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Ethnic Minority Children's Active Commuting to School and Association with Physical Activity and Pedestrian Safety Behaviors

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INTRODUCTION

The continued high level of childhood obesity in the United States remains one of the nation's most pressing public health issues.[1-2] Latino children are disproportionately affected by the obesity epidemic.[1] Obese children are at greater risk for abnormal lipids and hypertension,[3] becoming obese adults,[4-5] and thereby developing chronic diseases such as diabetes, cardiovascular disease, sleep apnea, certain cancers and psychosocial disorders.[6-7] Physical activity is an important contributor to energy balance and weight status[8] and independently associated with a reduced risk of several chronic diseases.[9-12] Young children in the U.S. are more likely to meet minimum standards for daily moderate-to-vigorous physical activity than adolescents or adults,[13] likely reflecting the significant decrease in moderate-to-vigorous physical activity as children transition from late childhood to adolescence.[14]

Improving youth physical activity is an important public health goal.[2] A promising way to improve children's moderate-to-vigorous physical activity is through active commuting to school, i.e. walking and cycling to school. Children who actively commuted to school had higher levels of physical activity, lower body mass indices and less fat measured by skinfold tests in a national study of U.S. adolescents.[15] Other studies in a variety of settings and populations generally provide support for active commuting to school and recognize similar health benefits, although randomized controlled trials are sparse.[16-17] Only 13% of children in the U.S. actively commuted to school in 2009 versus 42% in 1969-1970.[18-19] Increasing the proportion of children who actively commute to school was a sub-objective of U.S. Healthy People 2010. Similarly, increasing by 50% the percentage of children who actively commute to school is a benchmark of success in the White House Task Force on Childhood Obesity Report.[20]

Previous studies on children's active commuting to school have a number of limitations. The majority of reports used instruments not specifically validated to measure children's active commuting to school or used subjective measures to estimate moderate-to-vigorous physical activity rather than objective physical activity monitors.[16-17] Most studies on active commuting to school have not applied a theoretical framework, which would help to understand mechanisms of children's behavior change. Notably, few studies on active commuting to school have focused on pedestrian safety behaviors or Latino children. Previous studies have reported higher unadjusted rates of active commuting to school among Latino children, although these differences were attributable to household and neighborhood characteristics.[21-22] Emerging research has described inverse relationships between proxy measures of acculturation and active commuting to school.[23] This report seeks to fill these gaps and inform future programs and policies on active commuting to school among Latino children.

METHODS

Population and Sample

In March 2009, we recruited participants (n=149) in the fourth grade from a convenience sample of eight low-income schools (≥84% of children qualifying for the Federal Free or Reduced Price Lunch Program) in the Houston Independent School District (HISD) of Houston, TX, which is the seventh largest school district in the U.S. and is located in the fourth largest U.S. city. Schools were chosen only if they primarily served low-income, ethnic minority populations. Other criteria included the school's interest in participating in and accommodating the research project and informal field observations by the first author and research coordinators on whether the built environment had features that permit walking, such as sidewalks, marked crosswalks, and street connectivity. Parent involvement in school activities was generally low, according to school principals and faculty. We recruited individual participants for a randomized controlled trial of a walking school bus intervention among fourth grade children. We present cross-sectional baseline results. Children who lived greater than one mile from school (as determined by the parents/guardians), were generally excluded except for seven children whose parents approached study staff and agreed to transport the child to a designated walking school bus stop less than one mile from the school. No demographic data were collected on children ineligible for participation.

This study received ethics approval by the Institutional Review Board of Baylor College of Medicine and the Research Department of the Houston Independent School District.

Demographic Surveys

All participating parents/guardians completed a sociodemographic survey that assessed characteristics of the child, parent, and household, including age, gender, race/ethnicity, income, and home address. Distance from home to school was calculated using the "Get Directions" function for pedestrians on maps.google.com. Parents also completed questions related to acculturation previously shown to be related to immigrants' health behaviors:[24-29] (a) country of origin (non-USA including Puerto Rico = 0 and USA = 1), (b) years living in the U.S. (for parents: <15 years = 0 and ≥15 years =1; for children: <5 years = 0 and ≥5 years =1, and (c) preferred language (only Spanish or Spanish more than English = 0; and both English and Spanish, English more than Spanish, and only English = 1). The measures of child acculturation and parent acculturation were summed separately to provide each with a global measure of acculturation.

Theoretical Framework

We chose social cognitive theory as the theoretical framework to describe children's active commuting to school.[30-31] Social cognitive theory is one of the most widely applied health behavior theories used in physical activity studies among children, and its construct of self-efficacy has had the most support for playing a key role in children's physical activity behaviors as previously reviewed.[32] Self-efficacy is defined as one's personal sense of control over the health behavior.[31] Parents and children completed surveys developed to measure the psychosocial variable of self-efficacy, which were based on self-efficacy measures associated with physical activity in previous studies.[33-34] Children completed a 17-item questionnaire on self-efficacy for active commuting to school, which had acceptable internal consistency (Cronbach's alpha = 0.75). Similarly, parents completed a 15-item questionnaire on self-efficacy for allowing their children to actively commute to school (Cronbach's alpha = 0.88). Another useful construct from social cognitive theory is outcome expectations, which are defined as the expected outcomes (e.g. costs and benefits) of performing the health behavior.[31] Some promising evidence suggests that this construct is also useful for explaining children's physical activity.[32] Parents completed a 14-item questionnaire on outcome expectations for allowing their children to actively commute to school (Cronbach's alpha = 0.78). Only parents were asked about outcome expectations since it is a complex construct and likely beyond the cognitive ability of fourth grade children.

