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Individual, Social and Environmental Correlates of Physical Activity among Latinos in San Diego County

A dissertation submitted in partial satisfaction of the requirements
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in
Public Health (Health Behavior)
by
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2009

The Dissertation of Suzanna Marie Martinez is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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DEDICATION

I dedicate this dissertation to my grandparents who taught me to take a chance and to always have hope; to my father who taught me to always do better; to my mother for teaching me to keep the faith; and to my daughter, Sidney, for keeping me grounded.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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ABSTRACT OF THE DISSERTATION

Individual, Social and Environmental Correlates

of Physical Activity among Latinos in San Diego County

by

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Physical inactivity is a behavioral risk factor for obesity and chronic disease. While some studies have reported low levels of leisure time physical activity (PA) among Latinos, other studies support that some Latinos engage in other active behaviors such as walking for transportation. This study used the Social Ecological Model to provide a broader perspective of the multiple influences on PA patterns among Latinos adults. Structural equation modeling was used to explain how individual, social and environmental level factors influenced leisure and nonleisure time PA in a Latino border population of San Diego County.

In the fall of 2006, the San Diego Prevention Research Center conducted a telephone-administered survey assessing demographics, social-ecological factors, and PA. The survey was completed by 672 Latino adults randomly sampled from a community in San Diego County. The mean age of respondents was 39±13 years with the majority being female (71%). Over half of respondents were unemployed (53%), Spanish-speakers (57%) and classified as less acculturated. Less than one third of respondents met PA guidelines in their leisure (32%) and nonleisure (29%) time. Men were more likely to meet LTPA recommendations, whereas women were more likely to engage in nonleisure walking at recommended levels. Latino respondents living in the U.S. for less than 12 years were more likely to meet PA guidelines in their leisure and nonleisure time. In an individual-level model, social support and self-efficacy for PA and acculturation were not related to meeting LTPA guidelines, where as there was a direct relationship with consuming more fruits and vegetables. While increasing level of education and being single were also positively related to meeting LTPA guidelines, there was negative association with living in the U.S. for 12/more years and being female. After controlling for these relationships in a social ecological model, results showed that neighborhood cohesion was significantly associated with safety from crime, which was marginally associated with meeting LTPA guidelines. Structural/pedestrian safety was marginally associated meeting LTPA guidelines, but in the negative direction. Meeting LTPA guidelines was positively related to community resource use and being single, but was negatively associated with living in the U.S. for 12/more years and being female. A social ecological model was examined for nonleisure walking at recommended levels. Findings showed that being female was positively related to PA adherence in

nonleisure time. Factors negatively related to nonleisure walking at recommended levels were increasing income and acculturation, living in the U.S. for 12/more years, and being Mexican-born. The key findings highlight 1) gender and acculturation differences in leisure and nonleisure time PA, and 2) correlates of leisure and nonleisure time PA among Latino adults. This study provides a better understanding of PA, and can be used to inform future research targeting multi-level factors to promote active living in Latino communities.

I. INTRODUCTION

Despite the well-known benefits of physical activity (PA),[1] national studies show that Latinos are the highest among all ethno racial groups in leisure time inactivity.[2, 3] To inform programs that promote PA in the general population, a vast majority of studies have examined correlates that are important for leisure time physical activity (LTPA). Of these studies, many have reported that psychosocial factors, such as self-efficacy and perceived barriers, are important correlates of PA in the general population (predominantly White), and therefore, among Latinos as well.[4-7] Emerging research has shown that social and environmental attributes are correlates of PA in the general population. Given the diversity of the U.S. population, established findings are not generalizable to all ethno racial groups because of subcultural differences. The U.S. Latino population is rapidly growing, yet studies of Latinos make up a small portion of the existing PA research. Research including Latinos has mainly focused on individual level correlates of PA, but these factors explain little variance in PA outcomes. Little attention on the social, cultural and environmental attributes warrants the need for a progressive and comprehensive perspective of PA in Latinos. The social-ecological model emphasizes that PA behavior has multiple levels of influence, in particular culture. Thus, there are several reasons that merit this approach: First, studies that account for cultural differences are needed to validate past research findings that have been generalized to Latinos. Second, studies based on a culturally appropriate model will shed light on future PA research for the development of effective PA programs among Latinos, especially with limited funding.

To inform and increase the effectiveness of PA programs focusing on Latino health, this study proposes to examine correlates of PA in a Latino community in San Diego County. In addition, the study will use an innovative statistical approach that will allow simultaneous examination of individual, social and environmental contexts of PA. The first goal of the current study was to develop a model examining individual correlates of PA. The second goal was to examine a wider range of social and environmental correlates of PA. The following aims were proposed:

Specific Aims

Aim 1: To assess the importance of self-efficacy and social support for PA (e.g., LTPA) while examining the effects of acculturation among Latino adults in San Diego County.

Aim 2: To test a theoretically and empirically based multi-level model of PA by examining theorized direct and indirect effects of individual (i.e., self-efficacy and social support), social (i.e., neighborhood safety and neighborhood cohesion) and environmental (i.e., physical features) on the PA (e.g., LTPA and nonleisure walking) of Latino adults living in San Diego County.

Aim 3: To explore which models explain more variance, and to identify which factors have a larger influence on LTPA and nonleisure walking.

II. BACKGROUND AND SIGNIFICANCE

OVERVIEW OF CHRONIC DISEASE DISPARITIES

In developed countries, nutrition has been the main focus of the majority of health promotion studies targeting obesity and chronic disease prevention.[8] For populations living in industrialized societies, advanced technology and globalization have increased food availability making it possible for individuals to afford and consume more calories than needed. In addition, technological advancement has changed what were once active lifestyles to a less labor-intensive way of life (e.g., occupational activity and active transportation). As a result, individuals consume more calories on a daily basis, and engage in little or no moderate to vigorous-intensity PA. It is this energy imbalance that may be contributing to the epidemic levels of obesity here in the U.S.[9-12] Although nutrition has been the main focus of health promotion efforts, it explains part of the energy balance equation. Physical activity is of the same importance given that physical inactivity also increases the risk for becoming overweight and developing chronic diseases.[11, 13]

Given the health burden that chronic diseases and obesity place on society, national surveillance systems are used to assess health behaviors (e.g. physical activity and nutrition) that are primarily related to chronic diseases. Among non-Hispanic Whites living in the U.S., it has been estimated that 24% are obese and 7% suffer from diabetes.[14] The health disparity is prevalent among Latinos who suffer a disproportionate burden of diabetes and obesity compared to non-Latino Whites.[11, 13, 15] For instance, nearly one-third of Hispanics are obese compared with one-quarter of non-Hispanic Whites.[14] The prevalence of being overweight is higher in Hispanics than non-Hispanic

Whites.[16] Furthermore, Latinos who are obese are at greater risk for developing chronic diseases, the high prevalence of diabetes can attest to this fact (11%).[9, 13, 17 18] Latinos face health disparities that can be prevented by engaging in energy balance behaviors such as a healthy diet and meeting recommended levels of PA. This highlights the need for studies focusing on factors related to PA in the Latino community given that they comprise 14.8% of the U.S. population and 52% of border county populations.[19, 20] In addition, the number of Latinos living in the U.S. is projected to triple by 2050.[21] Provided that Latinos continue to engage in poor health behaviors, the existing health burden is likely to magnify and contribute to the economic and health impact of the U.S. healthcare system.

Physical activity has many health benefits that promote physical and mental well being.[22] For example, regular PA increases endorphins and reduces feelings of depression. Chronic diseases such as osteoporosis can be prevented by engaging in weight bearing exercise for bone building and maintenance, especially in the late stages of life.[22] PA can also lower total blood cholesterol and increase high-density lipoproteins. More importantly, regular exercise helps achieve and maintain a healthy weight, which can reduce the risk of becoming overweight or obese in addition to reducing the risk of chronic diseases (e.g., type 2 diabetes, colon cancer, hypertension, and stroke).[23] Unfortunately the increasing rates of obesity, diabetes and coronary heart disease (CHD), suggest that many Americans do not reap the health benefits associated with PA. According to the Centers for Disease Control and Prevention (CDC), the overall burden of obesity affects 25% of Americans.[24] Given this, targeting PA levels is imperative for public health promotion. The CDC recommends accumulating 30 minutes of moderate

intensity PA at least 5 days per week, or a minimum of 20 minutes of vigorous-intensity at least 3 days a week.[25] More recent PA Guidelines for Americans recommend a minimum of 150 min of moderate-intensity activity per week, while for vigorous-intensity activity it is a minimum 75 min per week. According to the CDC, moderate-intensity PA refers to a level of effort where an individual engages in an activity that burns 3.5 to 7 kcal/min and causes some increase in breathing. Vigorous intensity PA refers to a level of effort where an individual engages in an activity that burns more than 7 kcal/ min and experiences a large increase in breathing.

Physical inactivity has become a major concern in the U.S. In 2007, an estimated 281 million persons lived in the U.S.,[19] and most engaged in little or no leisure time physical activity (LTPA). National data from 2005, showed that 57% of Non-Hispanic Whites never engaged in any LTPA of vigorous intensity, and that only 27% engaged in three or more leisure time activities per week.[16] A smaller national study showed that 11% of Whites were physically inactive.[26] Given that Latinos are the largest ethnic minority and make up 14% of the U.S. population,[27] national surveillance surveys have also monitored PA patterns among them. (Note that Hispanic and Latino will be used interchangeably throughout given that the CDC's definition for Hispanic or Latino is defined as "a person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race."[28] Most PA studies have examined these subgroups as one group.) The percent of Latinos (24%) who have reported being physically inactive is greater than that reported by Whites (11%).[26] In 2002, an estimated 75% of Hispanics never engaged in vigorous-intensity LTPA and only 15% of Hispanics

engaged in three or more leisure time activities per week. The low levels of PA among Latinos pose a potential public health concern.

Almost half of the U.S. Latino population resides in California where they constitute one third of the state population, and largely reside in Los Angeles County.[19, 27] In 2006, data from the California Behavioral Risk Factor Surveillance System (BRFSS) showed that 30% of Latino adults never engaged in LTPA compared to 17.5% of Whites.[24] The situation may be worse for Latinos living in border regions (U.S.-Mexico) where Latinos have reported never engaging in regular exercise.[29, 30] Findings from the 2007 California Health Interview Survey (surveillance survey conducted by the University of California at Los Angeles) showed that in the Southern region of San Diego County, more Latinos are physically inactive (17.4%) compared with non-Latino Whites (7.5%). The percentage of Latinos in the South region not engaging in PA is higher compared with the entire county (13.2%).[31] Even more troublesome is the prevalence of physical inactivity among Latinos in the Imperial Valley, where the percentage is almost 24%. Given that the CHIS is telephone administered, there is a possibility that these estimates are biased (e.g., selection) due to convenience sampling of individuals with a houseline. Nevertheless, the prevalence of physical inactivity among Americans, especially Latinos, is disconcerting given the connection between PA, chronic diseases and obesity.

As a result of studies comparing Latinos' health outcomes with those of the general population, some researchers have suggested that Latinos exhibit a health advantage also referred to as the Hispanic Paradox. The Hispanic Paradox is a concept that arises from higher life expectancies and lower Hispanic mortality rates observed

from data classified by Hispanic-origin questions.[32] Regardless of socioeconomic status (SES), Latinos report better than expected health outcomes and higher life expectancies than more socioeconomically advantaged non-Hispanic Whites. For example, fewer Hispanics report suffering from CHD compared to non-Hispanic Whites.[14, 31] Researchers have partly attributed this to acculturation, which refers to the process by which immigrants adopt attitudes, values, customs, beliefs and behaviors of a new culture.[33] For instance, less acculturated Latinos practice favorable health behaviors such as less alcohol consumption and tobacco smoking, and as a result may experience a protective health benefit.[34-37] As Latinos acculturate to the American lifestyle, empirical studies suggest a negative impact on some health behaviors. Although research findings are mixed, it is possible that acculturation is related to patterns of PA.[2]

Leisure time physical activity is becoming less frequent, especially among U.S. Latinos who are described as being less active in comparison to Whites. The generalizability of these findings, however, may only hold true for less acculturated Latinos. It may be that more acculturated Latinos are reaping the benefits of PA during leisure-time, and less acculturated Latinos are reaping the benefits during nonleisure activities (e.g., walking for transportation, household and occupational activities).[24, 38] Assessments of different types of PA are needed to better understand Latinos' behavior patterns. It is also important to understand how patterns of PA differ by level of acculturation given the potential cultural differences in behavioral patterns.[39] Given the rapid growth of the Latino population, it is imperative that studies apply culturally appropriate methods to draw more reliable and valid conclusions regarding levels of PA.

Objective Measures

Quantifying PA involves using objective and self-report measures. Objective measures include the use of technological devices such as pedometers and accelerometers. Pedometers are worn at the hip and if worn correctly can monitor the number of steps that an individual takes in a given period of time. The CDC recommends that reaching 10,000 steps in a day is equivalent to meeting PA Guidelines for Americans.[40] More recent research, however, suggests that pace is more important than steps. Marshall et al. reported that walking a minimum of 3000 steps in 30 minutes on 5 days each week may be sufficient to meet current PA guidelines.[41]

Another device, the accelerometer, is an electronic 3-dimensional motion sensor that provides a precise measure that is practical for overcoming issues with PA recall. Like the pedometer, the accelerometer is worn at the hip on an elastic belt and it detects minute-by-minute body movement and acceleration. Unlike the pedometer though, the accelerometer's sensor has the ability to detect intensity and frequency of movement. Movement counts can are downloaded to a computer and data can then be broken down into sedentary, light, moderate and vigorous intensity PA.

There are several limitations to using objective measures to assess PA. For example, respondents may react to the measure and engage in more PA than usual thereby introducing measurement bias. The limitation of pedometer use is that it only counts steps, and does not detect other body movements such as stationary positions and upper body movements. Furthermore, pedometers and accelerometers are not designed to detect domains of PA such as the difference between bicycling and walking, occupational

and household activities (e.g., carrying heavy objects, washing dishes, laundry, etc.). In addition, pedometers can overestimate or underestimate step counts that result from heavy vibrations or light steps. There also are limitations of accelerometer use which include not being able to discriminate between domains of PA in addition to being very costly. Accelerometry is not a cost-effective method for assessing PA in large populations.

Self-report Measures

Due to low cost of self-report measures, many national surveillance surveys such as the National Health and Nutrition Examination Survey (NHANES), Behavioral Risk Factor Surveillance System (BRFSS), and National and Health Interview Survey (NHIS) have relied on self-report to assess PA patterns in the U.S. Of these measures, BRFSS and NHANES have been the most comprehensive surveys in asking respondents about frequency and duration of active transportation, household activities and LTPA, but not occupational PA. The BRFSS has been used to derive state-level statistics of adherence to PA in *Healthy People 2010*. Prior to 2001, the BRFSS PA module included two items regarding occupational and leisure time PA an individual mostly engaged in during the past month. The BRFSS PA module was updated in 2001 to include household activities, but the conceptualization was limited to gardening and did not account for other household chores. Other surveys such as NHIS can potentially have more bias given that they are less comprehensive and only ask respondents about LTPA. Not only may national surveys be limited in quantifying various types of PA, but cultural differences may not be accounted for given that measures have been developed and validated in

White or Caucasian populations. It is important to consider the different cultural perceptions and behaviors that ethno racial groups may have regarding PA. Due to cultural differences, items included in national surveys (e.g., BRFSS and NHIS) may be too general to describe the varying dynamics and perceptions of PA patterns in and across U.S. ethinic subgroups. For Latinos, opportunities for PA may be presented as transportation, household and/or occupational activities.

Given that opportunities for PA may occur outside of leisure time, other self-report measures have been developed to assess a range of PA behaviors. Some of the more common PA measures include the 7-day Physical Activity Recall (PAR), Global Physical Activity Questionnaire (GPAQ), International Physical Activity Questionnaire (IPAQ), Godin Leisure-Time Exercise Questionnaire, Baecke Questionnaire of Habitual Physical Activity, Paffenbarger Physical Activity Questionnaire and the Stanford Usual Activity Questionnaire. A majority of these measures assess frequency and intensity, but vary in measuring duration and domains of PA (e.g., occupational, household and transportation activity). The 7-day PAR is a one-time assessment of time spent sleeping, and activities performed in the morning, afternoon and evening for seven straight days. The intensity and duration of each activity are also reported in a given day. All of these self-report measures differ in at least one aspect. For instance, the IPAQ and GPAQ are much like the PA modules in national surveys, however, they are more comprehensive in assessing occupational PA and all types of household duties. Table 1 (below) provides a brief summary of the characteristics of the aforementioned self-report measures for quantifying PA.

Table 2.1. Summary characteristics of self-report PA measures

PA Measure	Domain*				Frequency	Duration	Intensity	Other	Validated among
	O	T	H	L					
NHANES		x	x	x	Days/week	x	x		Not found
BRFSS		x	x	x	Days/week	x	x		White, Black[42]
NHIS				x	Days/week	x	x		Caucasian
7-day PAR					Daily	x	x	open	Caucasian, Latino
GPAQ	x	x	x	x	Days/week	x	x		
IPAQ	x	x	x	x	Days/week	x	x		International
Baecke	x			x	Months/year	Hr/wk			Caucasian
Paffenbarger		x		x	Times/year, Daily for walking	x	x	Open	White, Black, Latino
Godin				x	often to never (in a week)		x		Caucasian
Stanford Usual				x					Caucasian

*Domains of PA (O: occupational; T: Active transportation; H: household; L: Leisure time)

The majority of PA measures included in Table 2.1 (above) have been validated for Caucasian and English speaking populations living in the U.S. including those used to monitor PA on a national level. Only the IPAQ was developed and translated in different languages to assess PA in international populations. Self-report PA measures are widely used given the potential to quantify PA in large populations (e.g., national). Unlike objective measures of PA, self-reports can be used to quantify all contexts of PA (e.g., occupational, household, and transportation and LTPA); this too is a strength of the IPAQ. Self-reports also involve interview or self-administered recall questionnaires, activity logs or diaries, however, they may not account for non-leisure time activities. Also, most measures quantify dimensions of frequency and intensity of PA, but less commonly assess the type and duration. A strength of self-report measures is that they can be adapted (e.g., culture and language) to fit the needs of a population or research question.

