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Walking for Transportation Among Latino Adults in San Diego County: Who Meets Physical Activity Guidelines?

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Abstract

Background—U.S. Latinos engage in non-leisure-time walking (NLTW) more than other ethno-racial groups. Studies are needed to explore factors associated with NLTW to inform interventions for effective physical activity promotion.

Purpose—To examine the social-ecological correlates of NLTW among Mexican-origin Latinos.

Methods—Individual, social, and environmental level factors and PA were assessed in a telephone survey completed by 672 Mexican-origin adults randomly sampled in San Diego County. Data were collected in 2006 and analyzed in 2009.

Results—Participants were mostly female (71%), with an average age of 39 years. Less than one third met PA guidelines for NLTW (29%). Structural equation modeling showed that NLTW was positively associated with being female, but negatively associated with living in the U.S. ≥12 years, and being U.S.-born.

Conclusions—In this sample NLTW differed by various indicators of acculturation and gender. These findings might help inform the development of interventions to promote NLTW and thus physical activity in Mexican-origin adults.

Keywords

physical activity; chronic disease; community-based research; health behavior; special needs populations

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Annually, the U.S. spends over $2.2 trillion on health care.[1, 2] Between 2003 and 2006, eliminating health disparities among Latinos could have reduced health care costs by $82 billion.[3] Health inequities in chronic diseases such as diabetes, cardiovascular disease, and cancer among U.S. Latinos are a public health challenge, attributable in part to health practices that deteriorate with the acculturation process, being an ethnic minority, low socioeconomic status, and living in an impoverished environment. Although regular physical activity (PA) promotes mental and physical well-being, it also reduces the risk of

chronic diseases. To produce health benefits, the *2008 Physical Activity Guidelines for Americans* recommends at least 150 minutes of moderate- or 75 minutes of vigorous-intensity activity per week.[4] Although these guidelines are intended for leisure-time PA (LTPA), there is a growing interest among transportation and health experts to emphasize and translate these PA recommendations to non-leisure time. Walking is the most commonly reported form of non-leisure-time PA (NLTPA includes both walking and bicycling) in adults.[5] A low impact activity such as brisk walking[4] has protective health benefits with little physical impact and is an accessible activity irrespective of income-levels.[6] Walking for transportation is a simple and affordable form of NLTPA that may play an important role in preventing chronic diseases and obesity in adults.[7]

The Latino population, already the nation's largest ethnic minority group, is projected to nearly triple by 2050.[8] Among all ethno-racial groups, Latinos are the least physically active during leisure time,[9, 10] which may contribute to their disproportionate prevalence of diabetes and obesity.[11, 12] Most PA research focuses on leisure-time activity and very little on PA patterns (e.g., incidental, transportation, household and occupational activities) within ethno-racial groups.[13–15] Little is known about the correlates of walking for transportation, in particular among Latinos. Understanding the various domains of PA in Latinos is important for several reasons. First, socioeconomic status and occupation may explain differences in PA.[16] Second, cultural factors such as acculturation may play a different role in PA with respect to leisure time and non-leisure time.[17, 18] For example, national data indicates that Latinos are less physically active in their leisure-time,[19] and California data show that they are more likely to walk for transportation compared with non-Latino whites (12% and 24%, respectively). [20] NLTPA has been shown to be more frequent in less acculturated Latinos (20%) compared with their more acculturated counterparts (13%).[20–23] It is not yet known, however, whether less acculturated Latinos have the potential to use their NLTW to attain PA recommendations and its health benefits. Finally, Latino females appear to engage in less LTPA than do Latino men so examining the extent to which they also engage in more or less NLTW may yield insights about this relationship.[17]

Social ecological frameworks can provide insight into the individual-, social- and environmental-level factors associated with NLTW. For example, one model included demographic characteristics (i.e., age, income, car ownership), safety (i.e., crime, traffic, animals), land use mixture, presence of trails and sidewalks and neighborhood aesthetics. [24] Other reviews and recent studies have consistently documented positive relationships between walking for transportation and these and other environmental factors such as land use mix, density, distance to nonresidential destinations, street connectivity, parks and open space. [24–26] For example, the 2003 California Health Interview Survey (CHIS) showed a positive association between neighborhood cohesion and access to a park with meeting recommended levels of PA during leisure and non-leisure walking among Latinos.[23] But these findings are both dated and preliminary so additional research is needed if interventions are to be developed to promote NLTW among Latino individuals who may have little leisure time to be active and few resources to access other activity-promoting resources.

The aim of the current study was to explore relationships between NLTW and individual- (i.e., demographic characteristics, self-efficacy), social- (i.e., acculturation, neighborhood cohesion), and environmental-level (i.e., neighborhood safety) factors among Latino adults of Mexican-origin in San Diego County. We hypothesized that NLTW would differ by gender and level of acculturation. Specifically, female and less acculturated individuals would be more likely to meet recommended levels of PA. The variables used in the proposed model were based on a social ecological framework and previous research.[27–29]

METHODS

Study Design

In 2009, we analyzed cross-sectional data from the CDC-funded research core project of the San Diego Prevention Research Center (SDPRC). Structural equation modeling was used to investigate the relationships between NLTW and individual, social and environmental factors.