Neighborhood Safety

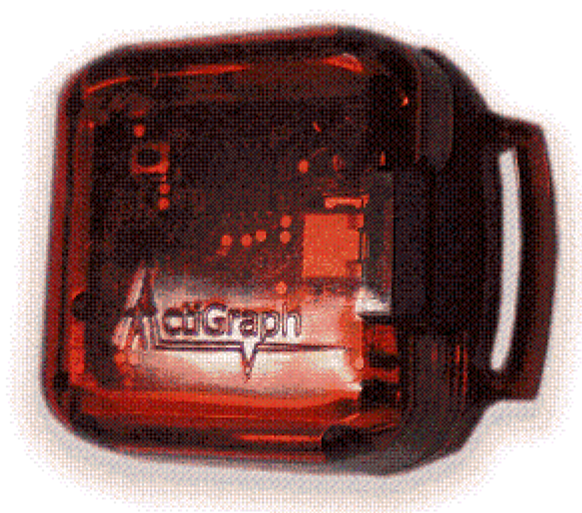
Parents completed a subscale from the Neighborhood Environment for Children Rating Scales that rated the quality of the family's neighborhood in terms of safety, violence, drug traffic, and child victimization.[35] This subscale had good internal consistency (Cronbach's alpha = 0.95), reliability (generalizability coefficient = 0.84), and discriminated between high and low risk neighborhoods ($p<0.01$) with regard to child maltreatment rates among an urban sample.[35] In a subsequent study among 3141 families, parents' perception of neighborhood safety using this subscale was inversely associated with their children's television viewing.[36]

Active Commuting to School Assessment

Children's active commuting to school was assessed every day at school for one week using an instrument previously validated among low-income fourth grade children in HISD and shown to have high test-retest reliability (kappa = 0.97) and convergent validity with parent report (kappa=0.87).[37] The written survey (available in English or Spanish) asked, "How did you get to school today?" and the children were instructed to choose the one best answer from among several choices: school bus, carpool, car, metro bus, walked with an adult, walked without an adult, and biked. Active commuting to school was classified as walking or cycling and the percent of trips to school over one week made by active commuting was the primary outcome.

Physical Activity Assessment

Children's physical activity was measured by accelerometry, which has provided a valid and reliable objective measure of physical activity in children.[38-39] Participants wore the Actigraph GT1M accelerometer (Actigraph, LLC; Ft. Walton Beach, FL) over their hip for seven days. The Actigraph GT1M's unidirectional accelerometer measured accelerations in the vertical plane and provided a measure of volume and intensity every one minute during the seven-day wear period. We used the accelerometer data criteria by Troiano and colleagues to facilitate comparisons to studies using the National Health and Nutrition Examination Survey accelerometer dataset.[13] Data were excluded if accelerometers were not in calibration when returned; data had extended sequences of the maximum recordable value; and for bouts of 60 or more minutes of activity in which there were no zero readings. We again used Troiano and colleagues' definition of a valid day and wear time for accelerometer data processing: a valid day had 10 or more hours



of accelerometer wear, nonwear time was operationalized as at least 60 consecutive minutes of no data recording (with allowance for 1-2 minutes of counts 0-100), and wear time was calculated by subtracting nonwear time from 24 hours.[13] Only participants who had one or more valid days of accelerometer wear were used in the main analyses. While it has been recommended that at least four or more valid days are necessary to estimate children's habitual physical activity,[39] this stringent criterion would have restricted this pilot study's sample by 25%. Moreover, there was no difference in the intraclass correlation coefficient whether we used one day (ICC=0.372) or four days (ICC=0.372) as the minimum criterion for valid days. The age-specific threshold for moderate-to-vigorous physical activity was set at 4 metabolic equivalents (counts per minute = 1770, 1910, 2059 or 2220 for ages 9, 10, 11, and 12 years, respectively).[13] The sum of minutes above this moderate-to-vigorous physical activity threshold for each participant who met the above criteria for data quality was then divided by the number of valid days to obtain moderate-to-vigorous physical activity per day. A total of 134 participants provided valid accelerometer data, of which 5.2%, 5.2%, 11.2%, and 78.4% provided 1-, 2-, 3-, or 4- or more valid days, respectively.

Anthropometric Measures

Children's height and weight were measured according to a standardized protocol by trained research assistants who passed an examination with standard subjects. Standing height was measured using a portable stadiometer (Seca 214) and body weight was measured using a digital scale (Tanita BWB-800S). Duplicate measures were taken of height and weight with the mean recorded as the value. A third measurement was taken if there was >0.2 cm or 0.2 kg difference between the two; mean values were used when three measurements were taken. BMI was calculated as weight in kilograms divided by height in square meters. BMI z-scores were calculated for each child based on the 2000 Center for Disease Control (CDC) growth charts.[40]

Pedestrian Safety

Children's pedestrian safety behaviors were observed at major intersections at each school and unobtrusively assessed using a previously validated instrument.[37] Children were observed for the following behaviors: crossed at a corner or crosswalk, crossed with an adult or safety patrol, stopped at the curb, looked left-right-left, walked and did not run across the street, and followed the traffic signal (if present). This instrument had acceptable percent agreement (91%), sensitivity

(85%), specificity (83%), and reliability (r=0.55, p<0.01) comparing trained research assistants to an expert.[37] These observations were conducted before the start of school without interacting with the children. Thus, no individual sociodemographic information was collected and the data reflects the behaviors of student pedestrians of any grade level approaching the study schools, i.e. it is school-level data.