Limitations of self-report include social desirability (the inclination to respond in a favorable manner) which can lead to over-reporting of PA.[43] Another limitation is

under-reporting of PA given that PA recall can be a complex cognitive task.[44] For example, older adults and children may have a limited ability to recall PA engagement. Researchers and respondents may also have different interpretations of PA and its related terms (e.g., intensity levels and operationalizations). Low literacy skills can also be problematic when surveys are not interview-administered among these individuals. Using PA logs such as the 7-day PAR can result in respondent burden given that PA must be recorded consistently morning, noon and night for seven continuous days. Also, PA logs can be burdensome for research assistants given the large amounts of data that must be entered, categorized and cleaned. PA logs can be time consuming which makes them less ideal for large population studies. Despite these limitations, the use of self-report measures does have strengths. For instance, PA logs can be extremely valuable for assessing different domains of PA because they are open-ended. Nonetheless, if needed, close-ended self-report measures can also be developed to assess all types of PA. A major strength of self-report measures is that they allow for surveillance of large populations, because they are relatively low in cost and can be administered in a short amount of time compared to objective measures.

Another consideration of self-reported PA is the manner in which it is administered. Surveys can be self-administered, or can be administered during face-to-face or telephone interviews. Furthermore, surveys that are intended for English speakers may limit the validity and generalizability of research findings. The literacy issues regarding self-administered PA measurement have been discussed above. Telephone and face-to-face interviews can pose administration limitations which can be addressed by proper training to increase inter-rater reliability. Because of the large Latino population, it

necessary to have bilingual data collectors who are trained to administer interviews in Spanish as well. Telephone administered surveys involve more serious study limitations. For instance, surveys that are administered over the phone can result in a convenience sample limited to more educated individuals with higher incomes (who can afford a phone). Respondents may include a high percentage of females and may not include individuals with more than one job. Response rates for telephone administered surveys also have decreased over the past years given the capability to screen telephone calls. Furthermore, home landlines are becoming obsolete given the increase in cellular phone usage.

To overcome issues of self-reported PA measurement, these can be validated with other self-report or objective PA measures in sample populations. Reliability studies can be used to minimize measurement error and reported variability in levels of PA. Validating self-report measures in target populations is recommended so that measures functions as intended. For the most part, self-report measures have been developed for and validated in the non-Latino White population. As a result, this limits the extent to which self-report measures can be implemented effectively in cultural or ethnic minority groups. Furthermore, past observations of Latinos' PA may not be accurate given that past implemented measures may not have been culturally competent to assess all domains of PA. This merits a summary of past PA measures used to assess PA in addition to the conclusions drawn about the PA engaged in by Latinos.

Physical Activity in Latinos

Few studies have used self-report to examine PA among Latinos compared to the general U.S. population, and even fewer studies have used objective measures. To date, only two studies have used accelerometry to either validate self-report measures or to quantify PA in Latinos living in the U.S. Recently, Arredondo and colleagues used accelerometry to assess PA longitudinally in Latinas living in San Diego County.[45] Marquez and investigators used accelerometry to validate a self-report measure of PA (EPAQ II) in Latinos living in the Midwest.[3] In addition to these studies, accelerometry was used to cross-validate the IPAQ for Spanish-speakers, however, this study was conducted in Guatemala.[46] Highlighting these studies is important because they address the lack of objective PA measurement in studies that target Latinos.

There is a need to increase the validity of self-report PA measures for use among Latinos living in the U.S. given that few have been validated for assessment among English and Spanish speakers. In fact, self-reported PA has been the preferred method for data collection. Mainly focusing on LTPA, seldom have studies assessed other PA domains such as occupational, transportation and household behaviors. Although Latinos engage in LTPA less frequently,[18] emerging research shows that Latinos engage in nonleisure time activities such as occupational PA.[3] Some measures have been improved and researchers have broadened the operationalization of PA to include a range of activities such as walking/jogging, sports, household chores and other activities. The following is a summary of measures that have been used to describe PA in Latino health behavior studies:

Table 2.2. Assessments of PA in Latino sample populations

Name of Measure	Reference	Language	Operationalization
Rapid Assessment of Physical Activity (RAPA - English)[47]	Topolski et al., 2006	English, Spanish	Light, moderate, vigorous PA (walking, stretching, yard work or vacuuming, aerobics, strength training swimming, stairs jog/run, tennis, racquetball)
National Health Interview Survey (NHIS) Walking Supplement[48, 49]	Castro et al., 1999	English,	Moderate and vigorous PA, flights/steps, walking, sports and leisure time PA
	Rauh et al., 1992	English,	Moderate and vigorous PA, flights/steps, walking, sports and leisure time PA
Physical Activity Social Support (PASS)[50]	Eyler et al., 1999	English	Leisure time, lifestyle/household chores, exercise, sports and social support for PA
7-Day Physical Activity Recall (PAR)[51]	Poston et al., 2001	English, Spanish	Sedentary, light, moderate, vigorous and very vigorous.
International Physical Activity Questionnaire (IPAQ)[46]	Craig et al., 2003	English, Spanish	Occupational, transport, yard, household, leisure, sitting
Modified Physical Activity Questionnaire (MPAQ)[52]	Laffrey et al., 2000	English, Spanish	Cleaning, cooking, shopping, leisure/sports
EPIC Physical Activity Questionnaire 2 (EPAQ2)[3]	Marquez & McAuley, 2006	English, Spanish	Home activities, activity at work, recreation
Minnesota Leisure Time Physical Activity Questionnaire (MLTPAQ)[53, 54]	Elosua et al., 2000; 1994	English, Spanish	Dancing, walking, surfing, bowling, martial arts, household activities
Lifestyle Behaviors Questionnaire (Modified HPLPII)[55]	Kim et al., 2004	English, Spanish	Walking, parking far from destination, exercising, gardening, aerobics, jogging, swimming
National Health and Nutrition Examination Survey III (NHANES III)[2]	Crespo et al., 2001	English, Spanish	Walking, running, small motor movements (exercising, gardening), heavy housework, heavy playing/exercise, organized sports/PE
Health-Promoting Lifestyle Profile II (HPLPII)[56]	Hulme et al., 2003	English, Spanish	Walking, parking far from destination, exercising, gardening, aerobics, jogging, swimming

Indeed, past PA studies focusing on Latino health have included small samples compared to the larger national surveillance studies. The NHANES III examined PA patterns among 4,893 Latinos/Hispanics in the U.S. despite the 44 million Latinos living in the U.S.[2, 19] From 2001 to 2007, this was the largest sample for which PA was reported among Latinos; however, the assessment of PA was limited to leisure-time activity and

household work. Recently, Marquez et al. examined levels of PA among 21,681 Hispanic subgroups which included occupational PA.[57, 58] On average, studies have included sample sizes of 200 Latinos/Hispanics. The smaller studies limited self-reported PA to household and leisure time activities; therefore, past reports may under-report PA. To improve PA measurement, the IPAQ was developed as comprehensive assessment of PA quantifying all domains of PA. To date, there have not been published findings using this measure to assess PA in both Latino men and women.

The availability of PA measures that account for cultural differences is limited. To address the potential lack of culturally appropriate measures that are valid for PA assessment among Latinos, Martinez et al. reviewed and evaluated 13 self-report measures that were used in PA studies of Latinos.[59] Authors used guidelines that were developed for the purpose of translating the IPAQ to evaluate the cultural translation and adaptation of the other 12 PA measures. Four of these measures had been administered among English-dominant Latinos, while nine had been administered to Spanish speakers. Of the English measures, one measure (RAPA-English) had been reviewed for cultural appropriateness and pilot-tested prior to implementation, and only one measure (PASS) had been pilot-tested. Prior to being translated into Spanish, all nine measures had been tested for reliability and validity in the mainstream population. Four Spanish measures (IPAQ, MPAQ, EPAQ II, MLTPAQ) had been rigorously translated and adapted to maintain equivalence and performance in the Latino population. These four measures had been translated (forward and back-translated) and either pilot-tested or reviewed for cultural appropriateness. The other five Spanish measures (HPLP-II, modified HPLP-II, RAPA-Spanish, 7-Day PAR, NHANES-III) had only been translated, but were not

reviewed for cultural sensitivity for Latino groups. The authors concluded the review with improved guidelines that could be used to increase the performance of translation and cultural adaptation of PA measures. In addition, the improved guidelines were used to improve the performance of the IPAQ during implementation of the SDPRC community survey.

Empirical evidence supports that Latinos engage in insufficient levels of moderate to vigorous intensity physical activity (MVPA). For instance, Crespo and colleagues found greater levels of leisure time inactivity among Latinos than in the general population.[2] Consistent with these results, Hulme and authors reported that Spanish-speaking Hispanics were in need of ways to increase their LTPA.[56] Despite these findings, cross-sectional studies have reported inconsistent PA levels, especially among Latinas. At baseline, Castro et al. reported that Latinas' PA levels fell below the 1991 guidelines from the American College of Sports Medicine.[60] In a more recent assessment using the 7-day PAR, Poston and colleagues reported that Latinas engaged in 11 hours of MVPA per week.[61] Reporting the prevalence of leisure-time and household activities, Eyler et al. observed that 17% of Latinas engaged in regular exercise.[50] Among older Latinos, Laffrey and authors found that almost half of their participants engaged in regular exercise at their criterion level of at least 20 minutes, 3 times per week.[62] Marquez and McAuley found that Latino men reported engaging in more occupational and overall PA while Latinas reported engaging in higher levels of household/domestic activity.[3] Furthermore, recent studies have shown a greater prevalence of walking for transportation in less acculturated Latinos than those who are more acculturated.[63-66] Moreover, the CHIS data showed that the longer Latino respondents lived in the U.S., the

less likely they were to report walking at recommended levels.[65] These studies provide valuable insight regarding Latinos' PA patterns. To provide more valid assessments of PA in Latinos, it is important to use culturally appropriate PA measures that assess a range of behaviors. This may reduce inconsistent findings in future PA research and allow for a better understanding of Latinos' PA.

THEORETICAL MODELS FOR PHYSICAL ACTIVITY PROMOTION

Expanding the field of PA promotion requires a better representation of the multi-contextual influences (e.g., individual, social, and environmental) on PA behavior. The U.S. population is culturally diverse, which explains the need to modify theoretical perspectives to account for influences that are important for ethno racial groups. For the most part, theoretical perspectives have not accounted for cultural differences and have been limited to the individual-level correlates of PA in the general population. For this reason, individual-level factors that predict behavior well (in the general population) have been the focus of experimental study. This limitation has been addressed by emerging research that has applied social ecological models to integrate and understand broader influences on health behavior. The application of broader perspectives such as those that are based on social-ecological theories may be fundamental for understanding, promoting, and achieving population change of PA. Furthermore, a social-ecological perspective may be ideal for understanding the cross-cultural contexts in which PA occurs; and can increase the effectiveness of PA promotion in diverse populations. Thus, to understand how theory can be applied to future PA research among Latinos requires a summary of previously used theoretical applications.

The following health behavior models have been applied to the field of PA and have received empirical support in predominantly Anglo/Caucasian populations: Theories of Reasoned Action and Planned Behavior,[67, 68] Expectancy-Value theories,[69] Relapse-Prevention Models, the Transtheoretical Model,[70, 71] and Self-Determination Model.[72-74] These theories focus primarily on individual-level processes such as attitudes and beliefs. In addition to these theories, Social Cognitive Theory and Behavioral Economics (or Behavioral Choice Theory) have been applied to emphasize behavior by focusing on the interplaying dynamics between the individual and the more immediate or micro environmental factors.[75-77] Application of traditional theories has rendered little PA research on perceptions of the social-environment and built environments. Given this, few studies have developed models that include synergistic levels of behavioral influence on PA. Therefore, the existing body of PA literature is limited in describing PA in a larger context.

The social and physical environments provide cues that may influence PA.[78-80] The social environment includes environmental stressors such as crime and safety, in addition to factors that go beyond an individual's control such as neighborhood disorder and environmental psychology. Physical characteristics include urban design, land use, transportation planning, and walkability factors. Given the multi-levels of behavioral influence, there is a need for studies that apply a comprehensive framework to examine determinants of PA. King et al. noted expanding theories to involve mediating influences that may be important for different population groups.[80] For instance, among Latinos, past PA studies seldom have emphasized individual, social and environmental factors.[80] Furthermore, the type and source of support (from the social or physical environment)

necessary for facilitating the adoption and maintenance of PA across diverse populations has yet to be empirically established. To significantly contribute to the existing body of PA literature, it is necessary to expand traditional theories by applying paradigms that are synergistic and bridge multiple levels of behavioral influence.

As noted above, PA research is based on theoretical foundations that have been developed and applied to populations of European descent. Because there is a lack of theoretical models developed specifically for ethno racial groups, existing theories have been generalized to research involving Latinos.[81, 82 83] Constructs from social learning theory have been applied to PA promotion to influence individual behavior and social environments.[84] Most studies featuring the PA of Latinos do not extend beyond the factors included in traditional health behaviors theories. Particularly, cross-sectional studies have included individual factors such as self-efficacy, perceived barriers, and social support,[85] but are limited in the application of broader ecological perspectives. In fact, there still is much to be understood regarding the PA of Latinos. For this reason it is important to apply theories that can be adapted to ethnically diverse groups such as ecological models of health behavior that can be culturally tailored to emphasize important cultural and ethno racial factors.

The social ecological model is an overarching perspective that conceptualizes the interdependence among individuals, their behavior and the environment.[86] The model emphasizes that personal, social and environmental factors may promote or hinder a physically active lifestyle.[78 87] Starting at the individual level, the principles of social ecology involve the intrapersonal environment including demographic, biological, psychosocial and familial factors. Interpersonal factors include behaviors that occur in the

social and cultural environment such as social support and modeling behaviors. These personal factors are the core of traditional health behavior theories, but the strength of the social ecological approach is that it encompasses community, environmental and organizational influences on PA. These factors are of importance given that the environment presents cues and opportunities (e.g., schools, work, parks and recreation facilities, sports leagues, trails, etc.) for mutual influence between people and their surroundings. There also are situational contexts that present frequent opportunities for PA such as safe neighborhoods and communities with social and active neighbors. These neighborhood level social interactions may differ across ethno racial groups, and communities of different social economic status. Some ethno racial groups (e.g., Latinos) are characterized as highly collective, thus it is important to address the cultural influences that are present in the social environment. It is these social and cultural factors that are likely to influence PA.[80] The social ecological model also conceptualizes environmental factors that are likely to promote higher levels of PA such as aesthetics, prevalence of recreational settings and facilities, and community networks (e.g. social capital). Other mediating environmental factors of PA may include environmental stressors (e.g., exposure to traffic, noise, and crime), and physical features (e.g., settings that reduce sense of environmental control/defensible space). The social ecological model is instrumental for health behavior studies given it's adaptability to account for a range of factors, specifically those that typically are not included in the more traditional health behavior theories. The model is an appropriate framework for research with ethnically diverse groups, which merits its application to describe PA in Latinos. Figure 2.1 (below) provides an illustration of the social ecological model and its adaptability to culturally

diverse populations. Moreover, the model outlines the contextual factors that may influence PA of Latinos and can be beneficial for studies using multi-level analysis. For the purpose of this study, the SE model will be used to outline possible correlates of PA among community sample of Latino adults.