Data Source

The SDPRC was funded by the Centers for Disease Control and Prevention to promote PA and physical well-being among Latinos in South San Diego County. To address gaps in the literature, the SDPRC conducted a survey to estimate levels of PA in the fall of 2006. Random-digit dialing was used to select Mexican-origin (i.e., Mexican immigrants/ Mexican-American) participants of a U.S.-Mexico border community of San Diego. The survey was structured telephone-based interviewer-administered. Using this method, 38% of those called responded and 62% of those who responded completed the survey. A total of 672 adults, between the age of 18 and 65 years, successfully completed the telephone survey in English or Spanish. The study was approved by the Institutional Review Boards of San Diego State University and the University of California, San Diego.

Measures

The survey's performance was enhanced for the target population by using culturally appropriate methods (e.g., backward translation, review for cultural congruence and sensitivity, and pilot-testing). [30] Participants reported on demographic characteristics, self-efficacy, social support for PA, acculturation, neighborhood cohesion, neighborhood safety, neighborhood aesthetics, and community PA resource awareness. All domains of PA (leisure and non-leisure-time) were assessed; however, only active transportation was examined in this study.

Dependent Variable—The International Physical Activity Questionnaire (IPAQ) was used as a comprehensive assessment of PA behavior.[31] For the purpose of this study we evaluated walking for transportation. This was possible because the IPAQ distinguishes between domains of PA (e.g., chores, gardening, and leisure-time). The IPAQ has been tested for test-retest reliability (.80) and criterion validity (.30) against accelerometer data. Participants were asked, "During the last 7 days, on how many days did you walk to do errands or to go from place to place…for at least 10 minutes at a time?" This item was followed up by asking how much time was usually spent walking on one of those days. The data for the variable were skewed and could not be transformed to meet statistical assumptions. To examine the data with greater public health relevance, participants were categorized as adherent or non-adherent to PA recommendations if they engaged in at least 150 minutes of walking for transportation.

Individual-level Factors

Demographic characteristics—Demographics variables included gender (female/male), age, marital status (single/married or living with a partner), employment status (unemployed/ employed), education (≤high school or equivalent/some college or more), and monthly household income (≤$1500/≥$1501).

Self-efficacy for Physical Activity—Three items from the scale of self-efficacy developed by Sallis and colleagues were used to assess confidence about being physically active in different situations (e.g., be active when stressed out).[32] Participants were asked to

respond to three items on a 5-point Likert scale, with responses ranging from "I'm sure I cannot (1)" to "I'm sure I can (5)." A higher score indicated greater self-efficacy to engage in PA. The reliability for the three items was 0.68. In confirmatory factor analysis (CFA), the three items loaded on a single factor (factor loadings between .65 and .88).

Social-level Factors

Acculturation Proxies—The following items were used in the current study to examine acculturation: country of birth (Mexico/U.S.), and years living in the U.S. (<12 years /≥12 years), and the eight-item Short Acculturation Scale for Hispanics (SASH).[18, 22, 33, 34] The SASH scale was tested for reliability (0.92) and criterion validity (.52-.76), and deemed appropriate for use in Mexican-Americans.[35] Respondents reported what language they spoke or used for reading, speaking, watching television and listening to radio. Response options ranged from "only Spanish (1)" to "only English (5)," with a higher score indicating a greater degree of English language use. In the present study, the CFA showed that six of the eight items loaded on one construct (factor loading between .75 and .92). Two items pertaining to ethnic background of friends and visitors did not load on the construct, and were not included in the final construct.

Neighborhood Cohesion—Six items were used to assess degree of neighboring, and sense of community.[36] Response options ranged from "very true (1)" to "not at all true (3)." Several items were recoded, with a higher score on all items indicating greater neighborhood cohesion. The scale was available in Spanish, and the items were tested for reliability (α = 0.71). CFA showed that the construct was best described by four items (factor loadings between .49 to .71). Items on neighborhood disorder (e.g. drugs and theft) did not load on the construct.

Neighborhood Crime Safety—Safety from crime at the neighborhood level was measured using four items from the Neighborhood Environment Walkability Scale (NEWS) developed by Saelens and colleagues.[37] Participants were asked to respond on a Likert scale, with responses ranging from "strongly disagree (1)" to "strongly agree (4)." Several items were recoded so that a higher score on all items indicated a more favorable atmosphere (α = 0.83). CFA showed that four items loaded on one construct measuring "safety from crime" (factor loadings between .30 and .67). This construct was correlated with perceived physical safety (ρ =.52), which was assessed by four of the five remaining items (described below). The remaining fifth item did not load on any construct of safety.

Environmental-level Factors

Neighborhood Physical Safety—Four items from NEWS were used to assess perceptions of pedestrian and traffic safety in the neighborhood (e.g., street lighting, crosswalks, traffic speed, and unattended dogs). Response options were based on a Likert scale and ranged from "strongly disagree (1)" to "strongly agree (4)," with a higher score indicating a more favorable atmosphere (α = 0.77). The construct was best described by four items in CFA (factor loadings between .41 and .61).