Statistical Analyses

Descriptive statistics and graphical procedures were used to describe the data and to examine the distributional properties. Little's Chi-square Test for data missing completely at random[41] was performed on the set of variables included in the primary analyses (excluding household education, household income, and race) and the subset of analyses among Latino participants (including child and parent acculturation). The Monte Carlo Markov Chain algorithm, based on the multivariate normal model, was used to impute missing data for all participants (excluding acculturation) in the first step.[42] The second step involved selecting only Latinos and subsequently imputing child and parent acculturation. Chi-square tests of independence and analyses of variance were used to investigate differences between Latino and non-Latino participants from the full sample. Ethnicity was dichotomized into Latino and non-Latino children; children who identified as White or "other" were combined with Black children into the non-Latino category due to their small numbers.

Stepwise linear regression analysis with backward elimination was used to identify significant correlates of active commuting to school and moderate-to-vigorous physical activity. Primary analyses included all subjects, and sub-analyses included Latino participants only. The linear regression models were conducted within a mixed-model framework to account for the clustering of participants within schools. The criteria for removal was set at p=0.10. Results from the final model included regression coefficients, standard errors, and corresponding p-values. Standardized coefficients were computed by multiplying the regression coefficient by the ratio of the standard deviation of the independent variable of interest to the dependent variable. The likelihood ratio R-squared (R^2_{LR}) was used to describe the variation explained by the set of independent variables. Variables included as independent variables in the model for active commuting to school were as follows: age, gender, BMI z-score, distance from home to school, ethnicity (dichotomized as Latino versus non-Latino), neighborhood safety, child self-efficacy, parent self-efficacy, and parent outcome expectations and all interactions with ethnicity. The model for moderate-to-vigorous physical activity included the addition of active commuting to school as an independent variable and excluded child self-efficacy, parent self-efficacy, and parent outcome expectations. The sub-analyses excluded ethnicity, since they were conducted only among Latino children, and included the main effects as well as interactions with child and parent acculturation.

Frequencies and percentages were used to describe the pedestrian safety behaviors performed by children walking to school. Although no child-level demographic characteristics were collected, the schools were classified as primarily Latino and non-Latino. Chi-square tests of independence were used to identify safety behavior differences between children at the primarily Latino and non-Latino schools.

All analyses were conducted using SAS 9.0 (SAS Institute Inc., Cary, North Carolina). Results were considered significant at the $p<0.05$ level. Since this was a pilot study and the analyses exploratory, results at the $0.05<p<0.1$ level were considered marginally significant.

Results

Due to the large number of participants with missing data for household education and income, and since the participants were recruited from low socioeconomic status schools, household education and income were excluded from the analyses. For the remaining variables included in the analyses, less than five percent of the data were missing and imputed as described above. Results from Little's Chi-square Test indicated that the data for the entire sample (X^2=127.38, df=112, p=0.152) and the Latino subsample (X^2=73.38, df=66, p=0.249) were missing completely at random.

Of 571 total children enrolled in the fourth grade at all eight study schools regardless of distance from home to school, 149 enrolled in the study (26.1%). No data (including home address) were collected on children who declined to participate in the study; therefore, the total eligible sample based on a one-mile walk radius could not be calculated nor comparisons made with non-participating children. Table 1 lists descriptive statistics for participant demographics, covariates, and dependent variables. Average age was 9.7 +/- 0.7 years; 53% were female. Most of the children were Latino (61.7%) or non-Latino Black (31.5%) and from low-income households. Average distance from home to school was 0.7 km (0.43 miles). Stratified by Latino versus non-Latino ethnicity, the only significant unadjusted difference in demographics, covariates, or outcomes was for parent education level, with Latinos having lower educational levels attained.

Results from the mixed-model analysis yielded significant main effects for parent self-efficacy, race/ethnicity, age, and distance to school for percent of weekly trips made by active commuting to school (Table 2). Parent self-efficacy (std. beta = 0.18, p=0.018) and age (std. beta = 0.18, p=0.018) were positively related to active commuting to school. Latino children had lower rates of weekly active commuting than non-Latino children (-16.5%, p=0.040). Distance from home to school was inversely related and had the strongest relationship with active commuting to school (std. beta = -0.29, p<0.001). Child self-efficacy, parent outcome expectations, child BMI z-score and gender, neighborhood safety, and interactions with ethnicity were not significant and excluded from the final model.

