. Adjusted differences were computed by matching respondents on child and household characteristics and distance to school.

**Results.** Of children whose parents reported high levels of social control, 37% walked or biked to school, compared with 24% of children whose parents reported low or neutral levels. The adjusted difference between the two groups was 10 percentage points ( $p=0.04$ ). The association was strongest for girls and non-Hispanic whites.

**Conclusions.** Higher levels of parent-perceived child-centered social control are associated with more walking and biking to school. Increasing physical activity through active travel to school may require intervention programs to address the social environment.

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### Introduction

Rates of overweight and obesity have increased among American youth in recent decades (Ogden et al., 2006). In response, public health advocates and researchers have sought ways to increase physical activity. Federal health and transport agencies have identified walking to school as an important intervention (U.S. Department of Health and Human Services, 2000; FHWA, 2008). Several studies have found an association between walking and biking to school and higher overall levels of physical activity (Alexander et al., 2005; Cooper et al., 2005; van Sluijs et al., 2009). For example, 5<sup>th</sup> graders in South Carolina who walked to school every day had 24 more minutes of moderate to vigorous physical activity than those who did not walk consistently (Sirard et al., 2005).

Distance to school has the strongest effect on the likelihood of walking and biking (Schlossberg et al., 2006; McDonald, 2008a; Sirard and Slater, 2008). In a nationally representative sample, McDonald (2008a) found that 48% of elementary and middle school students (ages 5–13) walked to school when they lived less than 1 mile from their school, but only 3% walked to school when the trip was more than 1 mile. Other factors, such as urban form and individual

demographic characteristics, also affect behavior. Low income and minority students walk to school at much higher rates than their peers (McDonald, 2008b). Urban form elements such as street-facing windows and mixed land uses were associated with more walking and biking in a California study of elementary schools (McMillan, 2007).

The social ecology model underlying much of this research suggests that multiple environments influence behavior (Bronfenbrenner, 1979). Yet most of the research on school travel considers demographic characteristics and only one component of the neighborhood—the built environment. This neglects the potential importance of the social environment. An example from Coleman, one of the major theorists on social capital, illustrates how parental beliefs about the neighborhood social environment can affect children's travel behavior. Coleman (1988) described a family with six children that had recently moved from suburban Detroit to Jerusalem. In Jerusalem—as opposed to Detroit—the mother was comfortable having her young children travel alone by bus and play without supervision in the park. Coleman ascribed this difference in behavior to the levels of social capital in Jerusalem and Detroit. He suggested that “the normative structure [in Jerusalem] ensures that unattended children will be ‘looked after’ by adults in the vicinity, while no such normative structure exists in most metropolitan areas of the United States.”

Beyond the theoretical and methodological reasons for including the social environment in analyses of children's school travel are

\* Corresponding author.

E-mail addresses: [noreen@unc.edu](mailto:noreen@unc.edu) (N.C. McDonald), [edeakin@berkeley.edu](mailto:edeakin@berkeley.edu) (E. Deakin), [annette.e.aalborg@kp.org](mailto:annette.e.aalborg@kp.org) (A.E. Aalborg).

important policy reasons. The US Department of Transportation, through the federal Safe Routes to School program, funds both infrastructure improvements (e.g., sidewalks and crosswalks) within 2 miles of elementary and middle schools and encouragement and education programs at schools. The program's goal is to make travel by foot and bike safer, thereby increasing active travel to school (FHWA, 2008). If there is an association between the social environment and walking to school, then Safe Routes to School programs may need to emphasize interventions that affect the social environment, not simply the built environment.

This study addresses this gap in knowledge by assessing how parent-report of the neighborhood social environment correlates with walking and biking to school after controlling for trip distance and demographic factors.

## Methods

### Data

This analysis used data from a cross-sectional survey of parents of 10- to 14-year-olds living in highly walkable neighborhoods near Oakland and Berkeley, California. This age group was chosen because previous research found that children in the United States begin to acquire travel independence around the age of 10, thereby making it easier for them to walk or bike to school (Matthews, 1992). We chose the study area by selecting ZIP codes in Oakland, Berkeley, Albany, and Richmond, California with a walkable built environment which was defined as the presence of gridded streets, sidewalks, and flat topography (Cervero and Duncan, 2003; Handy, 2005). From ZIP codes with the appropriate environmental conditions, nine were selected as a stratified sample with low, medium, and high median household incomes and low and high levels of ethnic and racial diversity as measured by the proportion of non-Hispanic whites in the ZIP code. The target sample size of 400 parents was chosen to detect a difference in walk rates of 10 percentage points with a power of 0.8 and a significance level of 0.05.