Community Resource Use—Several scales were developed to assess perceptions of PA supports in the physical environment. [38] Scale items were tested for reliability and validity (κ= −0.07 to 0.25 and ρ= 0.28 to 0.56).[39] The items were modified for the target community, and asked participants to report on how many times they visited 20 different parks and recreational facilities in their community during the past month. CFA identified that reported items on park visitation and use loaded on one construct (factor loadings between .25 and . 71).

Neighborhood Aesthetics—One item, also from the Community Resource Scale, was used to assess neighborhood aesthetics.[38] Participants were asked to "strongly disagree (1)" or "strongly agree (4)" on whether there were many interesting things to look at in their neighborhood. A higher rating indicated more appealing scenery while walking in the neighborhood.

Statistical Analysis

Preliminary analyses included obtaining descriptive data for all variables. Independent *t*-tests were used to compare means of health-related parameters between gender and years living in the U.S. Chi-square tests were performed to examine differences between those who adhered to PA recommendations for NLTW versus those who did not. These analyses were computed using the Statistical Package for the Social Sciences Version 15 (Chicago, Il).

Measurement models were evaluated to confirm the factor structure of the latent constructs included in the conceptual model (1ure 2), with factor loadings significant at p≤ .05. The model was restructured (Figure 3) to account for correlated structures.

To test the developed model, structural equation modeling was performed using Mplus software (Muthen & Muthen, Los Angeles, CA). Measurement models were evaluated using CFA prior to modeling any relationships. Model fit indices included Chi-square (p>.05), comparative fit index (CFI ≥90), root mean square error of approximation (RMSEA approximating .06), and standardized root mean square residual (SRMR ≤ .08).[40–42] The parameter estimates, standard errors, z-statistics, and squared multiple correlations were inspected for sign and/or magnitude.

Due to missing information and cases of over-reported PA, the sample size was reduced from 672 to 668 participants. These outliers were determined by the IPAQ standard, which is to exclude cases in which the sum total of all walking, moderate and vigorous time variables exceeds 960 minutes (16 hours). This criterion is based on the assumption that, on average, an individual spends 8 hours per day sleeping. Lastly, missing data was accounted for using full-information maximum likelihood.[43, 44]

RESULTS

Participant Characteristics

Study sample characteristics and health-related parameter estimates are summarized in Tables 1 and 2. Participants were either Mexican Immigrants or Mexican-American adults. Most participants were female, with a mean age of 39 years. Less than half of respondents were employed with more than a high school education. Although most participants were classified as less acculturated, the average number of years living in the U.S. was 19.

Less than a third of respondents (29%) adhered to the *2008 Physical Activity Guidelines for Americans* based on NLTW (Table 2), just higher than the national prevalence reported for Latinos (24%).[21] No meaningful difference was seen between women and men for percent adherence to recommended levels of PA (31% and 26%, respectively), (see Table 2). A significantly greater proportion of participants living in the U.S. for <12 years reported NLTW at recommended levels compared to those who had lived in the U.S. for ≥12 years (40% and 24%, respectively). A greater percentage of women living in the U.S. for < 12 years (42%) adhered to guidelines more so than women living in the U.S. for ≥ 12 years (32%); this finding was statistically significant (see Figure 2). No differences were observed in male participants.

Structural Equation Modeling

Non-leisure-time walking at recommended levels—The exploratory model of NLTW at recommended levels (Figure 3) investigated relationships with individual, social and environmental constructs (X^2 = 391.42 [df= 334, p<.05], CFI =0.97, RMSEA=0.03 [95%CI=.01, .04], SRMR= 0.05). A significant and positive relationship was observed between being female and NLTW. Other individual-level factors (monthly household income and self-efficacy) were not significantly related to NLTW at recommended levels.

All proxies of acculturation were negatively associated with NLTW at recommended levels. No associations were found between other social and environmental factors assessed in the survey. Education did not contribute to the final model.

DISCUSSION

NLTW was prevalent among Mexican immigrant/Mexican-American adults. An estimated 29% of participants engaged in NLTW at recommended levels. These findings support 2001 CHIS data showing that 24% of Latinos engaged in NLTPA at recommended levels.[20] More recent data showed that 23% of Latinos adhered to PA guidelines when walking for transportation or leisure.[23]

NLTW was positively associated with being female for which we provide several culturally-related explanations. Studies suggest that Latino women hold many family and household responsibilities[45] and compared with White women, Latino women are twice as likely to report being a homemaker.[10] Thus, women participants may have used active transportation for the purpose of meeting daily life demands such as grocery shopping, paying bills and/or walking children to school.[22]

NLTW was negatively related to all proxies of acculturation. Participants who were more acculturated, as measured by U.S.-born, living in the U.S. ≥ 12 years, and having a high acculturation score, were less likely to engage in NLTW at recommended levels compared with their less acculturated counterparts. Similarly, Berrigan et al. found a greater prevalence of NLTPA among less acculturated Latinos when using a similar acculturation scale.[21] Our findings suggest that walking for transportation is common in immigrant communities where Mexican culture is strongly retained. The acculturation process may, in part, explain the exchange of one transportation behavior for another (i.e., vehicle use).[22] Furthermore, this behavioral transition may occur slowly in border communities, whereas it may occur rapidly in communities where American culture is dominant.