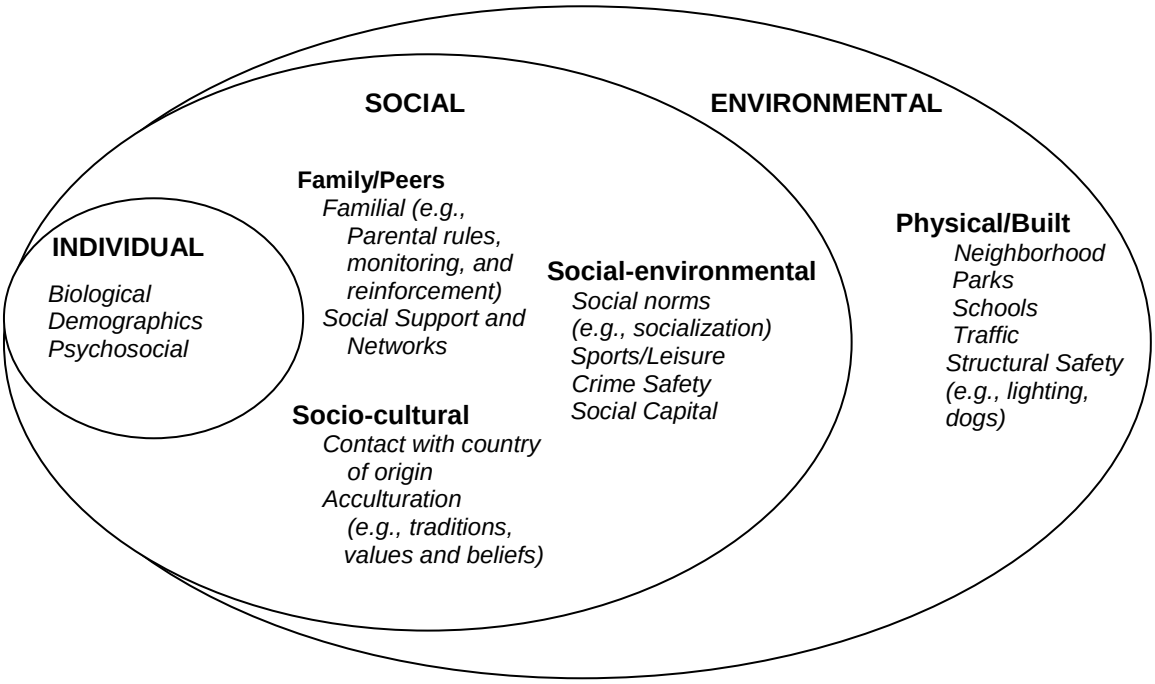

Figure 2.1. *Contextual Factors Influencing Individual Physical (In)Activity*

Correlates of Physical Activity

It is well established that PA behavior is influenced by individual-level factors including those that are interpersonal and intrapersonal (e.g., cognitive constructs and demographics). Health behavior, however, is influenced by the interdependence of individual, social and environmental factors; therefore, there is a need to outline the broad range of factors that that may be related to PA. The social-ecological model is a framework that can outline the level of influence of potential correlates of PA from an individual-level to an environmental-level. For instance, individual-level factors involve

demographics and self-perceptions about engaging in PA. Social-level factors include a range of immediate influences from familial norms (e.g., responsibilities) to interactions with family and friends (e.g., social support for PA). There are also more distal factors present in the social atmosphere (e.g., community to national level) that promote or impede PA behavior such as crime, social cohesion, cultural norms, and traditions). The space outside the person includes the physical environment, which can be actual or perceived external cues and opportunities for PA (e.g., perceived availability of parks, physical structures, traffic, and walkability). To be able to understand which factors may be related to PA in the Latino population warrants an overview of the multi-level factors identified as important in the general population. Past study findings will be reviewed in the next section.

Individual-level factors

Demographic and Biological: Studies have shown that PA decreases with age given the physical limitations in aging,[22, 26] and that men more than women engage in more PA (as previously discussed). In the general population, class indicators (e.g., race, education, income, employment and marital status) are related to health. The available literature examining the correlation between race (Latino vs. White) and PA was previously discussed. Studies have reported that adults with low educational attainment and income are physically inactive and that habitual PA increased with education.[6, 26, 88] Among women, however, studies are less consistent.[6] Employment also facilitates opportunities for PA; Simon et al. observed that physical inactivity was the highest among those who were not in the workforce, regardless of gender.[26] This is consistent with other studies that found a positive relationship between being employed out of the home and LTPA.[89,

[90] Studies examining the association between marital status and PA produced mixed findings. While Simon et al. found that leisure time inactivity did not differ among married/partnered White men or women,[6] one study reported more PA among women who had never been married.[91]

In the Latino population, associations between demographics and PA have been inconsistent, especially among Latinas. For instance, one study found that Latinas' PA increased with age.[6] While low levels of education and income have been related to physical inactivity in Hispanic men,[26] Hispanic women with high levels of income are less likely to be active. When examining employment status, studies have been inconsistent. Employed Hispanic men and unemployed Hispanic women were more inactive than White their counterparts of the same status.[26 92, 93] Married/partnered Hispanic men and women were more likely to be inactive compared to Whites of the same marital status.[26] Also, it has been reported that married/partnered Latinas are less likely to meet PA recommendation.[6] These findings are inconsistent and possibly a result of PA measurement.[94, 95] For example, Sternfeld et al. observed that being married was negatively associated to sport/exercise, whereas being married was positively related to household/caregiving activities among ethnically diverse women.[89]

Another well established correlate of PA in the general population is body mass index (BMI). Studies have shown an inverse correlation between physical activity (e.g., steps per day), body composition, and BMI.[96, 97] The 2000 BRFSS data showed that persons attempting to lose weight exceeded the PA recommendation of 150 minutes per week.[10] Furthermore, Rutt et al. found that increasing BMI was related to less moderate-intensity PA in a predominantly Latino community.[98]

In the Latino population, associations between demographics and PA have been evaluated far less frequently than in the general population. Furthermore, the few studies have produced inconsistent outcomes. The relationship between PA, demographics and biological factors among Latinos remain unclear; therefore, it is necessary to examine these factors to help fill in the gaps in existing PA literature.

Psychosocial: Modifying intrapersonal correlates of PA such as psychosocial variables, may be more easily attained than altering socioeconomics and environmental factors. For this reason, studies in the general population have commonly examined social cognitive factors (e.g., self-efficacy, perceived barriers and social support) and often are found to be associated with PA.[5, 99-103] In the general population, studies consistently found a relationship between self-efficacy, perceived barriers and PA.[104-106] These relationships are well established in the general population, yet empirical support in ethno racial groups is mixed.

Two reviews have been written regarding psychosocial correlates of PA among ethnically diverse groups. In 2002, Eyler et al. reviewed studies that focused primarily on ethnically diverse women, and concluded that Latinas were an underrepresented group in the study psychosocial correlates of PA.[6] In 2003, Marquez et al. reviewed studies that examined the relationship between psychosocial factors identified as important in the general population and PA among Latinos.[107] In this review, it was reported that perceived barriers, social support and self-efficacy for PA were among the most commonly reported correlates of PA in the Latino population, yet these studies were few.

Self-efficacy. Self-efficacy is one of the most widely studied psychological correlates of PA in the general population, commonly assessed with the self-efficacy

scale developed by Sallis et al.[5, 99, 104, 105, 108] Because self-efficacy is a well established correlate of PA in the general population, its relationship with PA has been observed in Latinos. Eyler et al., however, reported that self-efficacy is an understudied construct among ethnically diverse women. In a review by Marquez et al., a total of eight studies were identified that examined the association between self-efficacy and PA. Of these studies, the majority of them found a positive relationship between self-efficacy and PA.[60, 109] Since the publication of Eyler et al. and Marquez et al., three peer-reviewed studies have examined the association between PA and self-efficacy. Of these studies, two reported a positive association between PA and self-efficacy.[6, 107]

Because PA can be operationalized differently, some studies of Latinos have produced mixed findings. For instance, Hovell et al. found an association between self-efficacy and vigorous activities, but not for walking.[109] While Weitzel and Walker observed that self-efficacy was not related to exercise behavior, Marquez and McAuley reported that higher levels of LTPA was associated with greater self-efficacy.[62, 85] Laffrey et al. reported that self-efficacy was significantly related to "culturally relevant" leisure/sports, daily and habitual activities.[110] Self-efficacy may be an important correlate of LTPA, but this association may not be generalized to all domains of PA. Also, recent studies suggest that self-efficacy mediates the relationship between PA social support and PA in less active populations. It is worth examining this relationship in Latinos given that they engage in low levels of LTPA. Also, the few studies describing the relationship between self-efficacy and PA are limited to females, which merits the inclusion of men in studies of Latinos.

Perceived Barriers. A widely used scale, developed by Sallis and colleagues, has been used to assess barriers to PA.[50] It is generally found that individuals who perceive fewer barriers to PA are likely to engage in higher levels of PA.[89, 106, 111] Among Whites, lack of time, lack of motivation, lack of energy, and fear of injury are most commonly perceived as barriers to PA. Barriers to PA exist in every ethnic group, but they may not be the same across ethnic/cultural groups.[6] Eyler et al. conducted focus groups among ethnic minority women and found that most barriers were related to the domain of LTPA.[112, 113] Consistent with studies in white females, lack of time and motivation were reported as common themes in focus groups of Latinas and ethnically diverse women.[114] Other commonly reported barriers have included economic constraints, lack of social support, not knowing how to start an exercise program, caregiving, family obligations, lack of transportation, environmental barriers (e.g., availability of nearby resources and safety concerns), and cultural issues.[107, 108, 114-117] Everyday demands, however, such as cooking and cleaning were not expressed as barriers to PA.[118] Other barriers for Latinas have included fear of injury, concern for safety, and being discouraged by others (e.g., husbands).[112-114, 120] It is possible that Latinas face cultural challenges such as *machismo* (e.g., spousal disapproval).[114, 117] Despite these common themes in qualitative studies, quantitative studies have inconsistently reported perceived barriers as a correlate of PA among Latinos (e.g., rural and urban).[119] Furthermore, both qualitative and quantitative studies have not included Latino men; therefore, past research findings cannot be generalized to the Latino population as a whole.

Aesthetics. Environmental scales are used to capture neighborhood aesthetics (e.g., cleanliness, views of buildings, and scenery), and empirical evidence supports that

aesthetics is related to PA.[6, 120-122] Recent research in Australia suggests that neighborhood aesthetics is especially important factor for leisure time walking.[123] In the U.S., emerging research is consistent in showing that enjoyable scenery, the presence of hills, and having access to attractive open spaces are important correlates of walking.[100] Furthermore, living on an aesthetically pleasing street is important for achieving recommended levels of walking.[124, 125] These observed relationships may also hold true for Latino communities. King and colleagues examined environmental factors and PA in a multiethnic female sample, and after stratifying by ethnic group, the presence of hills in a neighborhood was positively associated with PA in Latinas.[100] These findings, however, cannot be generalized to all Latinos given that this sample consisted of middle and older-aged women. Further studies are needed to determine if perceptions of neighborhood aesthetics influences particular types (e.g., leisure-time walking and active transportation) and levels of PA among Latinos.

Behavioral Attributes: Individual's who eat a healthy diet may be motivated to exercise to maintain a healthy weight. Studies have shown that individuals who consume a high fat diet or eat less than five fruits/vegetables in a day engage in less PA than those with a healthier diet.[126, 127] Additionally, studies have shown a positive relationship between PA and consuming more fruits and vegetables.[128, 129] It is possible that individuals who eat a healthy diet are conscientious of their physical well-being, and engage in energy-balance strategies to maintain a healthy weight. For this reason, it is worth investigating these behaviors as motivational factors for LTPA in Latino adults. Moreover, it is important to understand whether healthy diet (e.g., fruit and vegetable intake) plays a role in PA given the change in dietary behaviors as Latinos acculturate to an American lifestyle.[130]

Social-level factors

Social factors that affect adults' PA are familial, cultural and environmental. Family and friends can play a significant role in encouraging PA. In addition, the cultural norms that are woven in a society can result in different PA behaviors for men and women. The relationships built with neighbors can also influence the frequency of physical activity performed during leisure time. These different social factors will be discussed in further detail below.

Family/Peers:

Social Support for Exercise. Providing PA social support may help overcome some of the barriers to PA; therefore, it is a well established correlate of PA in the general population.[2-4] Sources of PA social support include a spouse, family and friends. Numerous studies have found an association between high levels of social support and greater levels of PA among U.S. adults.[6, 131] Studies among have shown that not having a partner to exercise with was a barrier to PA and that having social support during exercise enhanced the enjoyment, adherence and likelihood of adopting a physically active lifestyle. Similarly, other studies with ethnically diverse groups reported that increased social support from spouse, family and friends facilitated the participation of PA.

As noted, Latinos are collective in nature, so it would be expected that PA social support from family and friends plays a significant role in LTPA. Marquez et al. identified six studies that examined the relationship between social support and PA in Latinos. In general, studies found that PA was associated with PA social support, and across ethno racial groups, Latinas tended to receive more social support from family and

friends.[50, 85, 100, 108] Studies findings, however, are inconsistent.[89, 108] Recent focus groups showed that Latinas have an interest in support groups for PA promotion.[116, 132] Despite few inconsistencies in the literature, social support for PA seems to be important among Latinos when examining the individual-level context of PA. Researchers, however, have yet to examine the mechanism of PA social support whether it differs by type (e.g., family or friends) and whether its relationship with PA is mediated by self-efficacy. Lastly, there is the need to establish whether PA social support differs for Latino men and women.

Family Structure. Family roles, responsibilities, and having children are family structure characteristics that may decrease the opportunity for engaging in LTPA. This relationship may be more apparent among women than men given the traditional gender role for women to take on family responsibilities (e.g., household, cooking, and caregiving). For instance, King et al. observed an inverse relationship between having children and family responsibilities and PA among White women.[100] Empirical evidence is also consistent across ethnically diverse female populations.[6] Having children presents women with multiple roles and responsibilities, which are likely to present women with barriers to LTPA.

Latinos typically demonstrate high levels of familism (*familismo*). Putting family needs before personal needs (familism) may influence several domains of PA, especially among Latinas who follow a more traditional role. For example, among Hispanic women, having children was negatively associated with sports/exercise, but inversely related to household and caregiving activities.[137] This finding suggests that Latinas with children may benefit from nonleisure time activities. This relationship has been less evaluated

among Latino men; therefore, it cannot be ascertained whether family structure influences levels of PA among them.

Social Networks. The extent to which one is interconnected and embedded in a community is referred to as a social network.[133] It has been concluded that social support together with social networks haven an important influence on health.[134] Characteristics that can be used to examine networks are characteristics (e.g., size, density, and homogeneity) and structure (e.g., face to face contacts and duration of relationship). Little is know regarding the relationship between social networks and PA given that few studies have been published. Reported findings show that select social network characteristics (e.g., number of individuals, frequency of contact and homogeneity) are positively associated with energy expenditure.[135, 136] Additional studies are needed to explore these social network characteristics as they relate to PA given that the mechanisms responsible for this influence are remain unclear.

Social-environmental factors:

Neighborhood Safety. Researchers have found that social-environmental characteristics of a neighborhood contribute to perceptions of safety for engaging in outdoor PA. For this reason, scales have been developed to assess perceptions of neighborhood safety such as safety from crime, violence, traffic, and stray dogs. The Neighborhood Environment Walkability Scale is a commonly used scale that was developed to assess neighborhood differences in PA.[121] Studies have identified neighborhood factors, such as crime and the presence of homelessness and gangs, facilitate or hinder PA. For instance, Sallis et al. observed that social barriers to PA (e.g., low perceived safety from crime) reduced the probability of LTPA in predominantly

White neighborhoods.[122] Similarly, Duncan et al. showed that perceived opportunities for PA were high when neighborhood problems were perceived to be low.[138] Women also were three to four times more likely to walk in their neighborhood if neighborhood safety was average versus below average. Overall, studies have demonstrated that community-wide PA and use of neighborhood parks decreased when women perceived neighborhood safety to be low. Thus, empirical evidence suggests that perceived neighborhood safety influences PA in the general population; it's inclusions in ecological models of health behavior is theoretically and empirically justified.[139, 140] Given that all communities differ in social aspects, it is important to understand how neighborhood safety is related to PA in predominantly Latino neighborhoods. Thus, it is likely that the probability of engaging in PA increases when residents perceive fewer social problems, particularly in Latino neighborhoods.

As previously mentioned, Latinos tend to live in marginalized neighborhoods, particularly those living in border regions. It has been reported that the estimated per capita income is less than $21,000 for Latinos living in 19 border counties.[20] Yet few studies have examined the influence of neighborhood safety on PA in border communities stretching from California to Texas. In recent focus groups with Latinas in Pennsylvania and North Carolina, it was revealed that park safety and neighborhood poverty were barriers to PA.[116, 141] Similarly, Latinas of border communities revealed that the presence of homeless, gangs and drunks were barriers to park usage for recreation.[114] Although it would be expected that high levels of crime in economically distressed communities would impede outdoors PA, data from cross-sectional studies with Latinas do not support previous focus group results.[29, 93, 142]

For the most part, studies do not demonstrate a significant relationship between PA and neighborhood safety among Latinos. It could be that neighborhood safety is related to PA via several potential mechanisms. Because the relationship remains unclear, there are several reasons to further investigate neighborhood safety on PA in Latino adults. First, some Latinos (e.g., immigrants) live in SES compromised neighborhoods where safety is typically lower compared to affluent neighborhoods. Second, there is a need to establish why neighborhood safety does not impede PA even though it is a barrier to PA in other ethno racial populations (e.g. African-Americans). Lastly, there is a need to examine neighborhood safety with other neighborhood factors (e.g., social cohesion) to better understand the social mechanisms of PA. This knowledge can be used to inform PA programs and policy that aim to increase environmental safety for nonleisure and leisure time PA.

Social Cohesion. Benefits gained from social networking include health and economic prosperity. Within the scope of neighborhood dynamics, social capital and social cohesion may be associated with PA of communities.[143] Social capital is defined as relationships such as networks and social norms that facilitate productive activity and mutual trust within individuals by working together to accomplish shared (health-related) goals.[144] Low levels of social capital are significantly related to poor (self-reported) health[143, 145, 146] and low levels of LTPA.[147] A relatively new construct stemming from social capital is social cohesion (e.g., neighborhood cohesion), which is described as "the absence of social conflict coupled with the presence of strong social bonds and mutual trust."[148] Researchers believe that socially cohesive neighborhoods are more successful at providing and maintaining community services and resources.[149] Social cohesion may

reinforce social norms for positive health behaviors, for example, sharing the same goal to create safer environments by reducing neighborhood crime to promote PA.[144, 150] Given the role that social cohesion may play in shaping healthy social environments, several scales were developed to assess social cohesion in the general population.[150, 151] These scales assess the degree of neighboring and sense of community in one's neighborhood.

