The influence of parental nativity, neighborhood disadvantage and built environment determinants on physical activity behaviors in Latino youth

By: Sandra E. Echverria, Punam Ohri-Vachaspati, and Michael J. Yedidia

Echeverría SE, Ohri-Vachaspati P, Yedidia M. The influence of parental nativity, neighborhood disadvantage and built environment determinants on physical activity behaviors in Latino youth. *Journal of Immigrant and Minority Health*. 2013 Oct 26. 2015 Apr;17(2):519-26.

This is a post-peer-review, pre-copyedit version of an article published in *Journal of Immigrant and Minority Health*. The final authenticated version is available online at: http://dx.doi.org/10.1007/s10903-013-9931-4

Abstract:

Little evidence exists examining if parental nativity, neighborhood disadvantage and built environment features are associated with physical activity behaviors in Latino youth. We used a representative sample of Latino youth (n = 616) living in New Jersey to examine parental nativity associations with active transport to school, active use of sidewalks, use of local neighborhood parks, and use of neighborhood physical activity facilities. We estimated prevalence ratios (PR) that accounted for the complex survey design. Latino youth with foreign-born parents were generally more active than their US-born peers, and those with parents in the US 10 years or less were more likely to engage in active transport to school (PR = 1.51, 95 % CI 1.04–2.21), after adjusting for census-based neighborhood disadvantage, self-reported neighborhood measures, and geocoded distance to school. Parental nativity status should be considered in policies or interventions designed to increase physical activity among Latino youth.

Keywords: Physical activity | Latino youth | Neighborhoods | Built environment

Article:

Background

The current obesity epidemic has highlighted the importance of diet and physical activity early in life. In the past 30 years, the prevalence of overweight has nearly tripled among children 6–11 years of age and increased twofold among those 12–19 years old in the United States (US) [1]. Along with the rising prevalence of obesity, US youth are also less likely to be active. An estimated 18 % of high school students meet the recommended levels of 60 min of moderate to vigorous physical activity per day, with generally lower levels of activity observed in racial/ethnic minority youth compared to White youth [2]. Physical inactivity is a risk factor for

overweight and obesity [3] as well as mortality, cardiovascular disease, and certain cancers [4, 5]. Thus, investigating determinants of physical activity in youth may help identify factors early in life that place individuals at risk for cardiovascular and other chronic conditions in adulthood [6].

Identifying factors associated with physical activity in Latino youth is particularly urgent as they are the fastest growing segment of the youth population and have high levels of obesity and physical inactivity. Between 2000 and 2010, the Latino population accounted for one-half of the nation's growth [7] and Latino youth today represent 22 % of the US population 18 years old and younger [8]. National data indicate that Latino youth 2–19 have the highest prevalence of obesity of all youth in the US [9], and only 50 % of Latino youth meet recommended levels of physical activity per week compared to 61 % of non-Latino white youth [10]. Further, only one-quarter participate in organized physical activity involving a coach, instruction or leader, compared to more than half of White youth [11]. Latino youth also have high levels of sedentary behavior [12, 13].

Despite their increased risk, few studies have comprehensively examined determinants of physical activity among Latino youth, particularly the role of parental nativity. Research on adult populations, for example, has shown a lower prevalence of obesity among first-generation immigrants (i.e., foreign-born) than the US-born [14], while physical activity has been shown to generally be lower among the foreign-born [15, 16, 17, 18]. In the few studies that have examined the role of nativity among youth, the evidence is mixed. Some studies find that the US-born and those with longer duration in the US are more active than their foreign-born peers [19, 20, 21], while others find increased activity for foreign-born adolescents or those from families with low levels of acculturation [20, 22]. Given that nearly 65 % of Latino youth in the US have at least one foreign-born parent [23], nativity status is likely an important determinant of physical activity in this population and may point to cultural factors that explain differences with US-born youth.