Study findings are mixed with respect to the relationship between self-efficacy and both leisure-and non-leisure-time walking.[46–48] Findings from our study do not suggest an association between self-efficacy and NLTW. Self-efficacy items focused on LTPA rather than NLTPA,[32] which may explain the lack of association. Also, high and low income earners, and employed and unemployed individuals were not different in NLTW.

Although safety-related attributes have been correlated with walking,[49, 50] our findings did not support direct pathways between constructs of neighborhood cohesion, crime safety, physical safety, and NLTW. Nevertheless, Wen et al. found perceived safety was not an important correlate in the presence of social cohesion and access to open space among Latinos.[23] Humpel et al. has attributed the lack of association between perceived neighborhood safety and PA to individuals being physically active in areas other than their neighborhood,[51] which may partially explain our results. Perhaps participants did not live in a walkable (destinations within walking distance) community; therefore, both social and environmental neighborhood factors did not play a significant role in NLTW. Another

possibility is that our social and environmental scales, which were developed for the mainstream population, did not successfully capture the social and physical characteristics we were looking to assess.

Lastly, the variables in this model accounted for 28% of the explained variance in the PA outcome. Another study, conducted in the Puget Sound area of Washington, reported that sociodemographic factors (i.e., employment and age) and neighborhood characteristics explained up to 35% of the variance in walking for transportation. [24] To our knowledge, the accounted variance observed in this study is the highest in explaining NLTW in any subgroup of the U.S. Latino adult population.

Study Strengths and Limitations

This study contributes to the small amount of PA literature in Latinos as one of the first to report on multi-level correlates of NLTW in Mexican-origin adults. The developed model was theoretically and empirically justified and was tested using structural equation modeling to simultaneously examine potential correlates of NLTW. Using several proxies of acculturation provided more insight about the relationship between acculturation and NLTW among participants of Mexican descent. Data were obtained using an internationally validated assessment of PA, which allowed us to estimate NLTW. Last, study participants were recruited using random digit dial methodology as opposed to a convenience sample.

As in all studies, there are potential limitations to acknowledge. The use of a telephone-administered community survey may have resulted in an underrepresentation of individuals without a home phone and cell phone-only users. Escobedo and colleagues, however, found that telephone surveys were generalizable for the purpose of research in U.S. Latinos in border communities.[52] We used self-report methods to assess PA, which is subject to recall bias. When comparing PA measured by self-report to accelerometry, Latinos tended to underestimate light intensity and unstructured PA when using self-report methods.[53–55] Both measures, however, provided similar qualitative trends (e.g., men being more active than women) with respect to age and gender.[54] Because Latinos may operationalize PA differently compared with researchers,[30] we used the IPAQ to minimize the underestimation of PA. The IPAQ assessed domains of PA (e.g., occupational, household, transportation and recreational activities); therefore, it may be easier to recall different types of activity. We also used scales, developed for the general population, to assess psychosocial and socio-environmental factors often associated with LTPA. This may have limited our ability to capture the information we sought to assess and may partially explain the lack of associations. Also, causality cannot be inferred given the nature of cross-sectional data. This was an exploratory model, which makes it one of many plausible models of NLTW. We did not assess car ownership, which may in part explain our results for NLTW. Half of our participants were from the city of Chula Vista where 42% of households reported ownership of one vehicle or less.[56] Households may have had either no car, one car or otherwise limited access to transportation by personal vehicle. Women in households with one car may walk more for transportation if the car is used by their husbands to commute to work. Lastly, study participants were of Mexican-origin and were from a U.S.-Mexico border community. The U.S. Latino population is diverse, with individuals coming from 19 different countries.[57] Currently, U.S. Latinos are comprised of 64% Mexican, 9% Puerto Rican, 4% Cuban, and 23% Central/South American or all other Latino/Hispanic.[58] Thus, research findings should be interpreted and generalized with caution.

Conclusion

Nearly one-third of participants adhered to PA guidelines during NLTW. NLTW was positively related to being female and negatively associated with being more acculturated in

Mexican-origin adults. This highlights the importance of measuring other PA domains to increase the validity PA assessments in both national and community-based studies.

The relationship between broader social and environmental factors remains unclear. The need for measures to assess factors related to NLTPA is warranted. Sallis and colleagues have stated that behavior-specific items should be developed to address and assess attributes specific to a particular behavior in a particular context or setting.[59] Measures should emphasize attitudes, neighborhood walkability, mixed land use, number of vehicles per household and perceived safety in the context of transportation PA. Understanding how to facilitate and maintain NLTPA is necessary to obtain health benefits associated with PA.