Results from the mixed-model analysis yielded significant main effects for percent of weekly active commuting to school, age, gender, and BMI z-score for mean daily minutes of moderate-to-vigorous physical activity (Table 2). Children with more active commuting to school had more daily moderate-to-vigorous physical activity (std. beta = 0.31, p <0.001). Both age (std. beta = -0.29, 0<0.001) and BMI z-score (std. beta = -0.19, p=0.009) were inversely related to daily moderate-to-vigorous physical activity. Male children achieved 15.8 more minutes of daily moderate-to-vigorous physical activity than female children (p<0.001). Latino children attained lower daily minutes of moderate-to-vigorous physical activity than non-Latino children, although this difference was not significant (std. beta = -0.14, p=0.092). Distance from home to school, neighborhood safety, and all interactions with ethnicity were not significant and were excluded from the final model.

In planned sub-analyses among Latino children (n=92), results from the mixed model linear regression analysis for percent of weekly trips made by active commuting to school yielded significant main effects for child age, distance from home to school, and child acculturation (Table 3). Child acculturation was inversely associated with active commuting to school (std. beta = -0.23, p=0.01). Parent outcome expectations were positively but marginally associated with children’s active commuting to school (std. beta = 0.49, p=0.085). Similar to the full sample, among the Latino subsample, age was positively associated (std. beta = 0.23, p=0.012) and distance from home to school (std. beta = -0.39, p<0.001) was inversely associated with active commuting to school. Child self-efficacy, BMI z-score and gender, parent self-efficacy, neighborhood safety, and interactions with acculturation were not significant and were excluded from the final model.

In parallel sub-analyses among the Latino children (n=92), results from the mixed model linear regression analysis for moderate-to-vigorous physical activity yielded significant main effects for percent of weekly active commuting to school, child age, gender, and BMI z-score (Table 3). Similar to the full sample, among the Latino subsample, a higher rate of active commuting to school was associated with greater daily moderate-to-vigorous physical activity (std. beta = 0.22, p=0.017) and male gender (std. beta = 0.41, p<0.001). Both age (std. beta = -0.20, p=0.027) and BMI z-score (std. beta = -0.20, p=0.021) were inversely associated with daily moderate-to-vigorous physical activity.

Table 4 lists the school-level demographics provided by the school district.[43] Four of the schools enrolled predominantly Latino children (henceforth termed Latino schools), two of the schools enrolled predominantly African-American children, and two of the schools were more evenly divided. All schools had ≥84% of students qualifying for the Free and Reduced Price Lunch Program, a proxy measure of school-level socioeconomic status.

For the school-level data on pedestrian safety (n=1252 student observations, Table 5), more than half of the children crossed at a corner (77.2%), crossed with an adult or safety patrol (91.6%), kept looking while crossing (54.2%), and walked, instead of ran, across the street (75.8%). Less than half of the children stopped at the curb (37%) and few looked left-right-left before crossing (2.6%). Of the 116 observations conducted at an intersection with a traffic signal, most waited to cross the street with the “walk” signal (69%). More children at the four Latino schools crossed with an adult or safety patrol compared to children at the other four schools (94.6% versus 88.3%, p<0.001). While looking left-right-left before crossing the street was rare, fewer children at the Latino schools performed that behavior compared to the other schools (0.9% versus 4.4%, p<0.001). No children at the Latino schools waited for the “walk” signal, while 82.5% of children at the non-Latino schools properly waited for the “walk” signal (p<0.001). Overall, less than 1% were observed performing no pedestrian safety behaviors at all, 30.4% performed 3 behaviors, and 0.6% performed all 6 behaviors (excluding crossing at an intersection with a traffic signal, since <10% of the sample was eligible). No differences were found for the total number of pedestrian safety behaviors performed between Latino and non-Latino schools.

Discussion

The overall rate of active commuting to school among our sample (43%) was higher than recent national U.S. estimates (13%).[19, 22] The higher prevalence in this study likely reflects characteristics of this sample, including a relatively lower socioeconomic status, a narrow age range, a mostly ethnic minority sample, and the urban setting. Regardless, the mixed models accounted for 27.6% and 39.4% of the variability in children's active commuting to school for the full sample and the Latino subsample, respectively, which were substantial. However, compared internationally, the rate of active commuting to school in this study was lower than the rates for other developed countries (49-70%).[44-49] This suggests that even larger proportions of our sample could actively commute to school and obtain the associated benefits from that form of physical activity.

We are among the first to apply a theoretical framework to children's active commuting to school behaviors. For the full sample, higher parents' self-efficacy was associated with more children's active commuting to school. This relationship was not found for the Latino children subsample; instead Latino parents' outcome expectations were marginally associated with their children's active commuting to school. We do not know why there was a lack of association between Latino parents' self-efficacy and their children's active commuting to school, although the smaller sample size could lead to a type II error. The lack of association was not due to lower variability for Latino parents' self-efficacy. Both of these findings require confirmation, but help to underscore the importance and influence of parents to their children's school commuting behaviors. Interventions to increase children's active commuting to school should be focused toward improving these parental psychosocial constructs.