Few studies have examined the association between social cohesion and poor health outcomes. The little amount of research suggests that low perceptions of social cohesion are related to low levels of PA in disadvantaged neighborhoods.[141] It has been shown that perceived opportunity for PA was significantly related to neighborhood cohesion in predominantly White neighborhoods. In turn, neighborhood cohesion was positively related to levels of PA.[138] Findings also indicated that perceiving high levels of neighborhood cohesion were related to few neighborhood problems.[138] Living in high crime neighborhoods has been associated with low levels of social cohesion, which in turn was related to physical inactivity.[151, 152] Thus, empirical evidence supports that social cohesion may be an important factor for PA promotion.

Latinos tend to live in less desirable neighborhoods with high crime and health-related risk factors.[153] Given the low socioeconomics of border communities, it is possible that neighborhood cohesion plays a salient role in the PA patterns of Latinos. For some disadvantaged communities, there is also the possibility that crime and safety outweigh the effects of social cohesion thereby providing less opportunity for engaging in PA. Currently, there are no studies describing the relationship between social cohesion and PA among Latinos living in the border region of San Diego. Given that Latinos are characterized as highly collective, it is likely that social ties may help overcome social

barriers (e.g., crime) to PA in one's community or neighborhood. For example, having a sense of camaraderie among neighbors may result in a cohesive neighborhood, which may increase safety and decrease crime. In other words, neighborhood cohesion may be indirectly related to PA. Also, residents of a cohesive neighborhood may share health-related information that may increase awareness and knowledge about how and where to access PA programs and resources. It is necessary to elucidate the relationship of neighborhood dynamics with PA given that it may be a possible strategy for promoting community-wide PA.

Socio-cultural factors:

Acculturation. Acculturation is a multi-faceted and dynamic process which immigrants experience while adopting attitudes, values and behaviors of a new culture. It is generally considered to be a linear and unidirectional continuum of two or more cultures (e.g., American and Mexican) resulting from cultural and psychological changes when cultural groups or individuals come into contact.[33] Acculturation is difficult to quantify, yet commonly examined proxies of acculturation have included country of origin, markers of time (e.g., years living in the U.S.) and variables that change over time (e.g., language). Using single a measure, however, may not be adequate for capturing the dynamic acculturative process.[154] To address the dimensionality of acculturation, scales (e.g., Acculturation Rating Scale for Mexican Americans) have been developed to assess factors (e.g. language use, cognition, identity, attitudes and stress) likely to be involved in the process of acculturation.[155] Studies of Latinos have found that health behaviors change with increasing levels of acculturation.[130] As mentioned above, less acculturated Latinos may experience protective health benefits as a result of engaging in behaviors

such as low alcohol consumption, a healthy diet and certain types of PA (i.e., occupational, household, active transportation). Individuals who are in the middle of the continuum often demonstrate less healthy behaviors, which may have a negative health impact. Given that acculturated Latinos may exhibit healthy behaviors such a healthy diet and LTPA, it is necessary to discuss those studies examining the relationship between acculturation and PA in Latino adults.

To date, cross cultural studies have found that less acculturated Latinos engage in higher levels of nonleisure time PA (e.g., walking for transportation, occupational and household activities) compared with more acculturated Latinos or non-Latino Whites. [57, 63, 64] For instance, Wen et al. found that Latinos in California reported higher odds of walking (for transportation and leisure) at recommended levels of PA, and this behavior was less frequent the longer respondents lived in the U.S.[65] In contrast, other studies observed that while more acculturated Latinos engaged in greater levels of LTPA,[2, 38, 63] less acculturated individuals engaged in higher levels of leisure-time physical inactivity.[33, 66] Berrigan et al. found a similar trend when examining the association between acculturation (assessed by language preference) and LTPA.[63] Pichon and colleagues found that less acculturated Latinas (measured by a 30-item scale) engaged in less vigorous-intensity PA, whereas more acculturated Latinas engaged in moderate-intensity PA.[156] Slattery et al., however, reported that more acculturated Latinas (assessed by language fluency) engaged in greater amounts of household and vigorous-intensity activities.[157] For lack of a gold standard to assess acculturation, has rendered inconsistent study outcomes.[2] One study considered multiple proxies of acculturation in relation to PA. Martinez et al. examined the relationship between four indices of acculturation and

active school commute among Latino child-parent dyads living in a border region.[64] Although separate models for each acculturation measure (e.g., nativity, language preference with family, years in the U.S. and the 12-item acculturation scale) produced mixed results, parents who were Mexican-born or living in the U.S. for <12 years actively commuted to school with their child more often than their more acculturated counterparts.

For the most part, studies indicate a positive relationship between acculturation and LTPA in addition to a change in PA patterns (e.g., an exchange of habitual activity patterns for leisure time activities). Less acculturated Latinos, however, may benefit from nonleisure activities (e.g., active transportation), which raises the need to establish the relationship between acculturation and different types of PA. To better understand acculturation as it relates to health behavior, researchers have recommended the use of other statistical approaches and modeling techniques.[33, 39] For example, confirmatory factor analysis (will be discussed in methods) may be useful to address the multidimensional properties of acculturation. Also, past research has investigated acculturation as a correlate of PA, yet it is possible that the acculturative process moderates the relationship between social cognitive factors and PA. Thus, future studies should involve an innovative statistical approach when examining the role of acculturation on health behavior.[39]

Physical/Environmental Factors

Characteristics of the built environment (i.e., objective) play a vital role in community health and health behavior, and can prevent or facilitate PA.[122, 158] For example, the availability of safe parks and recreation in a neighborhood may increase the

possibility of leading an active lifestyle. Pedestrian safety in a neighborhood can facilitate walking and bicycling. Due to the complexity involved in changing the built environment (e.g., community organizing, advocacy and/or policy) for PA promotion, it has received little empirical study. The existing literature on the role of the environment on PA is summarized below.

Physical Activity Community Resource Awareness. Access to parks and PA resources in the community may provide opportunities for LTPA; therefore, awareness of existing resources may also be related to PA behavior.[159, 160] Community resource awareness is a relatively new construct that can be assessed in multiple ways to capture objective aspects of the physical environment. For instance, a measure might ask participants to respond on a scale from "strongly disagree" to "strongly agree" regarding access or presence of PA resources.[161] Other measures may ask resident participants to check off resources they know of from a list of available PA community resources. Respondents also may be asked to report the frequency of community resource use in their community.

Little is known about the relationship between community resource availability and PA, yet a modest amount of research has observed high levels of PA in predominantly White communities with parks.[159] In addition, empirical support suggests that having a greater number of neighborhood parks and recreation areas near homes is associated with greater levels of PA.[101, 145, 160] Whites living in neighborhoods with parks also reported more opportunities for PA compared to residents of impoverished communities with fewer resources.[141]

Less acculturated Latinos are more likely to have low educational attainment, earn low wages, and live in low SES neighborhoods.[162] Given this, it may be that disadvantaged neighborhoods have few PA resources, thereby influencing levels of community-wide PA. In a community study of Latinos, residents who rated their neighborhood as poor disagreed that they had available facilities for PA engagement.[161] Also, focus groups with Latinas revealed that lack of parks near homes and not knowing about PA community programs were barriers to PA.[123, 163] While these findings would be expected, there is a need to understand the low levels of PA communities with PA resources. It is possible that perceptions of safety influence perceived availability of parks or individuals lack the knowledge and skills to access available resources in their community. Further studies are needed to elucidate the pathway by which community resource awareness is related to PA to improve community wide PA promotion.

Physical Structures for Safety. The presence of sidewalks and crosswalks facilitates PA behavior by increasing pedestrian safety for walking or bicycling. Without these physical features, fast moving or congested traffic are barriers to PA. Several scales have been developed and validated to assess the presence or lack of structural features that impede or facilitate PA. For example, the Neighborhood Environment and Walkability Survey (NEWS) assesses the presence of lighting, traffic and land-use mix for walkability.[121, 122] Pikora and colleagues also developed a scale to assess "functional," "safety," "aesthetic," and "destinations" as environmental features.[120] These scales have been used in combination to assess relationships between environmental attributes and PA behaviors.[139, 164]

For the most part, recent research examining the relationship between the environmental safety and PA has been conducted among middle-class, White adults. These studies showed that environmental barriers to PA and/or accessing PA facilities include heavy traffic, sidewalks, street lighting, and hills.[100, 164] Other studies observed that communities with crosswalks, light/slow traffic and destinations within walking distance were conducive for leisure and nonleisure walking (e.g., use of active transportation).[164] Across ethno racial groups of middle and older-aged women (e.g., African-American, Hispanic, Native-American, and White), King et al. found that one or more of the following were barriers to PA: heavy traffic, unattended dogs, lack of sidewalks and high crime rates.[100, 122]

Empirical evidence supports that having areas to walk is associated with higher levels of PA in Latino neighborhoods.[93] Qualitative studies have revealed that Latinas of disadvantaged neighborhoods, shared many of the same environmental barriers to PA as those reported by Whites (e.g., lack of sidewalks and parks, and presence of unattended dogs).[114, 148, 151, 165] In addition, lack of public transportation and being afraid to walk alone were expressed as barriers to accessing PA resources.[117, 141] Although heavy traffic is commonly reported to be a barrier to PA, Latinas living in neighborhoods with heavy traffic were more physically active outdoors than those living in areas with light traffic.[142] Researchers concluded that the presence of traffic may have provided Latinas with a sense of safety. Given these findings, it is important to establish the pathway between the physical environment and PA among Latinos.

Other Relevant Considerations in Conducting Health Behavior Research with Latino Participants

For the most part, traditional statistics (e.g., multiple regression and bivariate correlation analyses) have been applied in PA research to examine cross-sectional data for the purpose of identifying predictors, mediators and moderators of PA engagement. Traditional statistical techniques also have been employed to examine multi-level influences on PA, yet these approaches do not allow researchers to simultaneously examine multiple patterns of relationships within and across levels of analysis. Furthermore, traditional statistics have not been successful at providing conclusive evidence for moderators and mediators of PA; perhaps a conceptual limitation given that theory and statistics should go hand in hand. Filling in the gaps in PA research merits the application of innovative statistical approaches that can be integrated with theoretical frameworks (e.g., social ecological model), especially for the purpose of examining multi-level influences on PA. Furthermore, it is essential that researchers employ other statistical methods to allow hypothesis testing regarding potential mediators and moderators of PA. Given this, it would be appropriate to apply structural equation modeling (SEM) when investigating cross-sectional data for investigating relationships between correlates, moderators and mediators of PA.

Structural equation modeling refers to a series of procedures, not just a single statistical technique. SEM begins with a priori specifications that reflect the researcher's hypotheses which can be tested in analysis. Unlike traditional techniques (e.g., analysis of covariance), SEM allows the representation of a distinction between observed and latent variables. A combination of confirmatory factor analysis (CFA) and path models can be used to provide unbiased simultaneous parameter estimates while testing complex models.[166, 167] This allows for the assessment of latent constructs with more reliability. In

addition, SEM accounts for interactions among theoretical constructs (latent factors) and observed variables allowing researchers to examine relationships between multiple independent, intervening, and dependent variables. It is possible to understand correlations among a set of variables and to explain as much of their variance as possible with the model specified by the researcher.[167] Entire models (comprised of multi-level influences) can be evaluated which contributes to an analysis with a more social ecological perspective. Individual parameters or effects also are represented in SEM; however, in the end the full model must be rejected or accepted.

The application of an advanced method such as SEM has mostly been utilized in the health care field to evaluate physical and mental health.[168] SEM also has been employed to understand relationships between health-related quality of life, depression, and psychosocial factors. Recent literature states that SEM is an ideal method for examining the proposed influences of PA on an individual.[107] Recent studies have applied SEM to assess correlates of PA such as those that are psychosocial and environmental.[7, 169-171] McAuley and colleagues used SEM to describe relationships between psychosocial variables and exercise among older White adults.[7] McNeil and investigators applied SEM to examine multi-level influences on PA among Black and White adults.[171] Motl et al. used SEM to examine the indirect and direct influences of psychosocial and environmental factors of PA among adolescent girls.[170] Among Latinos, Pichon et al. used SEM to examine neighborhood safety on Latinas' PA. Although PA studies involving SEM exist, they are few and limited to Whites and females; minority groups and males are highly underrepresented.

To increase the scientific community's understanding of PA among Latinos, it is necessary to move beyond traditional statistics and to apply more multivariate modeling techniques. Advancing PA research in Latino communities requires perspectives of the various contexts in which PA occurs; therefore, SEM is ideal for examining dynamic and multi-level correlates of PA in addition to investigating multidimensional factors such as acculturation. For example, given the numerous ways to quantify acculturation, SEM can be used to examine acculturation as a latent construct. Furthermore, measures used to assess factors (e.g., self-efficacy, perceived safety, etc.) can also be examined as latent constructs rather than the traditional use of summary scores. In this way, SEM can then be used to test a priori models to describe the occurrence of PA in the Latino community.

Public Health Significance

In summary, low levels of energy expenditure are increasingly recognized as contributors to a variety of chronic health problems such as diabetes, osteoporosis, heart disease and cancer. Despite the well-known health benefits, levels of PA remain low among many Americans, in particular U.S. Latinos. Furthermore, Latinos living along the U.S.-Mexico border are disproportionately affected by chronic diseases such as diabetes. Most PA research focuses on the general U.S. population; therefore, PA measures are largely intended to describe the nature of LTPA among them. Given that LTPA is not so prevalent in Latino adults, commonly used measures may not be culturally suitable or appropriate for assessing their PA behavior.[59] For example, Latinos may also use active transportation, which they may not consider to be a form of PA; therefore, studies conceptualizing PA as leisure time behavior do not account for these differences in

behavioral patterns. Given this limitation, future research must incorporate culturally appropriate assessment of PA to provide more valid assumptions about the PA patterns (e.g., domains and levels) of Latinos.

Of the available studies identifying correlates of PA among Latinos, findings have been inconsistent due to a lack of culturally appropriate methods and/or assessments of PA. In addition, relevant measures to assess correlates of PA may not been culturally appropriate and may not account for the cultural factors associated with PA. Furthermore, studies have not been consistent in the use of acculturation measures, and analytical methodology has not been advanced to account for its multidimensionality. Most of the studies describing PA among Latinos pertain to Latinas, which may also limit the extent to which conclusions can be drawn regarding PA among Latino adults. Given the expected rise in the number of Latinos over the next 20 years, research efforts should aim to provide a better understanding of the multiple contexts of PA in Latino men and women. There is a need to recognize dynamic multi-level influences on PA while considering cultural differences between less acculturated and more acculturated Latino groups.

For the most part, past paradigms of PA assume that PA is associated with individual factors. Less attention has been given to the social and environmental correlates of PA, especially among Latinos. Furthermore, there is a lack of study that describes the simultaneous influence of multi-level factors on PA among Latinos, in particular those of border communities. In addition to the lack of culturally appropriate methods to describe PA behavior among Latinos, there is a lack of a social ecological perspective. Application of a social ecological framework is warranted to provide a more

complete picture of the contextual factors of PA among Latinos, and to draw better conclusions about how to promote an active lifestyle among them.

RATIONALE AND HYPOTHESIS

This study highlights the need for research founded on culturally appropriate methods when examining the PA of Latino adults. To address gaps in existing PA literature, this study proposes to examine data obtained from a culturally appropriate PA measure. The investigation will include individual correlates of PA in addition to acculturation as it may moderate the relationship between psychosocial variables and PA patterns. Using structural equation modeling (Aims 1 and 2), a simultaneous examination of contextual factors that may influence PA will be provided. These models will be compared to identify which factors affect PA the most. To our knowledge, this study will be one of the first to describe the nature of PA among Latino men and women living along the San Diego-Tijuana border. The results will be used to advance PA research and interventions that aim to promote PA in Latino populations.

The following are hypothesized for each Aim:

Aim 1: To assess the relationship between self-efficacy and social support on LTPA, while examining potential moderators of this relationship (i.e., acculturation and gender) among Latino adults in San Diego County (Figures 2.2 and 2.3).

a. Social support will have a direct (positive) relationship with LTPA.
b. Social support also will be mediated by self-efficacy.
c. Higher levels of acculturation will moderate the relationship between self-efficacy and LTPA.

d. There will be no gender by correlate interaction (e.g., social support and self-efficacy).

Aim 2: To test a theoretically and empirically based social-ecological model of PA, by examining theorized direct and indirect effects of social (i.e., neighborhood safety and neighborhood cohesion) and environmental (i.e., physical factors and PA resource awareness) on PA (i.e., LTPA and nonleisure walking/use of active transportation) of Latino adults in San Diego County (while controlling for potential individual correlates from Aim 1; Figures 2.4 and 2.5).

a. Neighborhood cohesion will be positively related to LTPA and nonleisure walking.
b. Increased levels of PA resource awareness will be directly (positive) and indirectly related to LTPA and nonleisure walking.
c. Neighborhood safety (e.g., social and physical factors) will be positively related to LTPA and nonleisure walking.
d. Social and environmental safety will be significant factors among women participants but not men.

Aim 3: To explore which models (i.e., individual-level or multi-level) explain more variance, and to identify which factors have a larger influence on LTPA and use of active transportation.

III. METHODS

DESCRIPTION OF PARENT STUDY

San Diego Prevention Research Center – Promoting PA among Latinos in a U.S./Mexico border community

Sampling Procedures

Given the proximity to the border, the target Latino population was expected to be less acculturated; therefore the SDPRC survey underwent rigorous mixed-methods prior to conducting interviews. Culturally appropriate methods (i.e., forward and backward translation, reviewed for cultural content and sensitivity, and pilot-testing) were applied to enhance the survey's performance in the target population. Mixed-methods included forward translation performed by native Spanish speakers, and backward translation performed by English speakers. Also, community members and bilingual researchers reviewed the English and Spanish versions for cultural relevance (adaptation), comprehension, and for maintaining conceptual and cultural equivalence. The survey included a range of constructs (e.g., individual, social, cultural, and environmental) deemed important and related to engaging in PA. The International Physical Activity Questionnaire (IPAQ) was selected to assess self-reported PA. The main survey included proxies of acculturation, individual (i.e., psychosocial and demographics), social (i.e., neighborhood) and environmental (i.e., physical) constructs/factors related to PA. Implementation of the survey was IRB (SDSU and UCSD) approved prior to conducting interviews in the South Bay community.