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References

1. Smith CS, Truffer C, et al. Health spending projections through 2015: Changes on the horizon. Health Aff. 2006; 25(2):w61–73.
2. Poisal JA, Truffer C, Smith S, et al. The national health expenditure accounts projections Team: Health spending projections through 2016: Modest changes obscure Part D's impact. Health Aff. 2007; 26(2):w242–253.
3. LaVeist, JA.; Gaskin, DJ.; Richard, P. The economic burden of health inequalities in the United States. Washington, DC: Joint Center for Political and Economic Studies; 2009.
4. U.S. Department of Health and Human Services. [Accessed October 23, 2008] Physical Activity Guidelines for Americans. 2008. [cited ODPHP Publication No. U0036; 61]. Available at http://www.health.gov/paguidelines/pdf/paguide.pdf
5. U.S. Department of Health and Human Services. Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
6. Schoenborn, C. Vital Health Stat. Washington, DC: U.S. Government Printing Office; 1988. Health promotion and disease prevention: United States, 1985. Series 10
7. Wagner A, Simon C, Ducimetiere P, et al. Leisure-time physical activity and regular walking or cycling to work are associated with adiposity and 5y weight gain in middle-aged men: The PRIME Study. Int J Obes. 2001; 25(7):940–948.
8. U.S. Census Bureau. [Accessed April 14, 2009] An older and more diverse nation by midcentury. Available at http://www.census.gov/Press-Release/www/releases/archives/population/012496.html
9. Macera C, Ham S, Yore M, Jones D, Ainsworth B, Kimsey C. Prevalence of physical activity in the United States: Behavioral Risk Factor Surveillance System, 2001. Prev Chronic Dis [serial online]. 2005; 2(2)
10. 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. [PubMed: 10808982]
11. Pate RR, Pratt M, Blair S, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA. 1995; 273(5):402–407. [PubMed: 7823386]
12. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002; 346(6):393–403. [PubMed: 11832527]

13. Centers for Disease Control and Prevention. Prevalence of regular physical activity among adults --- United States, 2001 and 2005. MMWR Morb Mortal Wkly Rep. 2007; 56(46):1209–1212. [PubMed: 18030281]
14. Marquez DX, McAuley E, Overman N. Psychosocial correlates and outcomes of physical activity among latinos: A review. Hisp J Behav Sci. 2004; 26(2):195–229.
15. Trost S, Owen N, Bauman A, Sallis J, Brown W. Correlates of adults' participation in physical activity: Review and update. Med Sci Sports Exerc. 2002; 34(12):1996–2001. [PubMed: 12471307]
16. Ham S, Yore M, Kruger J, Heath G, Moeti R. Physical activity patterns among Latinos in the United States: putting the pieces together. Prev Chronic Dis. 2007; 4(4)
17. Marquez DX, McAuley E. Gender and acculturation influences on physical activity in Latino Adults. Annals Behav Med. 2006; 31(2):138.
18. 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):1254–1257. [PubMed: 11499114]
19. Neighbors CJ, Marquez DX, Marcus BH. Leisure-time physical activity disparities among Hispanic subgroups in the United States. Am J Public Health. 2008; 98(8):1460–1464. [PubMed: 18048795]
20. Berrigan D, Troiano RP, McNeel T, DiSogra C, Ballard-Barbash R. Active transportation increases adherence to activity recommendations. Am J Prev Med. 2006; 31(3):210–216. [PubMed: 16905031]
21. 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. [PubMed: 16898271]
22. Martinez S, Ayala G, Arredondo E, Finch B, Elder J. Active transportation and acculturation among Latino children in San Diego County. Prev Med. 2008; 47(3):313–318. [PubMed: 18353433]
23. Wen M, Kandula NR, Lauderdale DS. Walking for transportation or leisure: What difference does the neighborhood make? J Gen Intern Med. 2007; 22(12):1674–1680. [PubMed: 17932724]
24. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Annals Behav Med. 2003; 25(2):80–91.
25. Saelens BE, Handy SL. Built environment correlates of walking: A review. Med Sci Sports Exerc. 2008; 40(7):S550–S566. [PubMed: 18562973]
26. Rutt CD, Coleman KJ. Examining the relationships among built environment, physical activity, and body mass index in El Paso, TX. Prev Med. 2005; 40(6):831–841. [PubMed: 15850885]
27. McNeill LH, Kreuter MW, Subramanian SV. Social environment and physical activity: A review of concepts and evidence. Soc Sci Med. 2006; 63(4):1011–1022. [PubMed: 16650513]
28. McNeill LH, Wyrwich KW, Brownson RC, Clark EM, Kreuter MW. Individual, social environmental, and physical environmental influences on physical activity among Black and White adults: A structural equation analysis. Annals Behav Med. 2006; 31(1):36–44.
29. Sallis, J.; Owen, N. Ecological models of health behavior. In: Glanz, K.; Rimer, B.; Lewis, F., editors. Health Behavior and Health Education: Theory, Research, and Practice. 3. San Francisco, CA: Jossey-Bass; 2002. p. 462-484.
30. Martinez SM, Ainsworth BE, Elder JP. A review of physical activity measures used among US Latinos: Guidelines for developing culturally appropriate measures. Annals Behav Med. 2008; 36(2):195–207.
31. Craig C, Marshall A, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003; 35(8):1381–1395. [PubMed: 12900694]
32. Sallis J, Pinski R, Grossman R, Patterson T, Nader P. The development of self-efficacy scales for health-related diet and exercise behaviors. Health Educ Res. 1988; 3:283–292.
33. Norman S, Castro C, Albright C, King A. Comparing acculturation models in evaluating dietary habits among low-income Hispanic women. Ethn Dis. 2004; 14(3):399–404. [PubMed: 15328942]
34. Kirtland KA, Porter DE, Addy CL, et al. Environmental measures of physical activity supports - Perception versus reality. Am J Prev Med. 2003; 24(4):323–331. [PubMed: 12726870]