We confirm that age was positively associated with active commuting to school, as was previously reported by our group[50] and among the majority of studies with children <12 years of age from a systematic review.[16] Distance from home to school had the strongest inverse association with active commuting to school, which was also noted previously.[17]

We report that Latino children were less likely than non-Latino children, most of whom were non-Latino Black (82.5%), to actively commute to school. While previous studies have reported that both Latino and Black children were more likely than White children to actively commute to school,[17] we are among the first to make comparisons between ethnic groups. We speculate that Latinos have lower rates of active commuting to school due to the effect of acculturation, which was associated with lower rates of active commuting to school among Latino children in our sample. This association was as influential as the child's age. Only distance from home to school was more influential. The inverse relationship between acculturation and active commuting to school among the Latino children was consistent with a previous study on a large sample of Latino children,[23] and consistent with the inverse relationship between active commuting for errands and acculturation among Latino adults.[51]

As expected, active commuting to school was positively associated with daily moderate-to-vigorous physical activity and was one of the strongest correlates of daily moderate-to-vigorous physical activity, besides gender. For each additional day of active commuting to school, daily moderate-to-vigorous physical activity increased by four minutes. This finding is consistent with a previous study which reported that for every 30 minutes of active commuting to school per day, children would achieve 4.5 additional minutes of moderate-to-vigorous physical activity/day.[15] This estimate is lower than previous reviews that reported 20-28 additional minutes of moderate-to-vigorous physical activity per day for active commuters,[16-17] although those estimates were based on studies that predominantly used subjectively measured physical activity.

The school-level data on pedestrian safety behaviors at major school intersections showed overall that a low percentage of children performed several behaviors considered fundamental to safety.[52-54] Only about half kept looking for traffic as they crossed the street, less than half stopped at the curb before crossing, and few looked left-right-left before crossing. While some minor differences in pedestrian safety behaviors were noted between children walking toward Latino and non-Latino schools, it should be noted that the low prevalence of several pedestrian safety behaviors was relatively similar between groups. This low prevalence is concerning, since an estimated 51,000 U.S. children are injured as pedestrians annually.[55] We speculate that since the majority of children crossed the street with an adult or school safety patrol staff member (91.6%), the children may have overly relied on the adult or safety patrol to decide when to cross the street. If children did not participate in the decision-making process for crossing the street, they missed out on an opportunity for learning this important pedestrian behavior. Since repeatedly teaching children pedestrian safety may improve their pedestrian safety behaviors,[56] parents and safety patrol staff should seek to engage the children in deciding when to cross the street. These teaching opportunities will help develop their skills and confidence, which is especially important among low socioeconomic status populations who face greater pedestrian injury risks.[55, 57]

Limitations for this study are common among pilot studies. The small sample size (n=8 schools) likely biased findings toward the null hypothesis. The focus of the study was on low- income, ethnic minority children in the fourth grade who agreed to take part in a randomized controlled trial, which limits external validity. The physical activity data were incomplete for a substantial number of children and would have decreased our sample size by 25% if we used a minimum of four days of valid data as the standard instead of one day. We have no data on the built environment, which has been shown to be influential to children's active commuting to school.[58] We used several proxy measures of acculturation rather than a multidimensional acculturation scale. Finally, we assessed pedestrian safety behaviors but did not collect data on pedestrian injuries.

In conclusion, active commuting to school among our low-income, ethnic minority sample was 43%, which suggests that policies and environments should be especially supportive of children's walking and cycling to school to ensure a safe commute. The rate of active commuting to school was lower than for European or Australian children, which suggests room for improvement. With regard to pedestrian safety, fewer than 50% of children observed performed even half of the pedestrian safety behaviors. Interventions and policies are necessary that engage parents, are culturally sensitive, and improve both physical activity and safety outcomes. More studies investigating both physical activity and pedestrian safety are also needed, to help optimize policies and programs related to child pedestrians.

References

1. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of High Body Mass Index in US Children and Adolescents, 2007-2008. *Jama.* January 13, 2010:2009.2012.
2. U.S. Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health.* 2nd ed. Washington, DC: U.S. Government Printing Office; 2000.
3. Freedman DS, Mei Z, Srinivasan SR, Berenson GS, Dietz WH. Cardiovascular risk factors and excess adiposity among overweight children and adolescents: the Bogalusa Heart Study. *J Pediatr.* January 2007;150(1):12-17 e12.
4. Guo SS, Chumlea WC. Tracking of body mass index in children in relation to overweight in adulthood. *Am J Clin Nutr.* July 1999;70(1):145S-148S.
5. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* September 25, 1997;337(13):869-873.
6. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics.* March 1998;101(3 Pt 2):518-525.
7. World Cancer Research Fund / American Institute for Cancer Research. *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective*: Washington, DC: AICR; 2007.
8. Butte NF, Christiansen E, Sorensen TI. Energy imbalance underlying the development of childhood obesity. *Obesity (Silver Spring, Md).* December 2007;15(12):3056-3066.
9. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report.* In: US Department of Health and Human Services, ed. Washington, DC2008.
10. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *CMAJ: Canadian Medical Association Journal.* 2006;174(6):801-809.
11. Janssen I, LeBlanc A. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity.* 2010;7(1):40.
12. Steele RM, Brage S, Corder K, Wareham NJ, Ekelund U. Physical activity, cardio-respiratory fitness and the metabolic syndrome in youth. *J Appl Physiol.* March 27 2008.

13. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* January 2008;40(1):181-188.

14. Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous physical activity from ages 9 to 15 years. *Jama.* July 16 2008;300(3):295-305.

15. Mendoza JA, Watson K, Nguyen N, Cerin E, Baranowski T, Nicklas TA. Active Commuting to School and Association with Physical Activity and Weight Status among US Youth. *J. Phys Act Health.* 2010:In Press.