Survey Procedures

Given the proximity to the border, the target Latino population was expected to be less acculturated; therefore the SDPRC survey underwent rigorous mixed-methods prior

to conducting interviews. Culturally appropriate methods (i.e., forward and backward translation, reviewed for cultural content and sensitivity, and pilot-testing) were applied to enhance the survey's performance in the target population. Mixed-methods included forward translation performed by native Spanish speakers, and backward translation performed by English speakers. Also, community members and bilingual researchers reviewed the English and Spanish versions for cultural relevance (adaptation), comprehension, and for maintaining conceptual and cultural equivalence. The survey included a range of constructs (e.g., individual, social, cultural, and environmental) deemed important and related to engaging in PA. The International Physical Activity Questionnaire (IPAQ) was selected to assess self-reported PA. The main survey included proxies of acculturation, individual (i.e., psychosocial and demographics), social (i.e., neighborhood) and environmental (i.e., physical) constructs/factors related to PA. Implementation of the survey was IRB (SDSU and UCSD) approved prior to conducting interviews in the South Bay community.

DESCRIPTION OF THE CURRENT STUDY

The purpose of the present study was to examine multi-level correlates of PA among a community-based sample of Latinos from the larger study described above. Data were obtained from the SDPRC community survey. It is these multi-level correlates of PA that influence PA in the mainstream U.S. population. This dissertation included a cross-sectional study design from which data were collected from 661 Latino participants in San Diego County. Analytical methods involved structural equation modeling

(described above) to test several relationships, elucidating potential pathways by which social cognitive and ecological factors influence PA.

There are several objectives for this study. First, it was of interest to examine levels of LTPA and the relationship with self-efficacy, and social support, while accounting for potential moderators (i.e., acculturation and gender). These individual-level variables may contribute to insufficient PA among Latinos, and it is unknown how these variables differ by gender and acculturation status. Within this aim, it was also of interest to assess simultaneous relationships using SEM; this statistical approach has been noted to be an ideal method for comprehending the effects of acculturation on health behaviors.[39] Second, social (i.e., social cohesion and neighborhood safety) and ecological factors (e.g., perceived and physical environment) may impact levels of LTPA and walking for transportation in the general population; therefore, it was of equal importance to examine these relationships among Latinos. Lastly, to provide a deeper understanding of the factors that influence Latinos' PA the most, it was of interest to compare the explained variance in the outcome for the individual- and multi-level models.

Description of Variables and Measures

A summary of measures and their origin is provided below (Table 3) in addition to a description of potential correlates and outcome variables.

Potential correlates of PA

The variables of interest included self-efficacy and social support for PA, neighborhood safety and cohesion, community resource awareness, and in addition to potential moderators (i.e., acculturation and gender). Possible confounders included monthly household income, age, education, number of children, marital and employment

statuses, BMI, motivation (i.e., dietary intake of fruit/vegetable and fast food), and neighborhood aesthetics.

Table 3.1. Correlates, Mediators, Moderators and Outcome Variables (Cross-sectional)

	Measure Name/Obtained from	**Items/Measure**	**Reference**
Correlates		**Total=39**	
Social Support	Social Support for Exercise	6	Sallis et al., 1987
Neighborhood cohesion	Measure of perceived microsystem	8	Seidman et al., 1995
Neighborhood safety	Neighborhood Environment Walkability Scale	9	Saelens et al., 2004
Awareness of PA resource	Sumter County Active Lifestyles Study	8	Ainsworth et al., 2002
Motivation	Dietary intake	2	
Demographics	Age, SES, number of children, education, employment and marital status	6	
Mediator		**Total=3**	
Self-Efficacy	Self-efficacy scale for Exercise	3	Sallis et al., 1988
Moderators		**Total=9**	
Acculturation	Short acculturation scale, country of birth, time living in the U.S., language preference	8	Marin et al., 1987
Demographic	Gender	1	
Outcomes		**Total=10**	
LTPA	IPAQ	4	Craig et al., 2003
Active transportation	IPAQ	6	Craig et al., 2003
Total Items		**61**	

Demographics. The items used to assess demographic variables included age (continuous), gender, education, number of children (under 18 years) living at home, and household income. The item responses for education were as follows: employed (full/part-time or self-), homemaker, unable to work, out of work, student and retired. Level of education was assessed by one of the following item responses: kindergarten/less, grades 1-6, grades 7-8, grades 9-11, high school graduate/GED, some college, college graduate and graduate work. Average monthly income was open-ended or assessed in increments of $500, ranging from $500/less to $5000/more. Item response options for marital status were the following: married, single, divorces, separated, living as married, and widowed. The item assessing number of children living at home was

open-ended. The item assessing the age of participants was open-ended. Body mass index, a continuous variable, was calculated using self-reported height and weight.

Self-efficacy for Exercise. From a 12-item scale developed by Sallis and colleagues, 3-items were included in the SDPRC community survey. Participants were asked to assess their confidence for engaging in PA in various situations. Response options were “I’m sure I cannot”, “I don’t think I can”, “maybe I can”, “I think I can”, and “I’m sure I can”. Values ranged from 1 to 5, and a higher score indicated higher self-efficacy for exercise. Test-retest reliability for the scale was 0.68. The measure was culturally adapted and translated into Spanish and showed good internal consistency (.80) in a pilot-study of Latinas.

Behavioral Attribute (Motivation). Observed dietary behavior was used as a measure of motivation to exercise. Survey items assessing dietary behavior were daily fruit and vegetable intake and weekly fast food consumption. Participants were asked to report how many times in typical day they ate fruits (including juice) and vegetables (not including French fries). Individuals were also asked to report the number of times in the past week they ate fast food from an establishment, lunch wagon or vending machine.

Social Support for Exercise. Developed by Sallis and colleagues, a 13-item scale to assess social support for exercise was reduced to 6-items for the SDPRC community survey. Respondents were asked how often they received PA social support from family and friends. Response options were “never”, “rarely”, “sometimes”, “often”, and “very often”. Scores ranged from 1 to 5, and a higher mean score indicated more PA social support. This measure has shown good internal consistencies ($\alpha = 0.61$-0.91), particularly

in a predominantly Latina sample ($\alpha = 0.75$). The measure was culturally adapted to fit Latino cultural norms and translated from English to Spanish.

*Acculturation. C*ommonly used proxies, such as country of birth, (U.S. or Mexico), language preference (English or Spanish), and years living in the U.S. (<12 years or ≥12 years), were used to assess acculturation in the current study. The Short Acculturation Scale for Hispanics (SASH) was also used given that acculturation scales are also used in health behavior research.[64, 66, 130, 172] This12-item scale was developed by Marin et al. and is used to place Latinos in the continuum (or process) of acculturation. For the purpose of the SDPRC community survey, the scale was shortened to 8 items. Respondents were asked what language they spoke or used for reading, speaking, watching television, and listening to the radio. Responses included “only Spanish”, “more Spanish”, “more Spanish than English”, “both equally”, “more English than Spanish”, and “only English”. Scores ranged from 1 to 5, with a lower score indicating a greater degree of Mexican-orientation and a higher score indicated a greater degree Anglo-orientation. Validity checks for this scale ranged from 0.65 to 0.86. The measure was validated in samples of Latinos and deemed an appropriate scale for Mexican-Americans ($\alpha = 0.92$).

Measure of perceived microsystem (neighborhood cohesion). The SDPRC community survey included eight items that were selected from a 12-item scale validated by Seidman et al. Participants’ assessed their attraction-to-neighborhood, degree of neighboring, and psychological sense of community. Response options were “very true”, “sort of true”, and “not at all true”. A mean score was calculated and a higher score

indicated having stronger ties with neighbors. The scale has shown good reliability for a six-item scale ($\alpha = 0.83$) and was available in Spanish.

Neighborhood Environment Walkability Scale. This scale included two subscales. One subscale of items assessed participants' perceptions of crime safety in their neighborhood. Response options, based on a Likert scale, were "strongly disagree", "somewhat disagree", "somewhat agree", and strongly agree". A mean score was calculated for the subscale and a higher score indicated a more favorable atmosphere ($\alpha = 0.83$). The second subscale asked participants to assess their perceptions of pedestrian and traffic safety in the neighborhood. The items consisted of street lighting, availability of crosswalks, speed of traffic and unattended dogs. Response options, based on a Likert scale, were "strongly disagree", "somewhat disagree", "somewhat agree", and strongly agree". A mean score was calculated for the subscale and a higher score indicates a more favorable atmosphere ($\alpha = 0.77$).

Sumter County Active Lifestyles Study. This scale was developed by the University of South Carolina Prevention Research Center to assess individual perceptions of physical activity supports in the social and physical environment. There were a total of three subscales, and each included four items. One subset asked participants about places and ways to engage in PA in their community. Within this subset was an item assessing neighborhood aesthetics, which asked participants to what extent they agreed that there were many interesting things to look at in their neighborhood. Response options, based on a Likert scale, were "strongly disagree", "somewhat disagree", "somewhat agree", and strongly agree". Another subscale asked participants to assess their satisfaction with the number and types of places for PA. Response options were "strongly dissatisfied",

"somewhat dissatisfied", "somewhat satisfied", and strongly satisfied". A mean score was calculated for each subscale and a higher score indicated greater satisfaction and more physical and environmental support for PA. A third subscale, which was adapted for the SDPRC community survey, assessed park visitation. This subscale asked participants about park visitation for exercise at 20 PA community parks/resources existing in the target community. The scale has been tested for reliability and validity in Sumter Country, South Carolina (κ= -0.07 to 0.25 and ρ= 0.28 to 0.56).[173]

Dependent Variables: Meeting Physical Activity Recommendations

Two PA behaviors were assessed using the International Physical Activity Questionnaire (IPAQ). This scale was developed as a comprehensive assessment of health-related PA and sedentary behavior in adults. The 31-item IPAQ long form assesses a broad range of daily physical activity habits: work, chores, transportation, and leisure (α=.80). Only the items assessing walking for errands/transportation and LTPA were used. With respect to LTPA, participants were asked, "During the last 7 days, on how many days did you do moderate [or vigorous] physical activities in your leisure time for at least 10 minutes?" These items were followed up by asking how much time was usually spent on one of those days doing PA during leisure time. From these items, it was determined whether participants met the recommended levels of PA. Participants met the PA guidelines if they engaged in one of the following: at least 150 minutes of moderate-intensity PA, at least 75 minutes of vigorous-intensity PA or a combination of the moderate- and vigorous-intensity PA. In regard to use of active transportation, participants were asked, "During the last 7 days, on how many days did you travel by motor vehicle [or walk], to do errands or to go from place to place…for at least 10

minutes at a time?" These two items were followed up by asking how much time was usually spent in a motor vehicle or walking on one of those days. Similar to meeting LTPA guidelines, participants were categorized as adherent or nonadherent to PA recommendations during nonleisure time walking (NLTW).

Data Analysis

Preliminary Analysis

The preliminary statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows Version 15.0 (Chicago, IL). The distribution of each PA outcome (i.e., LTPA and NLTW) was calculated and data was not uniformly distributed, even after applying square root and log transformations. As a result, LTPA and NLTW were dichotomized as meeting/not meeting the PA guidelines, which was previously described. Categorical responses for other observed variables (i.e., such as education, marital status, employment status, monthly household income and BMI) were recoded. Education, marital and high school statuses, monthly household income and number of children (under 18 years) were dichotomized (i.e., high school/GED vs. some college/graduate, single vs. married/living with a partner, unemployed vs. currently employed, ≤$1500 vs. ≥$1501, ≤1 child vs. ≥2 children). Age was left continuous and BMI was trichotomized (normal/under, overweight, or obese). Descriptive data (e.g., frequencies, means, and standard deviations) were generated for all variables (Table 4.1). Chi-square statistics and independent t-tests (p-value significant at .05) were computed for all variables by gender and level of acculturation.

Main Analysis

Confirmatory Factor Analysis (CFA): Prior to modeling any relationships between constructs, measurement models (e.g., self-efficacy, PA social support, neighborhood safety, neighborhood cohesion, and community resource awareness) were evaluated using CFA, to confirm the factor structure of the latent constructs included in the models.

Structural Equation Modeling (SEM): Structural equation modeling using Mplus for Windows, version 4.1 was used to test the fit of hypothesized PA models (Figures 1.2-1.5) to the data collected from participants. As described earlier, SEM was used to test a series of regression equations simultaneously such as the theorized direct, indirect and mediated relationships hypothesized for the current study. SEM assumes that all variables measured have measurement error, unlike regression analysis, which equally assumes that independent variables are measured perfectly. The measurement error in SEM is accounted for in an explanatory model. Because of the unreliability in the construct indicators, a strength of SEM is that estimated relations among latent variables are not biased.

Model fit. Structural equation modeling provides an opportunity to identify the best fitting model.). Model fit was assessed by evaluating Chi-square, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Chi-square statistic, based on the maximum likelihood method of estimation, assesses absolute fit of the model to the data.[174] The Chi-square is commonly used because it is a good representation of the process that generated the data in the populations. A chi-square with a nonsignificant test statistic (*p)* indicates a close fitting model, and it is an indication that the hypothesized model and the covariance structure matrix are the same.

Chi-square is sensitive to large sample sizes, which results in the need for other fit indices. The CFI was used to test the proportionate improvement in fit, by comparing the target/estimated model with the baseline/null model. When using the CFI, the null value specifies that all measures variables are uncorrelated, that there are no latent constructs and a value of 1.0 represents a perfect fit. Minimally acceptable fit was based on a CFI value of .90; good fit was indicated by values approximating .95.[175] Parsimony adjusted fit indices were provided by the RMSEA, which measures the difference between the true population model and the hypothesized model per degree of freedom. The RMSEA represents closeness of model fit, demonstrating close and exact fit with values approximating .06 and zero.[175, 176] The standardized root mean residual (SRMR) was used to capture the average difference between the observed correlation and the model-implied correlation. A value of less than .08 indicated an acceptable fit.[175] The parameter estimates, standard errors, z-statistics, and squared multiple correlations were inspected for sign and/or magnitude. Lastly, the SRMR captured the average difference between the observed correlation and the hypothesized model. A value of less than .08 indicated an acceptable fit and a value less than .05 indicated a good fit.

Statistical Considerations

Sample size and power: An important aspect of SEM is over determining adequate power. One assumption is that the CFA requires a large sample size. A minimum of 200 cases were required given the following restrictions: 10 cases to 1 observed variable and 10 cases to 1 estimated parameter. The models developed for Aim 2 involved 49 observed variables (49x10), an indication that 490 cases were required. For the present study, a total of 610 cases were available for analysis; therefore, the assumption was met.

Secondly, the number of observed scales per LV must be at least 3. This assumption was also met given that there were at least 3 observed variables for each latent construct. Observed variables do not have to indicate a LV to be included in the model.

Missing data: The initial sample size included 672 participants. The sample size was reduced to 668 given that one participant had most information missing, and four cases over-reported PA. These outliers were determined by the IPAQ standard, which is to exclude cases in which sum total of all walking, moderate and vigorous time variables exceeds 960 minutes (16 hours). This rule assumes that, on average, an individual spends 8 hours per sleeping. Lastly, full-information maximum likelihood (FIML) was used to account for missing data because there was missing data for some items assessing correlates of PA. In comparison to other missing data techniques (e.g., pairwise and listwise deletion), FIML has yielded more accurate parameter estimates and fit indices with up to 25% of simulated missing data.[177]

IV. RESULTS

DISTRIBUTION OF PHYSICAL ACTIVITY AND INDIVIDUAL, SOCIAL AND ENVIRONMENTAL CORRELATES AMONG LATINOS IN SAN DIEGO COUNTY

Description of Sample

In the fall of 2006 a total of 672 Latinos were randomly sampled from a community in South Bay San Diego and completed the SDPRC community survey in English or Spanish. Demographic characteristics for the study population are summarized in Table 4.1. The study sample was predominantly female with a mean age of 39 years. Age did not differ by gender, but significantly differed by acculturation (i.e., number of years living in the U.S). Respondents living in the U.S. for <12 years were significantly younger than those who had lived in the U.S. for ≥12 years. Most participants were classified as less acculturated given that the majority were Mexican-born, Spanish-dominant with a Mexican-oriented acculturation score. On average, participants had lived in the U.S. for 19 years. More than half of surveyed respondents were married (or living with a partner); less acculturated Latinos were more likely to be married than their more acculturated counterparts. Half of respondents were unemployed with a low education level (e.g., ≤high school); less acculturated respondents (Spanish-speakers) had a lower education compared to more acculturated respondents. More than half of respondents earned a monthly household income greater than $1500.

Distribution of Potential Correlates of Physical Activity

In addition to the demographics described above, potential correlates of PA behavior included other individual-level factors such as behavioral attributes (i.e., fruit/vegetable and fast food intake), self-efficacy, and BMI. Social-level factors included

social support, and perceptions of neighborhood safety, cohesion, and aesthetics. Aspects of the built environment included perceptions of environmental safety and community resource awareness (e.g., knowledge and satisfaction of parks and resources, and use). The distributions of these parameters are summarized in Table 4.2.