Equally important in physical activity research has been the consistent body of research in the last several years demonstrating that features of the built environment and neighborhood socioeconomic contexts influence physical activity. The burgeoning built environment literature has shown that individuals who live in 'walkable' neighborhoods [24, 25], mixed land use environments [26, 27, 28] and have access to open spaces [29, 30, 31] are more likely to be physically active than those living in places with fewer of these amenities. Studies employing youth samples have generally confirmed findings observed in adult populations and shown increased activity for those living in areas characterized by activity-enhancing built environments [30, 32, 33, 34, 35, 36], including shorter distance for walking to school [37, 38]. Similarly, while most of the early work on neighborhood socioeconomic condition focused on cardiovascular risk [39, 40, 41], several studies in recent years have examined associations between neighborhoods and overweight/obesity [42] and physical activity [26, 37, 38, 39, 40, 41, 42]. Generally, these studies indicate that individuals living in impoverished neighborhoods or with low social cohesion are less likely to be active [27, 43, 44, 45, 46, 47, 48] than those living in more advantaged neighborhoods, after accounting for individual-level socioeconomic position (SEP). While some studies conducted with youth samples, suggest no association between neighborhood disadvantage and activity [32, 34], others generally find lower activity with

increasing disadvantage [49, 50, 51, 52, 53]. This is particularly the case for racial/ethnic minority youth who tend to live in poorer neighborhoods and thus may decrease activity due to fear of safety, lack of PA resources, and less aesthetically pleasing surroundings [31, 50, 52, 54, 55].

In the present study, we investigate these distinct areas of research—nativity status, neighborhood disadvantage, and built environment determinants—to better understand physical activity patterns in Latino youth. Our main interest was to investigate differences by parental nativity status across four physical activity behaviors: active transport to school, use of sidewalks, use of local neighborhood parks, and use of neighborhood physical activity facilities. We extend prior work by classifying parents according to US-born status as well as length of stay in the US for the foreign-born. Given the strong body of evidence linking neighborhood and built environments to physical activity, we hypothesized that any observed difference by parental nativity status would be attenuated or disappear after adjusting for these contextual features.

Methods

Our study population was drawn from a representative sample of 1,708 households that participated in a random-digit-dial (RDD) telephone survey of residents living in five cities in the state of New Jersey (Camden, New Brunswick, Newark, Trenton, and Vineland). The survey was implemented from June 2009–March 2010 and was designed to identify risk factors associated with obesity among children 3–18 years of age. An adult respondent (herein 'parent') answered all study questions and was the person who made most of the decisions about food shopping for the household (in 94 % of the cases, this was the parent of at least one of the children who lived there). The adult respondent provided data on one randomly selected child in the household (index child). The telephone interviews were conducted in either English or Spanish and participants were offered an incentive of $10 to participate in the survey. Survey fieldwork was carried out by a private company and the response rate for the survey, calculated using the American Association for Public Opinion Research (AAPOR) criteria response rate 3 [56] was 49 %. This rate estimates what proportion of individuals of unknown eligibility is actually eligible, using the best available scientific information on what share of eligible cases are in the unknown population. Sampling probability weights were developed so that survey estimates represent the population of 3–18 year olds in in the five cities combined.

Parental nativity was our main independent variable and was assessed among adult respondents who self-identified as Latino/Hispanic of Latin American origin countries. Latino participants were further classified as US or foreign-born, and years of residence in the US among the foreign-born using commonly applied cut-points (<10, 10–19, and 20+ years in the US). Because of the survey design, all individuals of Puerto Rican origin were classified as US-born.

The dependent variables included four physical activity behaviors: active transport to school (walking, bicycling or skateboarding), use of sidewalks to walk, run, bike, or play, use of local neighborhood parks, and use of neighborhood physical activity facilities (e.g., walking or running tracks, basketball or tennis courts, swimming pool, or school gym in the parks). For each of these measures, parents were asked if the child engaged in this behavior 'Never', 'Rarely', 'Sometimes', and 'Often'. Nearly 60 % of parents indicated that the index child did not use any

active form of transport to get to school (i.e., did not walk, bicycle, or skateboard). Thus, this measure was dichotomized as no active transport versus all other response categories. For the other three dependent variables, we dichotomized responses into respondents who engaged in the behavior at least sometimes/often versus rarely/never.

The survey items used in the current analysis were derived from previous research studies [57, 58, 59, 60] and included self-reported and geocoded neighborhood and built environment measures. Participants were asked to think of their neighborhood as the area within a 20 min walk, or about 1 mile in all directions from around their home. Parents self-reported on neighborhood opportunity for physical activity and safety of exercise facilities in view of criminal activity using a 4-point Likert scale. These items were classified into a binary measure into 'high' versus 'low'. Neighborhood social cohesion was measured with a scale developed by Sampson et al. [58] that includes items on how 'close-knit' neighbors are, willingness of neighbors to help each other, if neighbors get along, if neighbors can be trusted, and if neighbors share the same values. A social cohesion score was calculated using cases where participants had data on 4 of the 5 items; increasing score represents increasing social cohesion.