16. Lee MC, Orenstein MR, Richardson MJ. Systematic review of active commuting to school and childrens physical activity and weight. *Journal of Physical Activity & Health.* November 2008;5(6):930-949.

17. Davison KK, Werder JL, Lawson CT. Children's active commuting to school: current knowledge and future directions. *Preventing Chronic Disease.* July 2008;5(3):A100.

18. US Department of Transportation; Federal Highway Administration. *National Personal Transportation Survey: Transportation Characteristics of School Children*. Washington, DC: US Department of Transportation; 1972.

19. National Center for Safe Routes to School. *US travel data show decline in walking and bicycling to school has stabilized.* Chapel Hill, NC: National Center for Safe Routes to School; 2010.

20. Task Force on Childhood Obesity. *Solving the Problem of Childhood Obesity within a Generation: White House Task Force on Childhood Obesity*. Report to the President. 2010.

21. Fulton JE, Shisler JL, Yore MM, Caspersen CJ. Active transportation to school: findings from a national survey. *Research Quarterly for Exercise and Sport.* September 2005;76(3):352-357.

22. McDonald NC. Active transportation to school: trends among U.S. schoolchildren, 1969-2001. *Am J Prev Med.* June 2007;32(6):509-516.

23. Martinez SM, Ayala GX, Arredondo EM, Finch B, Elder J. Active transportation and acculturation among Latino children in San Diego County. *Preventive Medicine.* 2008;47(3):313-318.

24. Ayala GX, Baquero B, Klinger S. A Systematic Review of the Relationship between Acculturation and Diet among Latinos in the United States: Implications for Future Research. *Journal of the American Dietetic Association.* 2008;108(8):1330-1344.

25. Dixon LB, Sundquist J, Winkleby M. Differences in Energy, Nutrient, and Food Intakes in a US Sample of Mexican-American Women and Men: Findings from the Third National Health and Nutrition Examination Survey, 1988-1994. *Am. J. Epidemiol.* September 15, 2000;152(6):548-557.

26. Dave JM, Evans AE, Saunders RP, Watkins KW, Pfeiffer KA. Associations among Food Insecurity, Acculturation, Demographic Factors, and Fruit and Vegetable Intake at Home in Hispanic Children. *Journal of the American Dietetic Association.* 2009;109(4):697-701.

27. Montez JK, Eschbach K. Country of Birth and Language Are Uniquely Associated with Intakes of Fat, Fiber, and Fruits and Vegetables among Mexican-American Women in the United States. *Journal of the American Dietetic Association.* 2008;108(3):473-480.

28. Neuhouser ML, Thompson B, Coronado GD, Solomon CC. Higher fat intake and lower fruit and vegetables intakes are associated with greater acculturation among Mexicans living in Washington State. *Journal of the American Dietetic Association.* 2004;104(1):51-57.

29. Stimpson JP, Urrutia-Rojas X. Acculturation in the United States Is Associated with Lower Serum Carotenoid Levels: Third National Health and Nutrition Examination Survey. *Journal of the American Dietetic Association.* 2007;107(7):1218-1223.

30. Bandura A. *Social Foundations of Thought & Action: A Social Cognitive Theory*. 1st ed. Upper Saddle River, NJ: Prentice Hall; 1986.

31. Bandura A. Health promotion by social cognitive means. *Health Educ Behav.* April 2004;31(2):143-164.

32. Lubans DR, Foster C, Biddle SJH. A review of mediators of behavior in interventions to promote physical activity among children and adolescents. *Preventive Medicine.* 2008;47(5):463-470.

33. Schwarzer R, Renner B. Social-cognitive predictors of health behavior: action self-efficacy and coping self-efficacy. *Health Psychol.* September 2000;19(5):487-495.

34. Lorig K, Stewart A, Ritter P, Gonzalez V, Laurent D, Lynch J. *Outcome Measures for Health Education and Other Health Care Interventions*. Thousand Oaks, CA: Sage; 1996.

35. Coulton CJ, Korbin JE, Su M. Measuring neighborhood context for young children in an urban area. *American Journal of Community Psychology.* February 1996;24(1):5-32.

36. Burdette HL, Whitaker RC. A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. *Pediatrics.* September 2005;116(3):657-662.

37. Mendoza J, Watson K, Baranowski T, Nicklas T, Uscanga D, Hanfling M. Validity of instruments to assess students' travel and pedestrian safety. *BMC Public Health.* 2010;10(1):257.

38. Puyau MR, Adolph AL, Vohra FA, Butte NF. Validation and calibration of physical activity monitors in children. *Obes Res.* March 2002;10(3):150-157.

39. Trost SG, McIver KL, Pate RR. Conducting accelerometer-based activity assessments in field-based research. *Med Sci Sports Exerc.* November 2005;37(11 suppl):S531-543.

40. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC Growth Charts for the United States: methods and development. *Vital Health Stat 11.* May 2002(246):1-190.

41. Little RJA. A Test of Missing Completely at Random for Multivariate Data with Missing Values. *Journal of the American Statistical Association.* 1988;83(404):1198-1202.

42. Yuan YC. Multiple Imputation for Missing Data: Concepts and New Development (Version 9.0). 2000; http://support.sas.com/rnd/app/papers/abstracts/multipleimputation.html. Accessed 6/23/2010.