Potential respondents were identified through their child's membership in Kaiser Permanente Northern California. After randomly choosing members aged 10 to 14, living in selected ZIP codes, Kaiser Permanente staff mailed a letter informing parents about the study and allowing them to choose not to participate. Two weeks after sending the letters, Kaiser research staff contacted parents to schedule phone interviews in English or Spanish. The study protocols were approved by the institutional review boards of the University of California, Berkeley and Kaiser Permanente Division of Research. Between August 2006 and May 2007, researchers attempted to contact 1,637 parents, and completed interviews with 432 individuals. In the remainder of cases, there was no response after six attempts ( $n = 534$ ), the phone number did not work ( $n = 318$ ), no one spoke English or Spanish ( $n = 52$ ), the respondent no longer met eligibility requirements ( $n = 42$ ), or the respondent refused to participate in the study ( $n = 259$ ). The raw response rate for the survey was 26% and the cooperation rate among reachable and eligible households was 58%. Respondents were removed from this analysis if they were home-schooled ( $n = 5$ ) or had missing information for mode to school ( $n = 6$ ), number of household vehicles ( $n = 2$ ), child's sex ( $n = 25$ ), home and school addresses ( $n = 23$ ), household income ( $n = 22$ ), and parent report of the social environment ( $n = 5$ ). The final sample size was 357 parents of 10- to 14-year-olds.

### Measures

#### Walking and biking

Respondents were asked, "What is the primary way your child travels to school?" Parents indicating their child walked, biked, skated, or scooted were counted as active travelers. Comparison of the parent-proxy and child-report of school travel mode was assessed by randomly contacting the children of 32 respondents. Results indicated high levels of agreement between parent and child report (% agreement = 0.91,  $\kappa = 0.83$ ).

#### Social environment

Multiple definitions and measures of the social environment exist (McNeill et al., 2006; Lochner et al., 1999). Coleman's anecdote suggested that the most important dimension of the social environment for children's travel is parental beliefs about whether neighbors will watch out for children.

Sampson et al. (1999) operationalized this dimension of the social environment with a scale measuring child-centered social control, which is defined as "expectation that neighborhood residents can and will intervene on the behalf of children." The 3-item Likert scale assessed how likely it was that "their neighbors could be counted on to "do something" if (1) "children were skipping school and hanging out on a street corner," (2) "children were spray-painting graffiti on a local building," and (3) "children were showing disrespect to an adult" (scoring: 1 = Highly unlikely, 5 = Highly likely). Properties of the scale are reported elsewhere (Sampson et al., 1999).

The scale score was computed as the average response across each item; scale scores were assigned to parents who answered one or more of the items. Internal validity was high (Cronbach's  $\alpha = 0.82$ ). The child-centered social control scale score was then dichotomized into a group reporting high levels of child-centered social control and a group reporting low or neutral levels of social control. Reported results use a cut-point of 4.0 between the two groups, but results were similar when 3.0, 3.5, or quantile-based cut-points were used.

### Statistical analysis

The analysis measured unadjusted and adjusted differences in rates of walking and biking to school between children whose parents believe levels of social control are high in the neighborhood and those who believe social control is low or neutral. Adjusted differences compare demographically matched respondents from each group to calculate the average treatment effect.

Respondents were matched on child's age, child's race (White, Hispanic, Other/Missing), child's sex, household vehicles per household adult, household income (<\$40,000, \$40,000–\$80,000, >\$80,000), and distance to school (measured as the shortest distance along the street network between the child's home and school). Previous research has shown a strong association between these factors and walking to school (McDonald, 2008a). The child's sex and race were matched exactly (i.e., a Hispanic girl will only be compared to another Hispanic girl). For other factors, the most similar observation (i.e., the observation that has the most similar combination of distance to school, household auto access, household income, and child's age) was used. For the non-exact matches, we tested to ensure there were no significant differences ( $\alpha = 0.05$ ) between the two groups. Direct matching, as opposed to propensity score matching (Oakes and Johnson, 2006), was used because this method does not rely on appropriate parameterization of the propensity score and is therefore more robust than propensity score methods (Abadie and Imbens, 2007). The *nnmatch* function in Stata (College Station Texas, version 9.2) was used to conduct the analysis