Geocoded data included measures of neighborhood socioeconomic condition and distance to school. Neighborhood-level socioeconomic status was determined by geocoding participants' report of their home address or nearest cross-street and linking this to the US 2000 census data [58]. Census-block groups were used as proxies of the neighborhood context. We created a composite neighborhood index broadly representing neighborhood wealth based on previously published work [61] that included the following items: log of the median household income; log of the median value of owner-occupied housing units; proportion of households receiving interest, dividend, or net rental income; proportion of adults 25 years of age or older with a high-school diploma; proportion of adults 25 years of age or older who had completed college; and the proportion of people employed in executive, managerial, or professional specialty occupations. The index was constructed by summing the Z-scores for each of the neighborhood-level variables, with Z-scores constructed using the mean and SD for all census-block groups in the state. Increasing score represents increasing neighborhood advantage. Preliminary analyses indicated that parental nativity was significantly associated only with active transport to school. Thus, we used distance to school as our main built environment determinant. Parents reported the school that the index child attended and roadway network distance between geocoded home and school addresses was calculated using ArcGIS software. Distance to school was entered in its original continuous form (in miles).

Other covariates included respondent's age, child's age, child sex, and individual-level measures of adult education (less than high school, high school, some college, and college graduate) and the family's ratio of income to the poverty level based on number of persons in the household and federal poverty thresholds established for 2008 (categorized as 200 % or below the federal poverty line or 200 % or more above poverty). All data collection and analyses were approved by the Institutional Review Board of the investigators' home institutions.

Statistical Analysis

The final analytic sample for our study included 616 youth of Latino origin. Sociodemographic, neighborhood and built environment characteristics were examined for the full sample and by the four classifications of parental nativity status. We calculated age-adjusted predicted probabilities (prevalence) of physical activity by fitting log binomial regression models that accounted for the complex survey design (Fig. 1). Parental nativity was entered as an ordinal variable in regression models to determine the significance of trends across categories (i.e., *p* value for trend). We also estimated prevalence ratios as functions of average marginal predictions for complex survey designs [62] to examine the association between parental nativity and each of the four physical activity behaviors. Model 1 presents the crude estimate between nativity and active transport to school, followed by Models 2–5 that adjust for a series of covariates. The number of records retained in these models varied depending on the covariates included. Notably, due to missing data on distance to school, the number of observations in Model 5 included 403 participants. Data management was conducted in SAS v9.2 and analyses performed in SAS-callable SUDAAN to account for the complex survey design.

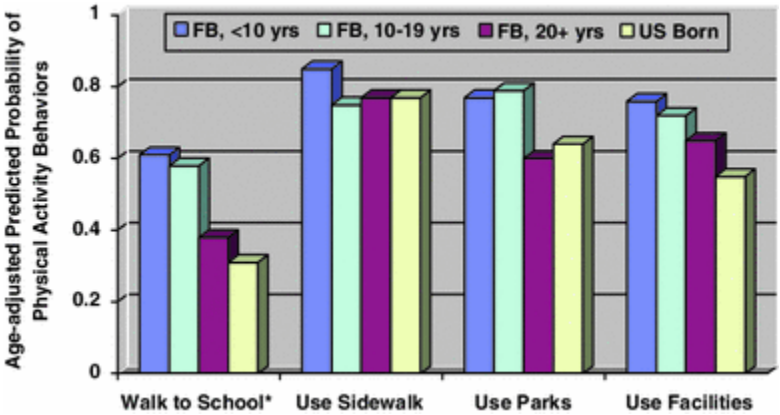

Figure 1. Age-adjusted predicted probability of physical activity behaviors (weighted), by parental nativity and duration in the US. *$p < 0.001$; all other trends $p > 0.05$

Results

A total of 56 % of Latino participants were foreign-born and lived an average of 15.5 years in the United States (Table 1). The average age of adult participants was 37.5 years (SE = 0.5) and 10.1 years (SE = 10.1) for children. Among foreign-born parents, between 34 and 38 % had less than a high school education, compared to 24 % of US-born parents. The average neighborhood score among the foreign-born generally increased with longer duration in the US. Approximately half of the participants reported having positive neighborhood features conducive to physical activity, with slightly higher averages for the group living in the US 20 or more years.