35. Marin G, Sabogal F, Marin B, Otero-Sabogal R, Perez-Stable E. Development of a short acculturation scale for Hispanics. Hisp J Behav Sci. 1987; 9:183–205.
36. Seidman E, Allen L, Aber JL, et al. Development and validation of adolescent-perceived microsystem scales: Social support, daily hassles, and involvement. Am J Community Psychol. 1995; 23 (3):355–388. [PubMed: 7572836]
37. Saelans B, Sallis J, Black J, Chen D. Neighborhood-based differences in physical activity: An environment scale evaluation. Am J Public Health. 2003; 93(9):1552–1558. [PubMed: 12948979]
38. Ainsworth BE, Wilcox S, Thompson WW, Richter DL, Henderson KA. Personal, social, and physical environmental correlates of physical activity in African-American women in South Carolina. Am J Prev Med. 2003; 25(3):23–29. [PubMed: 14499806]
39. Hu, L.; Bentler, P. Evaluating model fit. In: Hoyle, R., editor. Structural Equation Modeling: Concepts, Issues, and Applications. Thousand Oaks, CA: Sage; 1995. p. 76-99.
40. Hu L, Bentler PM. Fit indices in covariance structure modeling: Sensitivity to underparameterization model misspecification. Psychol Meth. 1998; 3:424–453.
41. Hu L, Bentler PM. Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Modeling. 1999; 6:1–55.
42. Enders CK, Bandalos DL. The relative performance of full Information maximum likelihood estimation for missing data in structural equation models. Struct Equ Modeling. 2001; 8(3):430–457.
43. Carlson SA, Fulton JE, Galuska DA, Kruger J, Lobelo F, Loustalot FV. Prevalence of self-reported physically active adults-United States, 2007 (Reprinted from MMWR, vol 57, 1297–1300, 2008). JAMA. 2009; 301(9):926–927.
44. Pichon LC, Arredondo EM, Roesch S, Sallis JF, Ayala GX, Elder JP. The relation of acculturation to Latinas' perceived neighborhood safety and physical activity: A structural equation analysis. Annals Behav Med. 2007; 34(3):295–303.
45. Easter MM, Linnan LA, Bentley ME, DeVellis BM, Meier A, Frasier PY, et al. "Una mujer trabaja doble aqui": Vignette-based focus groups on stress and work for Latina blue-collar women in Eastern North Carolina. Health Promot Pract. 2007; 8(1):41–49. [PubMed: 16885510]
46. Ball K, Timpiero A, Salmon J, Giles-Corti B, Roberts R, Crawford D. Personal, social, and environmental determinants of educational inequalities in walking: A multilevel study. J Epidemiol Community Health. 2007; 61:108–114. [PubMed: 17234868]
47. Sallis JF, Haskell WL, Fortmann SP, Vranizan KM, Taylor CB, Solomon DS. Predictors of adoption and maintenance of physical activity in a community sample. Prev Med. 1986; 15(4): 331–341. [PubMed: 3763558]
48. Hovell MF, Sallis JF, Hoestetter CR, Spry VM, Faucher P, Caspersen CJ. Identifying correlates of walking for exercise - An epidemiologic prerequisite for physical activity promotion. Prev Med. 1989; 18(6):856–866. [PubMed: 2626418]
49. McCormack G, Giles-Corti B, Lange A, Smith T, Martin K, Pikora TJ. An update of recent evidence of the relationship between objective and self-report measures of the physical environment and physical activity behaviours. J Sci Med Sport. 2004; 7(S1):81–92. [PubMed: 15214606]
50. Heath GW, Brownson RC, Kruger J, et al. Effectiveness of urban design and land use and transport policies and practices to increase physical activity: A systematic review. J Phys Activity Health. 2006; 3(S1):55–76.
51. Humpel N, Owen N, Iverson D, Leslie E, Bauman A. Perceived environment attributes, residential location, and walking for particular purposes. Am J Prev Med. 2004; 26(2):119. [PubMed: 14751322]
52. Escobedo LG, Landen MG, Axtell CD, Kaigh WD. Usefulness of telephone risk factor surveys in the New Mexico border region. Am J Prev Med. 2002; 23(1):22–27. [PubMed: 12093419]
53. Hawkins MS, Storti KL, Richardson CR, King WC, Strath SJ, Holleman RG, Kriska AM. Objectively measured physical activity of USA adults by sex, age, and racial/ethnic groups: a cross-sectional study. Int J Behav Nutr Phys Act. 2009; 6:31. [PubMed: 19493347]

54. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc. 2008; 40(1):181–8. [PubMed: 18091006]