On average, respondents were overweight, and nearly one third of the sample population was obese. Respondents living in the U.S. for <12 years had a significantly lower BMI than those living in the U.S. for ≥12 years. The mean number of fruits and vegetables consumed was four in a day while the number of times eating fast food was almost two times in a week. Statistical differences showed that females more than males had healthier dietary behaviors. Females ate about half a serving more of fruits and vegetables in a day and less fast food in a week than males. By level of acculturation, more acculturated respondents consumed fast food once more per week than their less acculturated counterparts.

Respondents were asked if they could engage in moderate-intensity PA in different situations (e.g., when sad/depressed, family takes a lot of time, and setting aside time), and more than half of participants were “sure” or “thought” they were capable of being active when they were sad/depressed (73%), when family/social life required a lot of time (63%), and that they could set aside time for a regular activity schedule (69%) .

Family offered more PA social support than friends. More than half of individuals reported that family “never” to “sometimes” encouraged PA (64%), offered doing PA (56%), and engaged in PA (81%) with them. These findings, however, differed by level of acculturation. Nearly half of more acculturated participants reported family was “sometimes” supportive of PA, whereas family “never/rarely” supported PA among more

than half of less acculturated individuals. The majority of participants reported that friends “never/rarely” encouraged PA (80%), offered to do PA (84%), nor engaged in PA (87%) with them.

Most participants had positive perceptions of their neighbors. Participants reported on fitting in with their neighbors, importance of having relationships with neighbors, getting a neighbor’s help in an emergency, and the ability of neighbors to distinguish a stranger in the neighborhood. Most individuals’ responses ranged from “very” to “sort-of true” (87%, 83%, 91%, 84%, respectively) that there was a sense of community within their neighborhood.

Participants were asked about perceived safety in their neighborhood for engaging in outdoor activities such as walking and playing. Individuals’ responses ranged from “strongly agree” to “strongly disagree” that their neighborhood was safe from crime, and that there was little risk involved with walking and participating in outdoors recreation. More than half of participants “somewhat/strongly agreed” that the speed of traffic was slow (54%), that dogs were attended (81%), and that it was safe enough to walk at night (53%) and during the day (83%). More than half of respondents reported that children were able to play outside (71%), there were crosswalks/pedestrian signals (76%), that bikers/walkers were visible from their home (54%). Almost half of respondents perceived that the streets were well lighted at night (49%).

Community resource awareness was assessed, and participants’ responses ranged from “strongly disagree/dissatisfied” to “strongly agree/satisfied”. More than half of participants “somewhat” agreed that they heard about ways to be active (65%), knew places to support activity (67%), and that they saw people being active in their

community (64%). Individuals also reported that there were interesting things to look at in the neighborhood (52%). Majority of participants were also satisfied with the number outdoor recreation areas (68%) and free/low cost recreation facilities in the neighborhood. On average, respondents used outdoors areas for PA eight times in the past month and visited PA community parks. Of 20 parks in the community, participants had frequented approximately four in the past year.

Prevalence of Physical Activity Behaviors

Participants were asked about the frequency and duration of 1) walking for transportation, 2) moderate-intensity LTPA, and 3) vigorous-intensity LTPA. These distributions are summarized in Table 4.2. The mean number of minutes of moderate-intensity LTPA was 58 per week (minimum of 150 min of activity per week), while for vigorous-intensity LTPA it was 70 in a week (minimum 75 min per week). Among participants, the mean total minutes of moderate-to-vigorous PA in a week was 128 minutes. There were statistical differences ($p<.05$) in the mean number of minutes of vigorous-intensity PA per week by gender and level of acculturation (Figure 4.1), which also contributed to a total mean difference in MVPA. Male and more acculturated respondents reported more minutes of MVPA in a week than their respective counterparts. On average, men reported more MVPA in a week (84 mins.) than women. Compared with less acculturated participants, more acculturated (i.e., SASH score) respondents engaged in more MVPA in a week (18 mins.). In contrast, respondents who lived in the U.S. for <12 years reported more minutes of MVPA in a week (33 mins.) than those living in the U.S. for ≥12 years. During leisure time, less than a third of

respondents met the *2008 Physical Activity Guidelines for Americans*; these estimates were lower than the national average of 57.2%, but consistent with other reports of Latinos living in San Diego County .[156, 178] Furthermore, statistical differences showed that males were more likely than females to meet LTPA guidelines.

During nonleisure time, less than one third of participants met PA guidelines (e.g., use of active transportation). In comparison with respondents who had lived in the U.S. for ≥12 years, respondents living in the U.S. for <12 years had a greater proportion of nonleisure walking at meeting PA guidelines. The mean number of minutes of nonleisure time walking in a week was 177. Within-gender differences showed that males and females living in the U.S. for <12 years engaged in more minutes of walking for transportation compared with their respective counterparts (Figure 4.1). Also, female respondents living in the U.S. for <12 years had a higher proportion of nonleisure walking at recommended levels than females living in the U.S. for ≥12 years (Figure 4.2).

MODELING INDIVIDUAL-LEVEL CORRELATES OF PHYSICAL ACTIVITY

Confirmatory Factor Analysis

Self-efficacy for PA. This scale consisted of three items assessing self-efficacy for engaging in moderate-intensity PA (Figure 4.3). The analysis showed that all three items loaded on one latent variable (df=0, just-identified model). Self-efficacy for engaging in moderate-intensity PA was defined by the following three items: "*I can* (a) do moderate PA (.65), (b) stick to a program of moderate PA (.88), and (c) set aside time for regular moderate PA (.70)."

Social Support for PA. There were a total of six items in the measure of PA social support (Figure 4.4). Confirmatory factor analysis showed that the construct of PA social support consisted of a two-factor correlated structure: a) social support from family, and b) social support from friends (X^2= 60.50, df= 8, CFI= 0.97, RMSEA = 0.10, SRMR= 0.05). Physical activity social support from family was defined by the following: "*Did your family…* offer to do PA with you (.82), do PA with you (.81), give you encouragement to do PA (.60)?" The second dimension of PA support was defined by the latter items, but provided that friends were the source of support (α. = .91, .90, .69, respectively).

Acculturation. A total of eight items were originally included from the 12-item SASH (X^2 =73.18, df= 9, CFI= .98, RMSEA= .10, SRMR= .02). A total of six items from the SASH loaded on the latent construct (Figure 4.5). The acculturation construct was defined by the respondents language(s) spoken (.92), read (.88), spoken at home (.83), spoken with friends (.85), language(s) of T.V. programs (.81), and language(s) of radio programs (.75). Other proxies of acculturation (e.g., number of years living in the U.S., language preference, and country of birth) did not load on the acculturation construct; these variables were examined as potential covariates.

Structural Equation Modeling

Model Specification

For Aim 1, three *a priori* and theoretically driven models were tested (Figures 4.9-4.13). The model presented in Figure 4.7 shows pathways between the individual-level latent and observed variables, and meeting LTPA guidelines. Subsequent models,

include the same paths, and account for proposed interactions by level of acculturation and gender (Figures 4.10-4.13).

According to our *a priori* proposition for meeting recommended levels of PA, the measurement model (Figure 4.9) examined individual-level and socio-cultural factors, namely PA self-efficacy, social support, and acculturation (X^2= 206.12, [df= 156, p<.05], CFI =0.99, RMSEA=0.03, SRMR= 0.03). It was hypothesized that PA social support would be directly and indirectly related to meeting PA guidelines; data did not support either of these relationships. Social support from friends was directly related to self-efficacy; however, the expected relationship between self-efficacy and meeting LTPA recommendations was not observed. Although acculturation was not associated with meeting LTPA guidelines, data showed a negative relationship between number of years living in the U.S. (β= -.12) and meeting recommended levels of LTPA. The model also examined dietary behavior as a motivating factor for adherence to PA. Dietary intake of fruits/vegetables was significantly associated with meeting recommended levels of LTPA (β=.04). The model controlled gender, education, martial status, and age. Being female was negatively associated with meeting LTPA guidelines (β= -.12), whereas higher education (β=.09) and being single (β=.15) were positively related to the LTPA outcome. Other covariates (e.g., income, age, BMI, having children, and weekly fast food consumption) were not significantly related to meeting PA guidelines and were excluded from the model.

It was expected that there would be an interaction between self-efficacy and acculturation. After including the interaction term with the individual-level relationships described above, results showed that the interaction between self-efficacy and

acculturation was not significant on meeting LTPA guidelines (Figure 4.10). Also, it was expected that there would be no gender by correlate interaction for self-efficacy and PA social support on meeting recommended levels of LT PA (Figure 4.11-4.13). After assessing the interactions term in the model, our data supported this hypothesis.

MODELING MULTI-LEVEL CORRELATES OF PHYSICAL ACTIVITY

Confirmatory Factor Analysis

An *a priori* model for the second aim included social-ecological factors such as neighborhood cohesion, neighborhood safety, and community resource awareness. Measurement models were evaluated to confirm factor structures of the latter constructs prior to structural equation modeling. The following describes the estimated measurement model for the purpose of achieving Aim 2:

Neighborhood cohesion. This scale included 8 items, and the construct was best described by four items ($X^{2=}$9.57, df= 2, CFI=.98, RMSEA=.07, SRMR=.02). The items (Figure 4.6) that loaded on the latent construct included the following: fitting in with neighbors (.56), having neighbor relations (.66), getting help from a neighbor in an emergency (.71), and neighbors being able to distinguish strangers in the neighborhood (.49).

Neighborhood safety. Nine items were included in this scale, and the construct was best described by two correlated factors (X^2 = 49.53, df= 19, $p<.05$, CFI=.95, RMSEA=.05, SRMR=.04). The two factors (.52) were perceived safety from crime/danger and structural/environmental facilitators for PA (Figure 4.7). Safety from crime/danger was defined by the following barriers to walking: traffic (.44), crime during

the day (.67), crime at night (.67), and unattended/stray dogs (.30). Structural/environmental safety included crosswalks/pedestrian signals (.41), lighted streets (.61), visible walkers and bikers (.58), and neighborhood is safe enough for children's play (.48).

Community Resource Awareness. The instrument for community resource awareness included nine items, and the construct was best described by three factors (X^2 = 17.58, df = 11, p>.05, CFI=.99, RMSEA=.03, SRMR=.03). The factors included: knowledge about ways and places to be active, satisfaction with PA community resources, and use and visitation of community parks within the past month (Figure 4.8). Satisfaction was correlated with knowledge (.72) and with use (.41), and there was a significant correlation between knowledge and use (.35). With respect to community resources, knowledge was defined by the three items assessing ways to be active (.59), places to support being active (.69), and noticing people being active (.62). Satisfaction was described by two items, specifically satisfaction with the number of outdoor recreational areas (.76) and satisfaction with the number of free/low-cost recreation facilities in the community (.74). The third factor (use) was defined by the monthly number of days using outdoors area for PA (.25), and the number of community parks visited in the past year (.71).

Structural Equation Modeling

Model Specification

An *a priori* and theoretically based model was generated for individual, social and environmental correlates of PA. Separate outcomes were examined for each model,

namely meeting recommended levels of LTPA (Figure 4.14) and nonleisure walking at recommended levels (Figure 4.15). In addition, these models controlled for the significant relationships found in the first aim.

Meeting PA Guidelines during Leisure Time and Correlates. The *a priori* model (Figure 4.14) for meeting recommended levels of LTPA demonstrated relationships with individual, social and environmental factors (X^2=735.85 [df= 635, p<.05], CFI= .97, RMSEA= .02, [95%CI=.01, .03], SRMR= .05). Contrary to our proposed hypothesis, the indirect pathways from both dimensions of PA social support (i.e., family and friends) to meets LTPA guidelines were not significant. Furthermore, self-efficacy was not related to meeting PA guidelines; therefore, it was not a mediator of the relationship between meeting LTPA guidelines and the following constructs: social support, community resource knowledge and community resource satisfaction. Acculturation (latent construct) was not related to meeting PA guidelines; however, the number of years living in the U.S. was largely associated with meeting recommended levels of LTPA (β= -.31). As expected, neighborhood safety was directly related to meeting LTPA guidelines, but the effects were marginal and the direction of association differed for each dimension (i.e. structural safety vs. safety from crime). For example, structural safety was negatively related to meeting LTPA guidelines ((β= -.27), whereas the relationship between safety from crime and meeting PA guidelines was positive (β=.18). Additionally, safety from crime was a mediator of the relationship between neighborhood cohesion and meeting LTPA guidelines (indirect effect β=.33). As expected, community resource use, a dimension of community resource awareness, was directly related to meeting recommended levels of LTPA (β=.09). The model controlled for marital status,

education, years living in the U.S. and gender. Being single was positively associated with meeting LTPA guidelines (β=.17), while being female and years living in the U.S. were negatively related to the outcome ((β= -.15 and β= -.31, respectively). Education was not associated with meeting LTPA guidelines. Other variables tested in this model were employment status, income, having children, BMI, daily fruit/vegetable intake, and weekly fast food consumption. Findings did not show significant effects, and for simplification of the model, the aforementioned variables were not included in the final model.

Meeting PA Guidelines during Non-leisure Time and Correlates. The *a priori* model non-leisure walking at recommended levels (Figure 4.15) included relationships with individual, social and environmental constructs (X^2=490.79 [df= 433, p<.05], CFI= .98, RMSEA= .02, [95%CI=.01, .03], SRMR= .05). Physical activity social support from friends was not significantly related to self-efficacy, which was not related to nonleisure walking at recommended levels. Results showed that acculturation was negatively associated with nonleisure walking at recommended levels (β= -.15). Contrary to our hypotheses, there were no significant relationships between neighborhood safety (i.e., crime safety and structural safety), neighborhood cohesion and nonleisure walking at recommended levels. Additionally, environmental factors (i.e., community resource use and neighborhood aesthetics) were not associated with meeting PA guidelines during nonleisure time. Results indicated that there were several significant covariates, specifically gender and other proxies of acculturation. Being female (β=.16) and being in the U.S.-born (β= .25) were positively related to walking at recommended levels, years living in the U.S. and monthly income were inversely related to nonleisure walking at

recommended levels (β= -.23 and β= -.04, respectively). Demographic factors such as education and employment status were not significant. Other covariates (e.g., BMI, age, number of children, and marital status) were examined, but were excluded from the analysis given that they did not contribute to the model. Lastly, a multiple group analysis did not show significant differences by gender.

COMPARISON OF INDIVIDUAL-LEVEL AND MULTI-LEVEL MODELS

An exploratory aim of the current study was to compare the explained variance produced by the individual-level and multi-level models (Figures 4.9-4.15). The individual-level model included self-efficacy, PA social support, and acculturation in combination with demographic factors. The structural equation model illustrated that for meeting LTPA guidelines, PA social support (i.e., family and friends) accounted for 4% of the variance in self-efficacy. Self-efficacy, acculturation, fruit/vegetable intake and demographic variables, these factors explained only a small portion of the variance (9%) in meeting PA guidelines during leisure time.

The structural equation for the multi-level model, specifically individual, social and environmental contexts of PA, illustrated that PA social support (i.e., family and friends) and community resource factors (i.e., knowledge and satisfaction) accounted for 2% of the variance in self-efficacy. Neighborhood cohesion accounted for 4% of the variance in perceived safety from crime. Comprehensively, individual, social and environmental factors accounted for 36% of the variance in meeting recommended levels of LTPA.

In terms of meeting recommended levels of PA during nonleisure walking, the structural equation model illustrated that PA social support from friends accounted for little explained variance in self-efficacy (1%). Neighborhood cohesion explained only 5% of the variance in perceived safety from crime. The range of multi-level factors, namely individual, social and environmental factors, accounted for 28% of the variance in nonleisure walking at recommended levels. When comparing all three structural equations, the multi-level model for LTPA explained more variance next to meeting the PA guidelines during nonleisure time (R^2 = .36 vs. R^2 = .28). Lastly, the individual-level model explained the least amount of variance of the three PA models (R^2 = .09); an indication that simultaneous inclusion of multi-level influences on LTPA resulted in a much more explanatory model of PA in this Latino community sample of San Diego County.

Summary of Key Findings

Individual-level correlates of interest were not associated with meeting PA recommendations in both individual-level and multi-level models. In other words, the expected relationships between PA social support, self-efficacy, acculturation (latent construct) and PA were not significant. Furthermore, there were no differences in these mechanisms by gender or level of acculturation.

Significant covariates for the relationships between PA and its correlates were significant in both the individual- and multi-level models. The individual-level model showed that education level and engaging in healthy dietary behavior (i.e.., fruit and vegetable intake), were positively related to LTPA among Latino respondents. This

behavior, however, did not play a significant role in the multi-level model of LTPA. Demographic variables, namely marital status, gender and the number of years living in the U.S., were significant factors in both individual- and multi-level LTPA models. Being single was positively associated with engaging in sufficient levels of LTPA, whereas being female and living in the U.S. for 12 or more years were negatively related to the PA outcome.

In a multi-level model of LTPA, social (i.e., safety from crime and neighborhood cohesion) and environmental factors (e.g., structural safety and community resources awareness) played a significant role in meeting LTPA guidelines among Latino respondents. Neighborhood cohesion had positive indirect relationship with meeting LTPA guidelines, which was mediated by safety from crime. Perceived safety from crime was positively related with the LTPA outcome; this relationship was marginally significant. Furthermore, structural safety had an inverse relationship with meeting recommended levels of LTPA, which was also marginally significant. Lastly, community resource use had a positive effect on meeting LTPA recommendations.