Figure 1 shows age-adjusted predicted probabilities for each physical activity behavior. While on average a large percentage of our sample engaged in these physical activity behaviors, there were marked differences by parental nativity status. Youth of parents living in the US less than 10 years, between 10 and 19 years and 20 or more years were significantly more likely to use active transport to school then their peers of US-born parents (61, 58, 38, and 31 %, respectively) (p for trend <0.001). Latino youth with foreign-born parents were also generally more likely to

use sidewalks, parks and physical activity facilities, although differences were non-significant ($p > 0.05$).

Table 1. Select characteristics (weighted) of adult and child participants, by parental nativity and duration in US, childhood obesity study, New Jersey

	Total (n = 615)	<10 years in US (n = 89)	10–19 years in US (n = 159)	20 or more years in US (n = 97)	US-born (n = 270)
Demographic variables					
Years in US, mean (SE)	15.5 (0.5)	6.4 (0.3)	14.0 (0.4)	26.4 (0.8)	–
Age of adult, mean (SE)	37.5 (0.5)	34.6 (1.0)	37.7 (1.0)	43.4 (1.1)	36.3 (0.8)
Age of child, mean (SE)	10.1 (0.2)	9.4 (0.6)	9.8 (0.4)	11.5 (0.6)	10.0 (0.4)
Education (adult), %					
Less than high school	30.9	38.3	33.7	37.9	24.1
High school	41.2	32.4	45.3	37.0	42.3
Some college	15.8	7.0	13.4	12.8	21.3
College or more	12.1	22.3	7.7	12.3	12.1
Family income at or below 200 % of the federal poverty level, %	82	94	89	79	74
Geocoded neighborhood/built environment measures					
Neighborhood socioeconomic score, mean (SE)	−0.0 (0.4)	−1.0 (1.0)	1.0 (0.4)	1.5 (0.5)	−1.0 (0.7)
Crime index at block-group level, median (SE)	290.5 (8.9)	317.2 (31.9)	308.8 (14.9)	252.7 (21.7)	281.9 (13.8)
Distance to school, in miles, mean (SE)	1.48 (0.08)	1.46 (0.27)	1.29 (0.14)	1.14 (0.14)	1.65 (0.14)
Self-reported neighborhood measures					
Neighborhood social cohesion score, mean (SE)	12.2 (0.2)	12.0 (0.6)	12.3 (0.3)	12.7 (0.4)	12.0 (0.3)
High physical activity opportunity in neighborhood[a], %	45.2	40.4	46.5	58.1	41.1
High safety of exercise facilities in view of criminal activity[b], %	50.1	46.3	47.2	57.3	52.8

[a] Percent of participants who self-reported that neighborhood offers opportunity to physically active as 'strongly/somewhat agree'

[b] Percent of participants who self-reported that with respect to crime their neighborhood was 'very/somewhat safe' for physical activity

Table 2. Prevalence ratios (weighted) for walking to school among Latino youth, by parental nativity and duration in the US

Nativity status	Model 1: crude	Model 2: demographic measures	Model 3: neighborhood socioeconomic condition	Model 4: self-reported neighborhood measures	Model 5: distance to school
Foreign-born, <10 years in US	1.65 (1.19, 2.27)	1.60 (1.16, 2.20)	1.60 (1.16, 2.22)	1.65 (1.17, 2.33)	1.51 (1.04, 2.21)
Foreign-born, 10–19 years in US	1.55 (1.16, 2.08)	1.50 (1.12, 2.0)	1.51 (1.12, 2.02)	1.35 (0.97, 1.87)	1.17 (0.83, 1.64)
Foreign-born, 20+ years in US	0.99 (0.64, 1.53)	0.92 (0.59, 1.45)	0.93 (0.59, 1.46)	1.0 (0.64, 1.56)	0.95 (0.58, 1.56)
US-born (referent)	1.0	1.0	1.0	1.0	1.0

Model 1 (crude); Model 2 includes nativity status, adjusted for child's age, child's gender, family income, and parental education; Model 3 includes covariates in Model 2, plus census-based neighborhood socioeconomic score; Model 4 includes covariates in Model 3, plus self-reported neighborhood social cohesion, neighborhood opportunity for physical activity, and safety of exercise facilities in view of criminal activity; Model 5 includes all previous variables plus geocoded distance to school (miles)