**Table 1**  
Demographic Characteristics of Sample (N = 357).

	Total Sample
Child's Mean Age (SD)	12 (1.4)
Child's Sex (%)	
Female	51
Male	49
Child's Race (%)	
Non-Hispanic White	30
Hispanic	31
Other/Missing	39
Household Income (%)	
<\$40,000	26
\$40,000–\$80,000	36
>\$80,000	38
Vehicles per HH adult: mean (SD)	0.6 (0.3)
Distance to School (km): mean (SD)	3.7 (5.2)
Distance to School (%)	
<1.6 km	41
1.6–3.2 km	27
>3.2 km	32
Mode to School (%)	
Walk	27
Bike	5
Scoot	0
Driven	55
Public Transit/Bus	13

HH, household.

Data collected in the San Francisco Bay Area (CA), 2006–2007.

assuming heteroscedastic errors and correcting for bias introduced through non-exact matches (Abadie and Imbens, 2006; Abadie et al., 2004).

## Results

### Descriptive statistics

Parents in the study had children who were 31% Hispanic, 30% non-Hispanic white, and 39% other races (or missing), with an average age of 12 years (Table 1). The average distance to school along the street network was 3.7 km (2.3 miles), with 41% of the sample living less than 1.6 km (1 mile) from their school. Household income reported by parents was under \$40,000 for 26% of families, between \$40,000 and \$80,000 for 36%, and more than \$80,000 for 38%. Overall, 32% of students used active travel modes (walk, bike, scooter/skate) to reach school. The remainder were driven (55%) or used transit or school buses (13%).

### Association between child-centered social control and active travel to school

Youth had higher rates of walking, biking, or scooting to school when parents believed it likely that neighbors would intervene to discipline behavior among youth. Of children whose parents reported high levels of child-centered social control in their neighborhood, 37% walked to school, compared with 24% for students whose parents reported low or neutral evaluations of social control (Table 2). After adjusting for covariates, the difference was 10 percentage points ( $p = 0.04$ ).

Significant variation existed in the association between social control and walking to school by sex and race/ethnicity. Unadjusted and adjusted differences were large and significant for girls, but insignificant for boys. This difference resulted from girls walking to school much less than boys when their parents had negative or neutral views of neighborhood social control. For example, 30% of boys living in areas with parent-reported low or neutral levels of social control walked to school; for girls, the rate was 19%. When parents perceived high levels of social control, there was no difference in walk rates between boys and girls. Differences also emerged by the race and ethnicity of the children. Non-Hispanic white children had an adjusted difference in active travel rates of 22 percentage points ( $p = 0.01$ ). The difference was insignificant for other racial groups.

## Discussion

This study finds evidence of an association between parental perceptions of child-centered social control and walking and biking to school. The association is strongest for girls and non-Hispanic white children. Few other studies have looked at the association between elements of the neighborhood social environment and walking to school. Using Sampson et al.'s (1997) measure of neighborhood social cohesion, McDonald (2007) found that parental perceptions of better social cohesion were associated with higher rates of children walking to school for trips under 1 mile. Hume et al. (2008) found that child-reported social capital was positively associated with moderate and vigorous physical activity and walking trip frequency. Although limited in number, these studies highlight the need for researchers to begin thinking more systematically about how the social environment can affect children's travel.

The analysis also found evidence that parents with negative or neutral perceptions of the social environment may limit girls' walking and biking more than boys'. This result may explain why previous analyses of sex differences in school travel have found contradictory results. Several authors found no significant association between gender and school travel (Black et al., 2001; Kerr et al., 2006; Bricker et al., 2002; Martin et al., 2007), whereas others have identified some sex differences

**Table 2**

Differences in Walking and Biking to School by Parental Perceptions of Neighborhood Child-Centered Social Control.<sup>a</sup>

	Walk and Bike Rates		Unadjusted Difference (p)	Adjusted <sup>b</sup> Difference (p)
	Low/ Neutral Social Control	High Social Control		
Overall	0.24	0.37	0.13 (<0.01)	0.10 (0.04)
Sex				
Male	0.30	0.37	0.07 (0.37)	0.05 (0.54)
Female	0.19	0.38	0.19 (<0.01)	0.16 (<0.01)
Race/Ethnicity				
Non-Hispanic White	0.24	0.49	0.25 (0.01)	0.22 (0.01)
Hispanic	0.31	0.37	0.05 (0.56)	0.10 (0.29)
Other/Missing	0.19	0.25	0.06 (0.41)	0.01 (0.84)

Data collected in the San Francisco Bay Area (CA), 2006–2007.