55. Carlson SA, Densmore D, Fulton JE, Yore MM, Kohl HW 3rd. Differences in physical activity prevalence and trends from 3 U.S. surveillance systems: NHIS, NHANES, and BRFSS. J Phys Act Health. 2009; 6 (Suppl 1):S18–27. [PubMed: 19998846]

56. U.S. Census Bureau. [Accessed March 8, 2010] Income, poverty status, educational attainment, and more for the region's 18 cities. Census Designated Places, San Diego County, CA, and the United States. Available at http://www.sandag.org/resources/demographics_and_other_data/demographics/census/data.asp

57. Marin, G.; Marin, B. Research with Hispanic Populations. Newbury Park, CA: Sage Publications; 1991.

58. Pew Hispanic Center. Statistical Portrait of Hispanics in the United States, 2007. Washington, DC: Pew Hispanic Center; 2009. Available at http://pewhispanic.org/factsheets/factsheet.php?FactsheetID=46 [Accessed December 1, 2009]

59. Sallis JF, Johnson MF, Calfas KJ, Caparosa S, Nichols JF. Assessing perceived physical environmental variables that may influence physical activity. Res Q Exerc Sport. 1997; 68(4):345–351. [PubMed: 9421846]

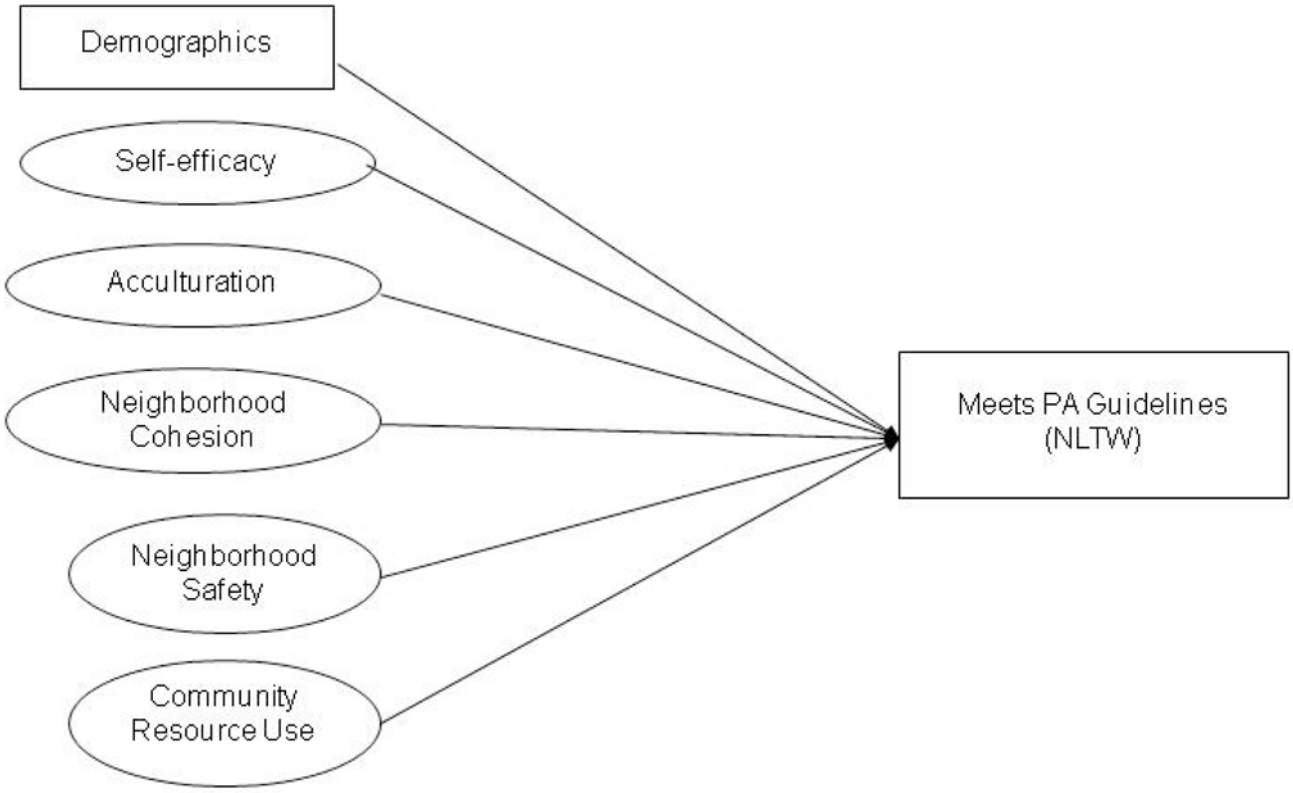

Figure 1.
Original model of pathways between individual, social and environmental-level factors, and meeting recommended levels of NLTW. Latent constructs are shown as ovals, observed variables as rectangles.