Table 2 presents a series of regression models estimating prevalence ratios for active transport to school. As previously noted, this was the only physical activity behavior significantly associated with parental nativity. When compared to youth of US-born parents, those with parents living in the US less than 10 years were 65 % more likely to use active transport to school (PR = 1.65, 95 % CI 1.19,2.27), followed by youth with parents living in the US 10–19 years (PR = 1.55, 95 % CI 1.16,2.08), and no significant difference observed for those living in the US more than

20 years (PR = 0.99, 95 % CI 0.64,1.53). This association remained virtually unchanged in sequential models (Models 2–4) that adjusted for socioedemographic, neighborhood socioeconomic context, and perception-based determinants of the neighborhood. Our final model (Model 5) includes distance to school, as our main built environment determinant. Results show that associations were somewhat reduced and models became marginally significant (PR = 1.51, 95 % CI 1.04, 2.21) for those living in US <10 years compared to the US-born. Results were non-significant for all other nativity groups.

Discussion

We found that Latino youth of foreign-born parents were generally more likely to engage in the four positive physical activity behaviors we examined than peers of US-born parents. These differences, however, were significant only for the active transport to school outcome. Latino youth with parents living in the US less than 10 years were 1.5-times more likely to walk to school than youth of US-born parents. Results remained relatively unchanged after adjusting for important features of the neighborhood socioeconomic context, perceptions of social cohesion, crime and safety, and distance to school (built environment measure). These findings extend prior research in several ways. First, we demonstrated that nativity differences observed in adult populations held in this population-based sample of Latino youth. Second, the study incorporated geocoded neighborhood attributes, built environment factors and self-reported measures that are rarely available in studies involving Latino youth. Lastly, by fitting a series of sequential regression models, we showed the potentially distinct role of each of the measures investigated on physical activity behaviors for one of the largest racial/ethnic minority groups in the US.

Our study corroborates prior research indicating more active transport to school and physical activity for Latino youth who are foreign-born or from foreign-born parents who are less acculturated [20, 21]. A particular strength of our study was that we adjusted for a range of factors associated with physical activity, including a geocoded measure of distance to school. One explanation for our findings may be that foreign-born parents with short duration in the US have preferences for walking to school that extend beyond any potential barriers present in their immediate neighborhood and built environment surroundings. Thus, the consistent association observed in our study, after adjusting for covariates previously shown to be important determinants of activity, suggests the critical role of parental nativity in shaping activity patterns in Latino youth. Nonetheless, important work remains in identifying why nativity status or ‘acculturation’ is associated with better physical activity behaviors and whether this varies across neighborhood contexts and built environment features [63, 64, 65], which we were not able to determine due to sample size limitations. Importantly, by identifying the factors that seem to be health-enhancing among foreign-born populations, we may be able to better tailor interventions to the US-born, including those with foreign-born parents.

While foreign-born youth generally engaged in the four physical activity behaviors investigated more than the US-born youth, differences were not statistically significant for three of these measures (use of sidewalks, use of parks, use of physical activity facilities). Our study population is relatively young (mean age of 10.1 years) and thus may generally be more active in regards to these forms of physical activity behaviors, with little disparities present by parental nativity status. However, there is also some research to suggest that specific built environment

features may relate to specific physical activity behaviors in different ways, such that some attributes of the built environment may facilitate distinct forms of activity and not others, though more research is needed to illuminate the reasons for this [64, 66].

Our study has some potential limitations that should be considered. As a cross-sectional study design, we were not able to demonstrate that longer duration in the US was associated with longitudinal changes in physical activity over time. Future studies are needed that identify the factors surrounding parental nativity differences by directly inquiring about activity preferences, cultural norms and habits generally and more specifically regarding physical activity, and other socioeconomic barriers not investigated in our study. Due to sample size limitations, we also were not able to explore if associations differed by perceived or geocoded socioeconomic indicators. This possibility remains to be determined in other larger, population-based samples. Moreover, our study population was largely poor and lived in poor neighborhoods, potentially limiting our ability to determine nativity differences across a broader range of socioeconomic position. One other limitation in our study was that we did not have data on whether a car was available for transportation to school. However, the study asked participants if there was access to a car for food shopping, which could be used as a proxy measure of access to a car in the household. When we adjusted for this measure, results remained virtually unchanged and thus this measure was not included in our final model. Like most large-scale surveys, we relied on parental report of youth physical activity, which may have introduced reporting errors. However, errors are likely random in nature and may have decreased the precision of our estimates. Additionally, we did not have data on the duration or intensity of these or other forms of physical activities in order to classify youth as engaging in light, moderate or vigorous forms of physical activity. Lastly, Latino health has been shown to vary by country of origin and thus we caution that results may not extend uniformly to all subgroups of the Latino population.