A multi-level model for meeting PA guidelines during non-leisure time was also examined. The structural equation model illustrated that self-efficacy for PA was not a significant mediator in the relationship between PA social support from friends and nonleisure walking at recommended levels. Individual factors related to demographics were significantly related to meeting recommended levels of PA when walking for transportation. For instance, being female was positively associated with engaging in active transportation and meeting the recommended levels of PA. In contrast, a higher monthly income, living in the U.S. for ≥12 years and being U.S.-born were negatively

associated with nonleisure walking at recommended levels. Additionally, the construct of acculturation was negatively related with the PA outcome, indicating agreement with the aforementioned proxies of acculturation. Contrary to our expectations, social-ecological factors such as safety, cohesion, neighborhood aesthetics, and community resource awareness were not significant factors in using active transportation to meet PA guidelines.

V. DISCUSSION

There is a small but growing body of literature on the PA of U.S. Latino adults. In the following discussion, the key findings will be described and compared to past PA research. Additionally, the strengths and limitations of this study will be addressed. Lastly, implications to advance future research and interventions will be presented in an effort to develop culturally appropriate PA programs intended for Latino communities.

KEY FINDINGS AND IMPLICATIONS

Summary of Findings – Aim 1 - Individual-level Correlates of Physical Activity among Latino Adults in San Diego County

The purpose of this study was to examine models of PA to address gaps in existing PA literature. This first aim involved examining individual and social cognitive correlates of PA among Latino adults in San Diego County. Within this aim, the relationships between self-efficacy, social support and LTPA were examined while accounting for potential moderators of this relationship (e.g., acculturation and gender). First, we hypothesized that social support would have a direct (positive) relationship with LTPA, and second, that social support would be mediated by self-efficacy. These relationships were not supported in the individual-level model. Findings indicated that both dimensions of social support, friends and family, were not related to meeting LTPA guidelines. Furthermore, self-efficacy was not a mediator of the relationship between PA social support and adherence to LTPA guidelines, although social support from friends was related to self-efficacy. Third, we hypothesized higher levels of acculturation would

moderate the relationship between self-efficacy and LTPA. Our results indicated that acculturation did not interact with self-efficacy.

Summary of Findings – Aim 2 - Multi-level Correlates of Physical Activity among Latino Adults in San Diego County

Meeting the Leisure Time Physical Activity Guidelines

The second aim of this study was to test a theoretically and empirically based social-ecological model of PA, while controlling for relationships observed in the first aim. We hypothesized that social and environmental factors would be directly and indirectly related to PA among Latino adults in San Diego County. First, it was hypothesized that neighborhood cohesion and neighborhood safety (e.g., crime and structural) would be positively related to LTPA, which our data partially supported. Our results showed that neighborhood cohesion was directly and indirectly related to meeting LTPA guidelines, in the positive direction. Perceived safety from crime mediated the indirect relationship between crime safety and meeting LTPA guidelines. Contradictory to our proposed hypothesis, structural safety was negatively associated meeting recommended levels of LTPA. It was also hypothesized that community resource awareness would be directly (positively) and indirectly related to LTPA, and data supported a direct relationship. Lastly, we hypothesized, that for female respondents, social and environmental safety factors would be associated with the outcome; data did not support gender differences.

Meeting PA Guidelines during Non-Leisure Time

The last objective of the second aim was to investigate the role of correlates of PA on nonleisure walking (i.e., walking for transportation or use of active transportation). We

theorized that neighborhood safety (i.e., social and environmental) would be positively related nonleisure walking to meet PA guidelines, and this hypothesis was not supported. Second, we proposed that neighborhood cohesion would be positively related to nonleisure walking. This relationship was not supported in the multivariate analyses. Third, we proposed community resource awareness would be directly (positively) and indirectly related to nonleisure walking at recommended levels, which data did not support. Lastly, we hypothesized that social and environmental neighborhood factors would be significantly related to nonleisure walking in women, but not in men. These differences were not supported in the multiple group analysis.

Implications

Leisure Time Physical Activity

The key findings of this study highlight the LTPA disparities for Latino adults as it relates to the *Healthy People 2010* goals. Our results showed that less than one-third (32%) of participants met the *2008 Physical Activity Guidelines for Americans* for MVPA, which coincides with national data.[24] Berrigan et al. who used data from the 2000 NHIS to examine Latinos adherence to PA guidelines. Using a similar PA outcome, Berrigan and colleagues estimated that 33% of Latinos adhered to PA guidelines. The NHIS data also showed that adhering to recommended levels of LTPA was more likely in more acculturated Latinos than who were less acculturated. Similarly, our findings showed that more acculturated (SASH score) respondents engaged in more minutes of MVPA than their less acculturated counterparts. This finding is also supported by several studies in the literature, including one study performed in San Diego County.[157] There are, however, inconsistencies in our findings with respect to proxies of acculturation. For

instance, we found that Latino respondents living in the U.S. for <12 years reported engaging in more minutes of MVPA and were more likely to meet LTPA guidelines than those living in the U.S. for ≥12 years. In addition to differences by acculturation status, we found that male respondents engaged in greater minutes of MVPA and reported meeting LTPA guidelines more than females. Similarly, the NHANES III data, collected from 1988-1994, showed a greater prevalence of leisure time inactivity among Latinas compared with Latino men.[66] Our study did not examine leisure time inactivity, yet there is a consistent trend.

Self-efficacy and PA social support are well established correlates of LTPA in the general population, and they are identified as important factors of LTPA among Latino adults living in the U.S. [6,85, 107, 108, 169, 179] Our findings, however, do not support that these factors play a significant role in the PA of Latino respondents in San Diego County. Unexpectedly, our study provides empirical evidence for other mechanisms that contribute to PA behavior among Latino adults in San Diego County. For instance, we found that dietary behavior (i.e., fruit and vegetable intake) positively influenced meeting LTPA guidelines.[128, 129] It is possible that individuals with healthy dietary practices have an awareness of energy balance and are knowledgeable about the benefits of healthy behaviors (e.g., PA and healthy diet). Thus, it is likely that healthful eating is a motivating factor for engaging in leisure time exercise and warrants further investigation.

In addition to dietary behavior, our data showed that demographic factors were significantly related to meeting LTPA guidelines. For instance, being female was negatively associated with meeting LTPA guidelines in both individual- and multi-level models. This finding was also highlighted in the previous section regarding gender

differences in LTPA. The low levels of LTPA in Latinas are well established in the literature, and some health experts attribute the gender differences in health behavior to socialized gender roles.[180, 181] For example, Latinas may be more likely to engage in household and familial related activities, such as cooking and caring for family, rather than engaging in LTPA. The present study also showed that being single was associated with meeting recommended levels of LTPA, which is consistent with that found in Build et al. This would be expected given that being married may introduce barriers to PA (e.g., spousal, familial and/or household responsibilities), which may decrease leisure time for exercise and recreation. Furthermore, the literature states that leisure time may not exist for some Latinos; perhaps this is more relevant for Latinas given their multiple roles and responsibilities. In addition to marital status, studies have observed that PA increases with educational attainment, which we found in the individual-level model of LTPA.[89, 100] Nevertheless, education did not play a significant role in meeting LTPA guidelines when examining the larger social-ecological context. Number of years living in the U.S., a proxy of acculturation, influenced meeting LTPA guidelines in the negative direction. These findings are consistent with the growing literature regarding the impact of acculturation on health behaviors.[63-66, 130]

The key findings highlight the social-ecological mechanisms that are specific to LTPA and shed light on the role of mediators on LTPA. The social-environment (i.e., neighborhood cohesion and perceived risk/crime safety) was directly and indirectly related to Latino respondents' adherence to PA guidelines. Our findings suggest that, for some Latinos, meeting LTPA guidelines depends on perceptions of safety from crime (or danger), which is influenced by the presence of mutual trust (social cohesion) in a

neighborhood. To our knowledge there is no empirical evidence to support this social-environmental mechanism in PA studies of Latinos, but PA researchers have noted social cohesion and perceptions of safety are relevant topics among Latinos. When examining data from the 2003 CHIS, Wen et al. reported that social cohesion was associated with leisure and nonleisure time walking at recommended levels among Latinos in California.[65] Several studies in the literature have made a connection between low levels of social cohesion and living in high crime areas, which has been shown to reduce the probability of PA in predominantly White neighborhoods.[122, 138, 151, 152] Similarly, Hooker et al. found that Whites are more likely to walk for exercise when they perceive their neighborhood to be safe from crime.[182] Of the studies examining perceived safety on LTPA among Latinos in the Midwest and East Coast regions, positive but not significant associations have been reported.[92, 93, 142] Although there is a lack of empirical evidence to support the relationship between perceived crime and LTPA in Latinos, empirical studies reported that high crime rates and fear for personal safety discouraged ethnic minority women from exercising.[183, 184] For instance, being able to rely on a neighbor in an emergency was noted as important for engaging in LTPA among Latinas in North Carolina.[93] Our findings and those stated in the literature suggest that safety is a greater concern for Latinas more than it is for Latino men, which may partially explain why Latina respondents reported fewer minutes of MVPA than male respondents.[185] Furthermore, Cronan et al. reported that Latinas used parks for exercise, but did not do so as often due to safety concerns such as theft, assault and lighting.[185] Thus, it is likely that having a sense of camaraderie with neighbors may provide some Latino individuals, in particular Latinas, with a sense of well-being for outdoor LTPA. Although our findings

did not show a connection between social-environmental factors and park use, these factors may work synergistically to influence PA behavior.

Our findings showed that community resource use (e.g., park use and visitation) positively influenced meeting LTPA guidelines, for which recent studies provide empirical support. Data from the 2003 CHIS showed that access to parks and recreation was positively associated with walking (leisure and nonleisure time) among Latino adults in California.[65] As previously mentioned, Cronan et al. found that Latinas primarily used parks for exercise. Other study findings also suggest that greater availability and use of community parks increased the likelihood of adhering to LTPA recommendations.[5, 160] For this reason, it is important to highlight the influence of the built environment on LTPA. The availability of parks within safe neighborhoods is noteworthy. It is the presence of these neighborhood-level factors that that may offer Latinos with the opportunity for meeting the recommended levels of LTPA.[138] Therefore, targeting these factors as a vector of change should be a focus of future PA research to inform public policy and urban development.

Health promotion experts consider structural safety (e.g., crosswalks, street signals and lights) to be an important environmental correlate of PA. For example, studies have found that perceiving greater structural safety in the built environment is conducive for walking, increases access to PA resources, and results in greater participation of PA.[100, 138, 164] In predominantly White neighborhoods, studies found that heavy traffic, lack of crosswalks and street lighting are barriers to PA.[122, 138] Contrary to our expectation, we found that perceived structural safety was inversely associated with meeting LTPA guidelines. Another study did not find any association between structural

facilitators and PA among Latinas in San Diego County.[156] Our findings showed that the presence of crosswalks, lights, and signals reduced the probability of engaging in LTPA. Perhaps some Latino respondents lived in more residential neighborhoods with little connectivity to places and destinations for LTPA; therefore the relationship between the presence of structural safety and LTPA was negative. It may be that community walkability (e.g., mixed land use) moderates the relationship between structural safety and PA; however, this cannot be determined given that we did not assess the distance from participants' homes to shops and destinations (e.g., recreational areas).

Non-Leisure Time Physical Activity

Walking for transportation is a prevalent behavior among less acculturated Latinos, as reported in national, state and local studies.[63-65] Berrigan et al. observed national data and found that 20% of Latinos engaged in walking/biking for errands and that this behavior was less prevalent among more acculturated Latinos.[63] Our data showed that 70% of Latino respondents reported engaging in some walking for transportation (at least 10 minutes in typical week), which is higher in comparison to the NHIS data. The mean number of minutes of nonleisure walking was 177 per week, and 30% of respondents walked for transportation to meet PA guidelines. Our findings also showed a higher proportion of nonleisure walking to meet PA guidelines among Latino immigrants living in the U.S. for <12 years compared to those living in the U.S. for ≥12 years. These findings have several indications. First, past judgments regarding Latinos' PA may not be accurate given that PA patterns may differ by subgroup. For example, some Latinos who walk for transportation may meet PA guidelines, especially if done so at a brisk pace (e.g., moderate-intensity level). Second, acculturating to American lifestyle over the

years may negatively influence healthy behaviors such as walking for transportation. This is noteworthy given that use of active transportation may be important for some Latinos who are not accustomed to exercise or PA during leisure time. We found a higher proportion of walking for transportation among females than males, but this was not statistically significant. After stratifying by gender, results showed that that females living in the U.S. for <12 years reported engaging in more minutes of walking for transportation than their counterparts living in the U.S. for ≥12 years. Latina respondents with <12 years in the U.S. were more likely to have children than those living in the U.S. for ≥12 years. There are several explanations for less acculturated Latinas walking for transportation. It could be that Latinas walked their children to school; however, the community survey did not assess this possibility. Another explanation is that there may have been one or no cars in the household; therefore, increasing the possibility using active transportation to run errands, walk to work, and perform daily life activities.

Latinos who walk for transportation can benefit by meeting recommended levels of PA; however, little is known regarding the correlates of non-leisure walking.[57, 63, 64] Studies have found that self-efficacy and social support for moderate-intensity PA are few of the factors that are correlated with leisure and nonleisure walking.[99, 163] The existing PA literature pertaining to Latinos, however, states that self-efficacy is not a correlate of walking for leisure, which our findings support.[104] Our study did not find an association between PA social support, self-efficacy and use of active transportation. Contrary to our hypothesis, we found that walking for transportation was related to other individual and socio-cultural factors (e.g., demographics and acculturation).

We found that demographic factors, such as income and gender, played a significant role in nonleisure walking at recommended levels. Similarly, Berrigan et al. found that while income and education attenuated the relationship between acculturation and nonleisure time PA, the association between acculturation and nonleisure time walking remained significant.[63] Our findings showed that monthly household income was inversely related to nonleisure walking at recommended levels in Latino respondents, whereas education was not. Data from the 2003 CHIS support this finding, but do not support our finding that being female was associated with walking for transportation at recommended levels. [65] Our findings also showed that Latina respondents living in the U.S. for <12 years were more adherent to PA guidelines during nonleisure time in comparison to those living in the U.S. for ≥12 years. We found that being U.S.-born negatively influenced engaging in non-leisure walking to meet PA guidelines. These findings are consistent with Martinez et al. who reported that Latinas in San Diego County were more likely to walk their children to school if they were foreign-born or living in the U.S. for <12 years.[64] Similarly, Wen et al. reported that greater percent of life in the U.S. was a negative correlate of leisure and nonleisure time walking among Latinos in California.

Our findings provide support that several dimensions of acculturation are important socio-cultural correlates of nonleisure time PA. We found an inverse association between acculturation (latent construct) and meeting recommended levels of PA during nonleisure time, which was consistent with the relationships between nonleisure walking at recommended levels and the number of years living in the U.S. Using a similar acculturation scale, Berrigan et al. found that nonleisure time PA was

more prevalent among less acculturated Latinos. On the other hand, when using the ARSMA-II scale to assess acculturation, Martinez et al. reported no significant association between acculturation and using active transportation. Findings also showed that nonleisure walking had an inconsistent relationship with different proxies of acculturation. For instance, being born in the U.S. was positively related to being born in the U.S. These findings indicate that all proxies of acculturation cannot be treated equally and that some measures may be more sensitive in detecting associations with respect to PA patterns.

In summary, our findings highlight the role of acculturation as a major predictor of non-leisure time PA. In addition, the importance of walking as a mode of transportation is underscored as it can assist in reaping the health benefits associated with PA, specifically among Latinas and less acculturated Latinos. Walking for transportation was more frequent among less acculturated Latina respondents, especially among those living in the U.S. for <12 years; therefore, nonleisure walking may be more beneficial among them. Our findings suggest that walking for transportation is a behavior that is ingrained in Mexican culture and becomes less frequent as Latinos acculturate. Also, economic parity may increase over time and length of stay in the U.S.; thus, it would be expected that use of active transportation reduces with increasing economic stability and acculturation.

It is important to highlight the role of the social-ecological environment as it involves cues that are barriers to and facilitators of walking. Data from the CHIS 2003 showed that neighborhood cohesion was related to walking (for leisure and nonleisure) among Latino adults in California.[65] On the contrary, we did not find a connection

between social cohesion, the built environment and nonleisure time walking. These findings indicate that, for some Latinos, walking for transportation is a behavior that is not influenced by environmental factors, but rather a behavior that is based on performing daily life activities. Nevertheless, nonleisure walking is a prevalent behavior among some Latino individuals. This merits the need for additional research to understand which factors can be targeted to facilitate and maintain the use of active transportation among specific Latino subgroups.

Comparison of Structural Equation Models

It is important to discuss how this study fits in the larger picture by comparing the explained variance in the PA outcomes of this study with that of other PA studies. When examining PA by walking and intensity levels (moderate- and vigorous-intensity), McNeil et al. reported that individual and social-environmental factors accounted for 15-21% of the variance in PA among Black and White adults. In a predominantly Latino population living in El Paso, TX, Rutt et al. reported that demographics, barriers to and facilitators of PA, and the built environment accounted for 6% of the variance in walking for exercise. Another study, conducted in the Puget Sound area of Washington, reported that demographic factors and neighborhood characteristics (e.g., mixed-land use and employment density) explained 31% and 35% of the variance in walking to work and to shops in week, respectively. In the San Francisco bay area (California), neighborhood factors (e.g., transit access and employment density) and urban attitudes (e.g., pro-transit) accounted for little explained variance (3 to 9%) in the number of walking and bike trips in the past week. Our multi-level model of LTPA supports that the examined individual,

social, and environmental factors accounted for 38% of the variance in meeting LTPA guidelines among Latino adults in San Diego County. To our knowledge this is one of the first models of LTPA to show an explained variance of this magnitude in any subgroup of the U.S. population. Furthermore, when examining nonleisure walking at recommended levels, our study accounted for 26% of the explained variance in the PA outcome. The accounted variance is one of the highest in explaining nonleisure walking with respect to the U.S. Latino population. In summary, this study provides structural equation models that contribute to the existing PA literature of Latinos.