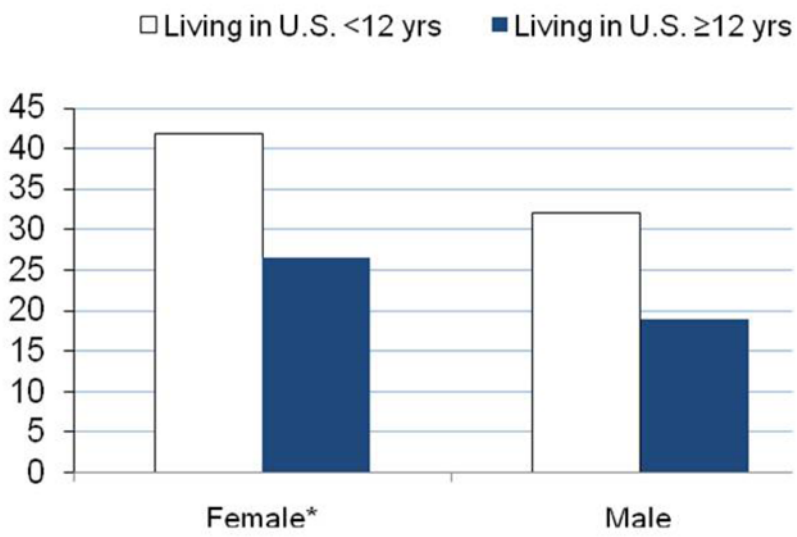

Figure 2.
Differences in meeting recommended levels of NLTW by gender and years living in the U.S. *Significant differences within female group at $p<0.05$.

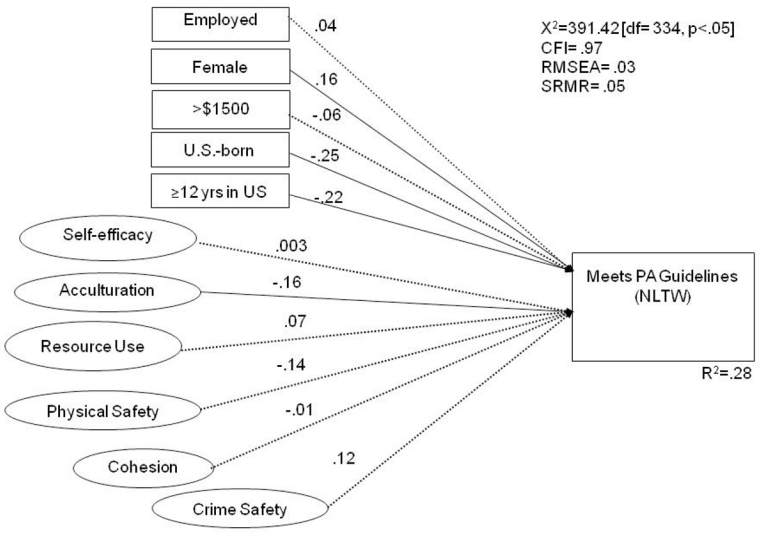

Figure 3.

Final model of pathways between individual, social and environmental level factors, and meeting recommended levels of NLTW. All solid pathways are significant ($p<0.05$). CFI= comparative fit index, RMSEA= root mean square error of approximation, SRMR= standardized root mean square residual.

TABLE 1

Demographic characteristics of Mexican-origin adults in San Diego County (N=668)

	All Participants
Mean age (SD)	39.3 (13)
% Women	71.0
% Prefer Spanish	58.2
% Single	41.9
% More than a high school education	39.2
% Employed	46.1
% Monthly income > $1500	61.4
% U.S.-born	30.4
Mean years living in the U.S. (SD)	19 (12)
Acculturation Score[A] (SD)	2.2 (0.9)

[A] Acculturation scores ranged from 1 to 5, with a higher score indicating a greater degree of English language use.

TABLE 2

Prevalence of Non-Leisure-Time Walking Differences and Health Parameter Estimates of Mexican-origin adults in San Diego County

Parameters	Male	Female	<12 yrs in U.S.	≥12 yrs in U.S.	Total
					N=668
% Meets recommended levels of NLTW	26.8	31.4*	40.0	24.2*	29.3
Mean self-efficacy for PA (range= 1–5, SD)	4.0 (.9)	3.9 (1.0)*	4.1 (.9)	3.9 (1.0)	4.0 (1.0)
Mean neighborhood safety (range =1–4, SD)					
Safety from crime	3.1 (.7)	3.0 (.7)	3.1 (.7)	3.1 (.7)	3.1 (.7)
Physical	2.8 (.8)	2.8 (.7)	2.8 (.8)	2.8 (.8)	2.8 (.8)
Mean neighborhood cohesion (range= 1–3, SD)	1.5 (.5)	1.6 (.5)*	1.6 (.5)	1.5 (.5)	1.6 (.5)
Mean neighborhood aesthetics (range =1–4, SD)	2.6 (1.1)	2.5 (1.1)	2.6 (1.0)	2.6 (1.1)	2.5 (1.1)
Monthly community resource use (mean, SD)	4.8 (4.0)	4.8 (3.9)	4.8 (3.9)	4.9 (4.1)	4.8 (3.9)

Note. higher score indicates greater self-efficacy for PA, neighborhood safety, neighborhood cohesion, neighborhood aesthetics, and community resource use, respectively.

*Chi-square and *t*-test analyses significant at p≤ .05