Conclusion

In summary, few studies have focused on a wide range of factors associated with physical activity in Latino youth. Our study advances prior research by using a rich dataset that allowed us to simultaneously examine the role of parental nativity, neighborhood-level socioeconomic determinants and built environment factors. Specifically, the use of both geocoded and self-reported measures allowed us to examine ‘objective’ from perceived attributes that may explain parental nativity differences. Our findings suggest the need to support immigrant families to continue to be physically active and the importance of this population, from a research perspective, for helping us identify why activity patterns change so dramatically with longer duration in the US, and by implication for the US-born.

Acknowledgments

This study was in part supported by a grant from the RobertWood Johnson Foundation, Active Living Research, New Connections, and a Diversity Supplement (SEE) NIH, NCI, R01CA149705-02S1.

References

1. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999–2000. JAMA. 2002;288(14):1728–32.
2. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance—United States, 2009. Surveillance Summaries. June 4, 2010. 2010;59 (No. SS-5).
3. US Department of Health and Human Services. Physical activity and health: a report of the surgeon general. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, CDC, National Center for Chronic Disease Prevention and Health Promotion. 1996.
4. Leitzmann MF, Park Y, Blair A, et al. Physical activity recommendations and decreased risk of mortality. Arch Intern Med. 2007;167(22):2453–60.
5. Powell KE, Thompson PD, Caspersen CJ, Kendrick JS. Physical activity and the incidence of coronary heart disease. Annu Rev Public Health. 1987;8:253–87.
6. Cleland VJ, Ball K, Magnussen C, Dwyer T, Venn A. Socioeconomic position and the tracking of physical activity and cardiorespiratory fitness from childhood to adulthood. Am J Epidemiol. 2009;170(9):1069–77.
7. Fry R. Latino settlement in the new century. Washington, DC: Pew Hispanic Center; 2008.
8. Fry R, Passel JS. Latino children: a majority are US-born offspring of immigrants. Washington, DC: Pew Hispanic Center; 2010.
9. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007–2008. JAMA. 2010;303(3):242–9.
10. Crespo CJ, Smit E, Troiano RP, Bartlett SJ, Macera CA, Andersen RE. Television watching, energy intake, and obesity in US children: results from the third National Health and Nutrition Examination Survey, 1988–1994. Arch Pediatr Adolesc Med. 2001;155(3):360–5.
11. Centers for Disease Control and Prevention. Physical activity levels among children aged 9–13 years—United States, 2002. 2003;52(33):785–8.
12. Carvajal SC, Hanson CE, Romero AJ, Coyle KK. Behavioural risk factors and protective factors in adolescents: a comparison of Latinos and non-Latino whites. Ethn Health. 2002;7(3):181–93.
13. Gordon-Larsen P, McMurray RG, Popkin BM. Adolescent physical activity and inactivity vary by ethnicity: the National Longitudinal Study of Adolescent Health. J Pediatr. 1999;135(3):301–6.
14. Bates LM, Acevedo-Garcia D, Alegria M, Krieger N. Immigration and generational trends in body mass index and obesity in the United States: results of the National Latino and Asian American Survey, 2002–2003. Am J Public Health. 2008;98(1):70–7.
15. Abraido-Lanza AF, Chao MT, Florez KR. Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. Soc Sci Med. 2005;61(6):1243–55.

16. Crespo CJ, Smit E, Andersen RE, Carter-Pokras O, Ainsworth BE. Race/ethnicity, social class and their relation to physical inactivity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988–1994. Am J Prev Med. 2000;18(1):46–53.

17. Crespo CJ, Smit E, Carter-Pokras O, Andersen R. Acculturation and leisure-time physical inactivity in Mexican American adults: results from NHANES III, 1988–1994. Am J Public Health. 2001;91(8):1254–7.

18. Berrigan D, Dodd K, Troiano RP, Reeve BB, Ballard-Barbash R. Physical activity and acculturation among adult Hispanics in the United States. Res Q Exerc Sport. 2006;77(2):147–57.