<sup>a</sup> Social Control is a 3-item scale measuring parental perception that neighbors will 'do something' if children (1) spray paint graffiti, (2) skip school, or (3) show disrespect to adults.

<sup>b</sup> Adjusted for child's age, child's race, child's sex, household vehicles per adult, household income, and network distance between home and school.

in school travel (McMillan et al., 2006; Timperio et al., 2006; Rosenberg et al., 2006). These mixed results may derive from not adequately controlling for parental perceptions of the social environment.

This study also showed that the travel behavior of non-Hispanic white children was more sensitive to parental perceptions of the social environment than children of other races. An explanation for this observation is that white students are more likely to be "choice walkers" (McDonald and Aalborg, 2009). Because white families may have other options for getting their children to school (e.g., by driving them), their behavior may be particularly affected by the social environment. Previous analysis of nationally representative data has shown that minority students walk and bike to school at higher rates than white students and that those differences are explained well by differences in vehicle access and income (McDonald, 2008b). Lower-income minority households may have fewer options for getting their children to school, resulting in behavior that is less sensitive to the social environment. Another explanation for the observed differences is that unmeasured differences in the neighborhoods varied with race and ethnicity. For example, there could be differences in traffic safety, crime, and neighborhood-level SES.

### Implications for safe routes to school programs

Previous studies have shown that rates of walking to school are higher when distances to school are short and the built environment supports walking (McDonald, 2008a; Sirard and Slater, 2008; McMillan, 2007). This study adds to that literature by showing that the highest proportion of students walk to school when the built environment is supportive and parents believe neighbors will monitor the behavior of children. The federal Safe Routes to School (SRTS) program provides funds to reimburse communities for infrastructure created within 2 miles of an elementary or middle school to make active travel safer. The majority of the funds, 70%–90%, must be spent on infrastructure, but the balance can be spent on non-infrastructure education and encouragement programs. Although infrastructure investments are essential to improving safety, they may not be enough to change behavior. This finding suggests that programs that allow parents to interact and make connections are an appropriate use of SRTS non-infrastructure funds. Potential interventions range from assisting development of school- and neighborhood-based e-mail listservs to more formal programs connecting families that live near each other and helping them organize to walk their children to school (i.e., "walking school buses"). Preliminary studies of walking school buses suggest they increase rates of walking to school (Mendoza et al., 2009; Sirard et al., 2008; Staunton et al., 2003).

### Study limitations and strengths

The cross-sectional nature of this analysis makes it impossible to draw causal inferences from our data. This has two specific implications for our research. First, the direction of the relationship could be reversed from what we have hypothesized. Specifically, families that walk to school may meet more people in the neighborhood and therefore believe people will watch out for their child. Such a mechanism was described by Leyden (2003) in his analysis of the relationship between social capital and the built environment. The second issue is self-selection. Parents who want their children to walk to school may pre-select environments that support this behavior. Third, our sample is representative of dense, first-ring suburban areas with high levels of diversity, where the built environment is supportive of walking. This limits the generalizability of our results. Finally, our statistical models did not account for clustering within neighborhoods. Although this does not affect the reported coefficients, it could mean the true standard errors are higher than those reported here.

The strength of the study is that it introduces a robust measure of the social environment into the literature on walking and biking to school and demonstrates the need to consider neighborhood social relations in future analyses on the topic. Methodologically, this study also introduces a direct matching method, common in the econometrics literature, which presents advantages over propensity score matching.

### Conclusions

This study provides evidence that parents are significantly more likely to allow their children to walk and bike to school when they believe other adults in the area will watch out for and monitor children. These effects are strongest for girls and non-Hispanic whites. The results suggest that an appropriate use of federal Safe Routes to School funds is encouraging informal connections among parents and neighbors through non-infrastructure education and encouragement programs.

### Conflict of interest statement

The authors declare that there are no financial interests or conflicts of interest to disclose.

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