43. Houston Independent School District. Elementary Schools. 2009; http://www.houstonisd.org/. Accessed 6/22/10.

44. Chillon P, Ortega FB, Ruiz JR, et al. Socio-economic factors and active commuting to school in urban Spanish adolescents: the AVENA study. *Eur J Public Health.* October 1, 2009;19(5):470-476.

45. Santos MP, Oliveira J, Ribeiro JC, Mota J. Active travel to school, BMI and participation in organised and non-organised physical activity among Portuguese adolescents. *Preventive Medicine.* 2009;49(6):497-499.

46. Grize L, Bringolf-Isler B, Martin E, Braun-Fahrlander C. Trend in active transportation to school among Swiss school children and its associated factors: three cross-sectional surveys 1994, 2000 and 2005. *International Journal of Behavioral Nutrition and Physical Activity.* 2010;7(1):28.

47. Panter JR, Jones AP, Van Sluijs EMF, Griffin SJ. Neighborhood, Route, and School Environments and Children's Active Commuting. *American Journal of Preventive Medicine.* 2010;38(3):268-278.

48. Voss C, Sandercock G. Aerobic Fitness and Mode of Travel to School in English Schoolchildren. *Medicine & Science in Sports &*

Exercise. 2010;42(2):281-287 210.1249/MSS.1240b1013e3181b1211bdc.

49. Page A, Cooper A, Griew P, Jago R. Independent mobility, perceptions of the built environment and children's participation in play, active travel and structured exercise and sport: the PEACH Project. *International Journal of Behavioral Nutrition and Physical Activity.* 2010;7(1):17.

50. Mendoza J, Levinger D, Johnston B. Pilot evaluation of a walking school bus program in a low-income, urban community. *BMC Public Health.* 2009;9(1):122.

51. Berrigan D, Dodd K, Troiano RP, Reeve BB, Ballard-Barbash R. Physical activity and acculturation among adult Hispanics in the United States. *Research Quarterly for Exercise and Sport.* June 2006;77(2):147-157.

52. Rivara FP, Booth CL, Bergman AB, Rogers LW, Weiss J. Prevention of Pedestrian Injuries to Children: Effectiveness of a School Training Program. *Pediatrics.* October 1, 1991;88(4):770-775.

53. Rosenbloom T, Ben-Eliyahu A, Nemrodov D. Children's crossing behavior with an accompanying adult. *Safety Science.* 2008;46(8):1248-1254.

54. Zeedyk MS, Kelly L. Behavioural observations of adult-child pairs at pedestrian crossings. *Accid Anal Prev.* September 2003;35(5):771-776.

55. Committee on Injury Violence and Poison Prevention. Pedestrian Safety. *Pediatrics.* August 1, 2009;124(2):802-812.

56. Duperrex O, Bunn F, Roberts I. Safety education of pedestrians for injury prevention: a systematic review of randomised controlled trials. *Bmj.* May 11, 2002;324(7346):1129.

57. Pressley JC, Barlow B, Kendig T, Paneth-Pollak R. Twenty-Year Trends in Fatal Injuries to Very Young Children: The Persistence of Racial Disparities. *Pediatrics.* April 1, 2007;119(4):e875-884.

58. Zhu X, Arch B, Lee C. Personal, Social, and Environmental Correlates of Walking to School Behaviors: Case Study in Austin, Texas. *TheScientificWorldJOURNAL.* 2008;8:859-872.

TABLES

Table 1. Participant characteristics stratified by Latino and Non-Latino ethnicity

Characteristic	Non-Latino	Latino	Total
Total, *n (%)*	57 (38.2)	92 (61.7)	149 (100.0)
Gender- males, *n (%)*	26 (45.6)	44 (47.8)	70 (47.0)
Race/Ethnicity, *n (%)*[a]			
Latino	n/a	91 (98.9)	91 (61.1)
Non-Latino Black	47 (82.5)	n/a	47 (31.6)
Non-Latino White	2 (3.5)	n/a	2 (1.3)
Other	6 (10.5)	n/a	6 (4.0)
Missing	2 (3.5)	1 (1.1)	3 (2.0)
Household Education, *n (%)*[b]*			
High School graduate or less	28 (49.1)	60 (65.2)	88 (59.1)
Some college or technical/vocational school	17 (29.8)	9 (9.8)	26 (17.4)
College graduate	9 (15.8)	3 (3.3)	12 (8.1)
Missing	3 (5.3)	20 (21.7)	23 (15.4)
Annual Household Income *n (%)*[b]			
≤ $30,000	29 (50.9)	47 (51.1)	76 (51.0)
>$30,000	15 (26.3)	18 (19.6)	33 (22.1)
Missing	13 (22.8)	27 (29.3)	40 (26.8)
Child's age (years), *M (SD)**	9.9 (0.7)	9.6 (0.6)	9.7 (0.7)
Distance to school (km), *M (SD)*	0.7 (0.6)	0.7 (0.6)	0.7 (0.6)
BMI z-score, *M (SD)*	1.1 (1.3)	1.1 (1.0)	1.1 (1.1)
% ACS/week, *M (SD)*	41.2 (41.9)	29.4 (43.7)	33.9 (43.3)
MVPA/day, *M (SD)*	49.3 (22.9)	45.6 (24.9)	47.0 (24.2)
Child self-efficacy, *M (SD)*	37.7 (6.1)	36.5 (5.7)	37.0 (5.8)
Parent self-efficacy, *M (SD)*	33.7 (6.4)	33.7 (6.9)	33.7 (6.7)
Parent outcome expectations, *M (SD)*	20.9 (4.9)	20.1 (3.7)	20.4 (4.2)
Neighborhood safety, *M (SD)*	9.4 (6.7)	9.7 (6.5)	9.6 (6.6)
Child Acculturation *M (SD)*	n/a	2.1 (1.0)	n/a
Parent Acculturation *M (SD)*	n/a	0.9 (1.1)	n/a