19. Gordon-Larsen P, Adair LS, Popkin BM. The relationship of ethnicity, socioeconomic factors, and overweight in US adolescents. Obes Res. 2003;11(1):121–9.

20. Martinez SM, Ayala GX, Arredondo EM, Finch B, Elder J. Active transportation and acculturation among Latino children in San Diego County. Prev Med. 2008;47(3):313–8.

21. Unger JB, Reynolds K, Shakib S, Spruijt-Metz D, Sun P, Johnson CA. Acculturation, physical activity, and fast-food consumption among Asian-American and Hispanic adolescents. J Community Health. 2004;29(6):467–81.

22. Allen ML, Elliott MN, Morales LS, Diamant AL, Hambarsoomian K, Schuster MA. Adolescent participation in preventive health behaviors, physical activity, and nutrition: differences across immigrant generations for Asians and Latinos compared with Whites. Am J Public Health. 2007;97(2):337–43.

23. Shin HB. School enrollment in the United States—social and economic characteristics of students: October 2003. Washington, DC: US Census Bureau. US Department of Commerce, Economics and Statistics Administration. 2005.

24. Saelens BE, Handy SL. Built environment correlates of walking: a review. Med Sci Sports Exerc. 2008;40(7 Suppl):S550–66.

25. Wilson DK, Kirtland KA, Ainsworth BE, Addy CL. Socioeconomic status and perceptions of access and safety for physical activity. Ann Behav Med. 2004;28(1):20–8.

26. Saelens BE, Sallis JF, Black JB, Chen D. Neighborhood-based differences in physical activity: an environment scale evaluation. Am J Public Health. 2003;93(9):1552–8.

27. Saelens BE, Sallis JF, Frank LD, Cain KL, Conway TL, Chapman JE, Slymen DJ, Kerr J. Neighborhood environmental and psychosocial correlates of adults' physical activity. Med Sci Sports Exerc. 2012;44(4):637–46.

28. Ewing R, Schmid T, Killingsworth R, Zlot A, Raudenbush S. Relationship between urban sprawl and physical activity, obesity, and morbidity. Am J Health Promot. 2003;18(1):47–57.

29. Giles-Corti B, Broomhall MH, Knuiman M, et al. Increasing walking: how important is distance to, attractiveness, and size of public open space? Am J Prev Med. 2005;28(2 Suppl 2):169–76.

30. Floyd MF, Bocarro JN, Smith WR, et al. Park-based physical activity among children and adolescents. Am J Prev Med. 2011;41(3):258–65.

31. Lovasi GS, Hutson MA, Guerra M, Neckerman KM. Built environments and obesity in disadvantaged populations. Epidemiol Rev. 2009;31:7–20.

32. Davison KK, Lawson CT. Do attributes in the physical environment influence children's physical activity? A review of the literature. Int J Behav Nutr Phys Act. 2006;3:19.

33. Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. Future Child. 2006;16(1):89–108.

34. Salmon J, Timperio A. Prevalence, trends and environmental influences on child and youth physical activity. Med Sport Sci. 2007;50:183–99.

35. Cohen DA, Ashwood JS, Scott MM, et al. Public parks and physical activity among adolescent girls. Pediatrics. 2006;118(5):e1381–9.

36. Timperio A, Giles-Corti B, Crawford D, Andrianopoulos N, Ball K, Salmon J, Hume C. Features of public open spaces and physical activity among children: findings from the CLAN study. Prev Med. 2008;47(5):514–8.

37. McDonald NC, Brown AL, Marchetti LM, Pedroso MS. U.S. school travel, 2009 an assessment of trends. Am J Prev Med. 2011;41(2):146–51.

38. McDonald NC. Children's mode choice for the school trip: the role of distance and school location in walking to school. Transportation. 2008;35(1):23–35.

39. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and incidence of coronary heart disease. N Engl J Med. 2001;345(2):99–106.

40. Diez-Roux AV, Nieto FJ, Caulfield L, Tyroler HA, Watson RL, Szklo M. Neighbourhood differences in diet: the Atherosclerosis Risk in Communities (ARIC) Study. J Epidemiol Community Health. 1999;53(1):55–63.

41. Yen IH, Kaplan GA. Neighborhood social environment and risk of death: multilevel evidence from the Alameda County Study. Am J Epidemiol. 1999;149(10):898–907.

42. Mujahid MS, Diez Roux AV, Borrell LN, Nieto FJ. Cross-sectional and longitudinal associations of BMI with socioeconomic characteristics. Obes Res. 2005;13(8):1412–21.

43. Diez Roux AV, Evenson KR, McGinn AP, et al. Availability of recreational resources and physical activity in adults. Am J Public Health. 2007;97(3):493–9.

44. Echeverria S, Diez-Roux AV, Shea S, Borrell LN, Jackson S. Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: the Multi-Ethnic Study of Atherosclerosis. Health Place. 2008;14(4):851–63.

45. Fisher KJ, Li F, Michael Y, Cleveland M. Neighborhood-level influences on physical activity among older adults: a multilevel analysis. J Aging Phys Act. 2004;12(1):45–63.

46. Humpel N, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity: a review. Am J Prev Med. 2002;22(3):188–99.

47. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. Annu Rev Public Health. 2006;27:297–322.

48. Estabrooks PA, Lee RE, Gyurcsik NC. Resources for physical activity participation: does availability and accessibility differ by neighborhood socioeconomic status? Ann Behav Med. 2003;25(2):100–4.

49. Babey SH, Hastert TA, Brown ER. Teens living in disadvantaged neighborhoods lack access to parks and get less physical activity. Policy Brief UCLA Cent Health Policy Res. 2007;(PB2007-4):1–6.

50. Floyd MF, Crespo CJ, Sallis JF. Active living research in diverse and disadvantaged communities: stimulating dialogue and policy solutions. Am J Prev Med. 2008;34(4):271–4.

51. Carver A, Timperio A, Crawford D. Perceptions of neighborhood safety and physical activity among youth: the CLAN study. J Phys Act Health. 2008;5(3):430–44.

52. Gomez JE, Johnson BA, Selva M, Sallis JF. Violent crime and outdoor physical activity among inner-city youth. Prev Med. 2004;39(5):876–81.

53. Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of adolescent physical activity and inactivity patterns. Pediatrics. 2000;105(6):E83.

54. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc. 2000;32(5):963–75.

55. Abercrombie LC, Sallis JF, Conway TL, Frank LD, Saelens BE, Chapman JE. Income and racial disparities in access to public parks and private recreation facilities. Am J Prev Med. 2008;34(1):9–15.

56. American Association for Public Opinion Research. Standard definitions: final dispositions of case codes and outcome rates for surveys. 2009. Available at: http://www.aapor.org/Content/NavigationMenu/ResourcesforResearchers/StandardDefinitions/StandardDefinitions2009new.pdf. 2009.

57. Echeverria SE, Diez-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. J Urban Health. 2004;81(4):682–701.

58. Sampson RJ, Raudenbush SW, Earls F. Neighborhoods and violent crime: a multilevel study of collective efficacy. Science. 1997;277(5328):918–24.

59. Environmental Supports for Physical Activity Questionnaire. Prevention Research Center, Norman J. Arnold School of Public Health, University of South Carolina. IP 4-99 Research Group. October 2002.

60. California Health Interview Survey. Building Healthy Communities. Los Angeles, CA: UCLA Center for Health Policy Research and The California Endowment. 2009. Retrieved from http://healthpolicy.ucla.edu/chis/design/Documents/CHIS2009childquestionnaire.pdf.

61. Diez-Roux AV, Kiefe CI, Jacobs DR Jr, et al. Area characteristics and individual-level socioeconomic position indicators in three population-based epidemiologic studies. Ann Epidemiol. 2001;11(6):395–405.

62. Bieler GS, Brown GG, Williams RL, Brogan DJ. Estimating model-adjusted risks, risk differences, and risk ratios from complex survey data. Am J Epidemiol. 2010;171(5):618–23.

63. Broesch J, Hadley C. Putting culture back into acculturation: identifying and overcoming gaps in the definition and measurement of acculturation. Soc Sci J. 2012;49:375–85.

64. Lovasi GS, Neckerman KM, Quinn JW, Weiss CC, Rundle A. Effect of individual or neighborhood disadvantage on the association between neighborhood walkability and body mass index. Am J Public Health. 2009;99(2):279–84.

65. Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: structural racism, intersectionality theory, and immigrant health. Soc Sci Med. 2012;75(12):2099–106.

66. Van Dyck D, Cerin E, Conway TL, et al. Perceived neighborhood environmental attributes associated with adults' transport-related walking and cycling: findings from the USA, Australia and Belgium. Int J Behav Nutr Phys Act. 2012;9:70.