[a] Data as imputed for missing values (n=6) for race/ethnicity (Latino/Non-Latino)
[b] Education and income not imputed or included in analyses due to amount of missing data
* Significant difference between Latino and Non-Latino for education (excluding missing) (p=0.001) and child's age (p=0.008)
Abbreviations: MVPA = moderate-to-vigorous physical activity; ACS = active commuting to school

Table 2. Results from stepwise mixed model linear regression analyses for percent of weekly active commuting to school (ACS) and moderate-to-vigorous physical activity (MVPA) outcomes (n=149)*

Model: Outcome Independent Variables	Beta (SE)	Std. Beta	p-value
Model 1: % ACS/week			
Parent self-efficacy	1.7 (0.5)	0.18	0.018
Ethnicity (Latino =1)	-16.5 (8.0)	-0.19	0.040
Age (years)	11.5 (4.8)	0.18	0.018
Distance to school (km)	-22.6 (5.9)	-0.29	<0.001
R^2_{LR}=27.6			
Model 2: MVPA/day			
% ACS/week	0.2 (0.1)	0.31	<0.001
Ethnicity (Latino =1)	-6.7 (4.0)	-0.14	0.092
Age (years)	-10.4 (2.6)	-0.29	<0.001
Gender (Male=1)	15.8 (3.4)	0.33	<0.001
BMI z-score	-4.0 (1.5)	-0.19	0.009
R^2_{LR}=33.8			

*Initial Variables for Model 1: Ethnicity (Latino and non-Latino), age, gender, BMI z-score, distance to school, neighborhood safety, psychosocial variables (child self-efficacy, parent self-efficacy, parent outcome expectations) and all interactions with ethnicity. Initial Variables for Model 2: Ethnicity (Latino and non-Latino), age, gender, BMI z-score, distance from school, neighborhood safety, % weekly ACS, and all interactions with ethnicity

Table 3. Results from stepwise mixed model linear regression analyses for percent of weekly active commuting to school (ACS) and moderate-to-vigorous physical activity (MVPA) outcomes for Latino children (n=92)*

Model: Outcome Independent Variables	Beta (SE)	Std. Beta	p-value
Model 1: % ACS/week			
Parent outcome	1.9 (1.1)	0.49	0.085
Age (years)	16.2 (6.3)	0.23	0.012
Distance (km)	-30.7 (7.3)	-0.39	<0.001
Child acculturation	-10.6 (4.0)	-0.23	0.010
R^2_{LR}=39.4			
Model 2: MVPA/day			
% ACS/week	0.1 (0.1)	0.22	0.017
Age (years)	-8.1 (3.6)	-0.20	0.027
Gender (Male=1)	20.6 (4.3)	0.41	<0.001
BMI z-score	-5.0 (2.1)	-0.20	0.021
R^2_{LR}=36.4			

*Initial Variables for Model 1: Child and parent acculturation; child's age, gender, and BMI z-score; distance to school; neighborhood safety; psychosocial variables (child self-efficacy, parent self-efficacy, parent outcome expectations); and all interactions with corresponding child and parent acculturation. Initial Variables for Model 2: Child and parent acculturation; child's age, gender, and BMI z-score; distance from home; neighborhood safety; % weekly ACS; and all interactions with child and parent acculturation

Table 4. School-level characteristics provided by the Houston Independent School District, 2008-2009

	Enrollment	% Latino	% African American	% Free and reduced lunch
School 1*	701	78	13	84
School 2*	935	94	4	95
School 3	471	8	92	94
School 4	580	43	50	84
School 5*	490	92	8	93
School 6*	560	93	5	97
School 7	492	7	92	95
School 8	521	59	41	98

*considered a predominantly Latino school for analyses

Table 5. Percentages for each pedestrian safety behavior, stratified by the predominant school ethnicity (Latino versus Non-Latino)

	Non-Latino	Latino	Total	Test Statistic	
	(n=588)	(n=664)	(n=1252)	X^2, df=1	p-value
% Performing behavior					
Crossed at Corner	79.1	75.5	77.2	2.33	0.127
Crossed with adult/safety patrol	88.3	94.6	91.6	16.18	<0.001
Stopped at curb	35.0	38.7	37.0	1.80	0.179
Looked left-right-left	4.4	0.9	2.6	15.50	<0.001
Kept looking while crossing	57.0	51.7	54.2	3.55	0.060
Walked (not run) across street	77.7	74.1	75.8	2.23	0.135
Total observations with a traffic light and walk signal	(n=97)	(n=19)	(n=116)		
% obeyed the walk signal	82.5	0.0	69.0	50.49	<0.001