STRENGTHS AND LIMITATIONS

Strengths. The current study has several strengths, which increase the validity of our findings. To our knowledge, this is one of the first studies to use structural equation modeling to simultaneously examine multiple levels of influence on the PA of Latinos. There are few studies describing the nature of PA among Latinos of border communities. This study is a major contribution to the PA literature of Latinos, an understudied population in PA research. Another major strength was the inclusion of multiple proxies of acculturation given the dual importance of Mexican and America culture in this border population of San Diego. As a result, we were able to simultaneously examine several dimensions of acculturation on PA. Additionally, acculturation was examined as a potential moderator along with gender. Our results shed some light regarding gender differences on LTPA and nonleisure walking. We also examined mediators such as psychosocial and socio-ecological factors that are important for engaging in nonleisure and leisure time PA. As a result, this study provides evidence regarding the mechanism of

neighborhood cohesion and safety from crime on meeting LTPA guidelines, and adds to existing knowledge regarding community resource use and LTPA in Latino adults. Another strength of the study was that the measure of community resource awareness was objective in the sense that it asked respondents about available parks in the community. This may have provided a more accurate representation of the perceived neighborhood environment and its influence on LTPA. With respect to domains of PA, this is one of the first studies examining correlates of active transportation among Latino adults. Our analyses included data obtained from a survey that was culturally translated and adapted to assess PA and its correlates among Latinos in San Diego County. Furthermore, random digit dial methodology was used to select Latino individuals for they survey. Thus, this study may provide a more valid and reliable description of PA among Latinos in San Diego County. Furthermore, our findings may be generalized to Latinos living along the U.S.-Mexico border and Southern California. It is also possible that our estimates of meeting the PA guidelines are generalizable to the U.S. Latino population given the consistency of our results with those reported by Berrigan et al.

Limitations. In addition to the strengths of this study, several study limitations must be acknowledged. First, surveys were telephone-administered, which could have led to an underrepresentation of individuals in the lowest income bracket. Furthermore, cellular phone use is also becoming more common, with landlines becoming obsolete. Escobedo and colleagues, however, found that telephone surveys were valid for research in U.S.-Mexico border populations, providing similar results to face-to-face interviews.[186] Second, PA was quantified using a self-report measure, which is subject to recall bias and/or over-report. This bias may have been minimized given that the IPAQ distinguishes

between active transportation, occupational, leisure time and household activities; therefore, more reliable report of PA patterns. Third, the data were cross-sectional which limits the ability to infer causality. For this reason, structural equation modeling was used to provide a theoretical understanding of the variables that influence PA. Fourth, our construct of acculturation did not include other proxies of acculturation; however, country of birth and years living in the U.S. were still accounted for in our analyses. Fifth, proximity to parks was not accounted for in the parent study, which limits our understanding of park availability and use on PA. Sixth, when examining factors related the nonleisure walking, we used measures of self-efficacy and PA social support for moderate-intensity LTPA. Walking is considered a low impact moderate-intensity activity, which justified the use of these measures to examine correlates of nonleisure walking. Lastly, these results may only be generalizable to Latinos in San Diego County, and perhaps Latinos of border county communities along the U.S.-Mexico border.

RECOMMENDATIONS FOR RESEARCH AND PRACTICE

This study demonstrated that Latinos engaged in low levels of PA, which is consistent with national studies that report Latinos to be less physically active across ethnic groups. There is, however, little known about multi-level factors to target in the promotion of PA in Latino adults. As a result, social-ecological factors specific to PA are not well understood in border communities that are predominantly Latino. Furthermore, there is little understanding about the role that gender plays in the activity patterns of Latinos. Some researchers have attributed gender differences to demographic factors for which empirical evidence is either weak or mixed.[6] The purpose of this study was to

address the shortcomings of PA research conducted with Latinos. To our knowledge, this is the first study to examine potential moderators and mediators while simultaneously examining multi-contextual factors and patterns of PA among Latino adults in San Diego County. Thus, our recommendations provide a cultural and social-ecological perspective that can be used to inform future PA studies to advance the field of PA promotion in the Latino population.

Indeed, there is a need to continue to advance PA promotion among Latino men and women, as both exhibited low levels of PA. For this reason, it is important to understand which factors to target so that efforts are effective. Our findings suggest that self-efficacy and social support for PA did not play an important role in the PA patterns of Latinos. On the contrary, gender, marital status, education, and years living in the U.S. significantly influenced meeting LTPA guidelines. In addition, dietary behaviors (e.g., fruit and vegetable intake) also influenced LTPA at recommended levels. These findings suggest that, when using a model that emphasizes individual-level factors, PA promotion should consider these demographic and behavioral factors among Latino individuals. Perhaps it is necessary to impart and increase knowledge about energy balance. Additionally, it is imperative to address acculturation and gender issues in future PA studies and health promotion efforts focusing on behavior modification. The association between the number of years living in the U.S. and meeting PA guidelines suggests that PA patterns do change over time as a result of acculturation. Also, males engaged in LTPA more often than females, which is an indication of socialized gender roles. To change social norms pertaining to Latinas' engagement of sports/exercise, it may be

useful to promote PA among those who are married/living as married to increase levels of MVPA among females and couples.

Our data supported that a social ecological model of PA explained more variance in meeting recommended levels of LTPA compared to an individual-level focused model. The social and environmental factors, namely social cohesion, safety from crime, and parks use, played a significant role in meeting LTPA recommendations among some Latinos. This finding highlights the need for PA interventions to engage community members to play an active role in increasing neighborhood safety to provide a sense of physical wellbeing. To improve efforts in the field of PA promotion, it is necessary to evolve in several ways. First, collaborating with a broad range of professionals such as advocacy, policy and crime experts may be beneficial in increasing safety to promote safe and active communities. Second, empowering Latino individuals to become community advocates for safe parks and neighborhoods can be an effective approach to foster neighborhood cohesion and perhaps increase LTPA among them. Third, interventions and programs should focus on promoting the use of neighborhood parks. The importance of parks is noteworthy in meeting PA guidelines. Physical activity researchers should collaborate with parks and recreation to offer co-ed class curriculum, clubs or intramural sports, which can also build social cohesion in Latino communities. Taking on a progressive approach, such as co-ed and/or couples PA programs, may have several benefits. For one, a buddy system has the potential to increase perceptions of safety, and second, there is the possibility of changing socialized gender roles. To be able to improve PA rates in the Latino population, there is a need to consider these novel approaches in upcoming PA programs and interventions.

Past PA research with Latinos has primarily focused on LTPA. For some Latinos, leisure time may be an irrelevant concept; therefore, there may be misconceptions regarding PA patterns among them. As a result, PA promotion during leisure time may not be the most effective approach for increasing levels of PA among less acculturated and female Latinos. Otherwise, future LTPA research should focus on better recruitment strategies for Latinas and less acculturated Latinos. Alternatively, perhaps it is worth exploring non-leisure time activity as an opportunity for meeting and/or maintaining levels of PA among certain Latino subgroups. Further studies are needed to establish the gender and acculturation differences in nonleisure time activity to improve the cultural sensitivity and appropriateness of future PA programs and interventions.

Several researchers have highlighted the correlation between acculturation and health behavior; however, to date there is no gold standard for capturing acculturation. Using different proxies to assess the relationship between acculturation and PA has rendered inconsistent study outcomes, including the findings of the current study. Our results suggest that using number of years living in the U.S. may be a better proxy of acculturation given that it was a consistent correlate of both leisure and nonleisure time PA; and there is empirical evidence to support this. Nevertheless, our results shed some light on the topic of the Hispanic Paradox that recent immigrants practice healthy behaviors and behaviors decrease with acculturation. Time in the U.S., however, is only one dimension of acculturation, which warrants the need for improved measures that are behavior specific. This will allow for improved assessment of cultural behaviors that become less frequent, and those behaviors that become more frequent as immigrants and first generations acculturate to another lifestyle. For instance, measures should include

items such as, “my Mexican-oriented friends engage in nonleisure time PA.” Linking acculturation measures to PA may provide more consistent study outcomes thereby contributing to the development of more effective PA programs in different Latino subgroups.

Furthermore, there is a need to assess Latinos’ knowledge regarding the health benefits of PA. Given the cultural differences in PA patterns (leisure vs. nonleisure) here in the U.S. and in Mexico, it may be that less acculturated Latinos do not understand the health benefits associated with PA. Providing knowledge to make the connection between PA, and prevention of obesity and chronic diseases may be important for sparking interest or motivation in living a physically active lifestyle.

The key findings of this study highlight the disparities in PA among Latino adults as they relate to *Healthy People 2010* goals (e.g., improve the quality of life for those at risk for diabetes). In conclusion, with respect to Latino health, this study was able to 1) successfully draw attention to the disparities in PA, 2) draw conclusions regarding gender and acculturation differences in PA, 3) provide a social-ecological perspective of the factors related to different types of PA, an area of disparities research that up until now has received very little attention, and 4) offer recommendations for future PA research and health promotion efforts.

TABLES

Table 4.1. Demographic characteristics of Latino adults in San Diego County (N=668)

Participant characteristics		Gender		SASH		Living in U.S.	
		Male	Female	Low	High	<12 years	≥12 years
Sample size	668	191	477	522	146	150.0	310.0
%		29.0	71.0	78.1	21.9	22.5	46.4
Language Preference							
Spanish (%)		45.5*	63.3*	54.8*	26.1*	95.3*	70.0*
English (%)		54.4*	36.7*	2.1*	97.9*	.7*	30.0*
Age (M±SD)	39.3± 13.3	39.1± 14.8	39.4± 12.8	40.0±13.0*	36.9± 14.5*	33.0±9.6*	45.8±11.4*
Marital Status (%)							
Single	41.9	46.1	40.3	36.9*	39.7*	30.7	63.4
Married/living as married	57.9	53.9	59.7	62.4*	60.3	69.3	36.6
Children under 18 (M±SD)	1.6±1.4						
≤ 1 Child	53.7	63.2*	50.3*	50.8*	65.3*	35.3*	54.9*
> 1 Child	45.8	36.8*	49.7*	49.1*	34.7*	64.7*	45.1*
Education (%)							
≤ High school /GED	60.6	56.8	62.2	62.6	54.1	64.4	62.9
≥ College	39.2	43.2	37.7	37.4	45.9	35.6	37.1
Employment (%)							
Unemployed	53.4	49.2	44.5	53.5	54.4	57.3	51.1
Employed	46.1	50.8	55.5	46.5	45.5	42.3	48.9
Monthly household income ($M±SD)	2999± 2419						
≤ $1500(%)	19.6	17.0*	27.1*	27.2*	13.2*	23.3*	28.8*
≥ $1501	61.4	83.0*	72.9*	72.8*	86.8*	76.7*	71.2*
Years Living in the U.S. (M±SD)	19.4± 12.4	22.8±12.6*	18.1± 12.1*	17.3±11.8*	26.9± 11.9*	5.8± 2.3*	25.9± 9.5*
Country of birth (%)							
Mexico	69.6	70.7	69.2	69.9	68.5	59.3*	77.7*
U.S.	30.4	29.3	30.8	30.1	31.5	40.7*	22.3*
Acculturation Score (M±SD)	2.2± .9	2.5±.9*	2.0±.9*	1.8±.6*	3.5± .4*	1.5± .5*	1.9± .8*

*p<.05

Table 4.2. Health parameters of Latino adults in San Diego County (N=668)

		Gender		SASH		Living in U.S.	
Characteristics		Male	Female	Low	High	<12 years	≥12 years
Body Mass Index (M±SD)	28.2± 5.8	28.0± 5.5	28.3± 5.9	28.1± 5.4	28.7± 6.7	26.9± 5.1*	28.8± 5.5*
Normal/under (%)	24.9	28.9	30.6	29.5	33.8	39.7*	23.7*
Overweight (%)	30.8	42.2	32.8	37.3	30.9	30.2*	41.1*
Obese (%)	29.5	28.9	36.6	33.2	37.4	30.2*	35.2*
Physical Activity (mins/week)							
Active transportation	177 ± 314	182± 360	174±293	177± 317	177± 302	190 ± 259	159± 330
Moderate-intensity leisure-time	58± 117	73±147	51±101	61±124	46± 84	66.1± 128.9	62.7± 128.6
Vigorous-intensity leisure-time	70± 144	114±197*	52±111*	63±136*	96± 165*	75.7± 132.9*	45.6± 112.9*
Meets recommended PA guidelines (%)							
No (Leisure time)	68.3	60.7*	71.3*	69.5	63.7	62.7*	73.8*
Yes (Leisure time)	31.7	39.3*	28.7*	30.5	36.3	37.3*	26.1*
Meets recommended PA guidelines (%)							
No (Active transportation)	70.7	73.2	68.6	69.5	71.3	60.0*	75.8*
Yes (Active transportation)	29.3	26.8	31.4	30.5	28.6	40.0*	24.2*
Dietary (M±SD)							
Fruit/vegetable intake (daily)	3.9± 2.2	3.6± 2.4*	4.0± 2.2*	3.8± 2.2	4.0± 2.4	3.9± 2.0	3.6± 2.3
Fast food (weekly)	1.5± 1.9	1.9± 1.9*	1.3± 1.8*	1.3 ±1.6*	2.1± 2.6*	1.3± 1.4	1.2± 1.5
Self-efficacy (range = 1-5, M±SD)	4.0± 1.0	4.1±.9*	3.9±1.0*	4.0± 1.0	3.9± .9	4.1± .9	3.9± 1.0
Social support (range = 1-5, M±SD)							
Family	2.6± 1.1	2.6± 1.1	2.6± 1.1	2.6± 1.1	2.6± 1.1	2.5± 1.1	2.6± 1.1
Friends	2.1± 1.1	2.1± 1.2	2.1± 1.1	2.1± 1.2	2.1± 1.2	2.0± 1.1	2.1± 1.1

*p<.05

Table 4.3. Perceived neighborhood characteristics of Latino adults in San Diego County (N=668)

				SASH		Living in U.S.	
Characteristics (M±SD)		Male	Female	Low	High	<12 years	≥12 years
Neighborhood safety (range = 1-5)							
Safety from crime	3.1± .7	3.1± .7	3.0± .7	3.1± .7	3.1± .7	3.1± .7	3.1± .7
Structural	2.8± .8	2.8± .7	2.8± .8	2.8± .8	2.8± .7	2.8± .8	2.8± .8
Neighborhood cohesion (range = 1-5)	1.6± .5	1.5± .5*	1.6± .5*	1.6± .5*	1.7± .5*	1.6± .5	1.5± .5
Neighborhood aesthetics	2.5± 1.1	2.6± 1.1	2.5± 1.1	2.6± 1.1*	2.3± 1.1*		
Community resource awareness							
Knowledge (range = 1-4)	2.9±.8	2.9±.8	2.8±.8	3.0± .8*	2.5± .7*	3.0± .7	2.9± .9
Satisfaction (range = 1-4)	2.7± .9	2.8± .8	2.7± .9	2.9± .9*	2.3± .8*	3.0± .8*	2.8± .9*
Use (monthly)	4.8± 3.9	4.8± 4.0	4.8± 3.9	5.0± 3.9	4.2± 3.9	4.8± 3.9	4.9± 4.1

*p<.05

FIGURES

Note: Circles represent latent constructs; black box represents observed variables; blue boxes represent scale items and indicators.

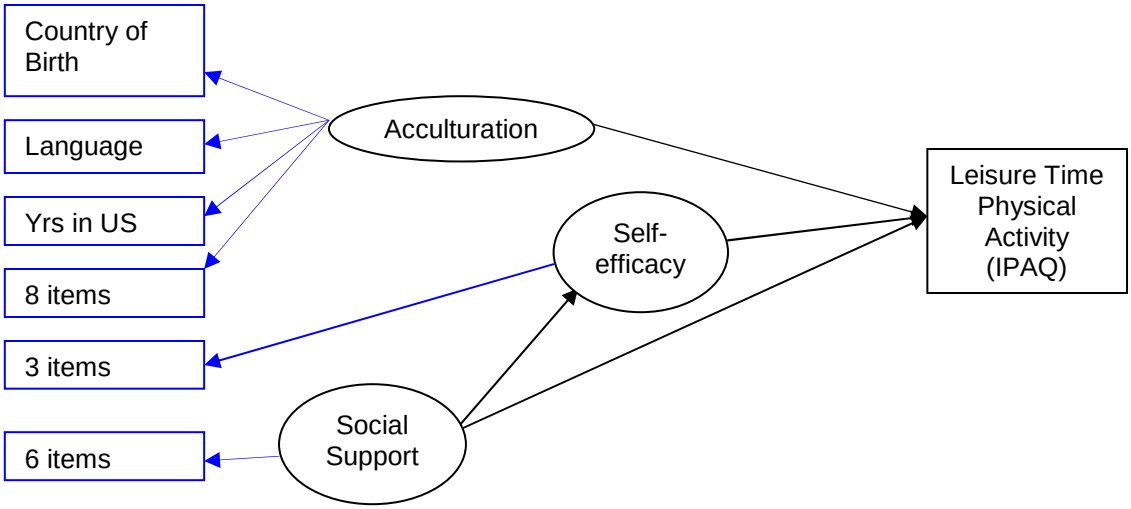

Figure 2.2. A priori model of individual correlates of LTPA with a mediator (i.e., self-efficacy)

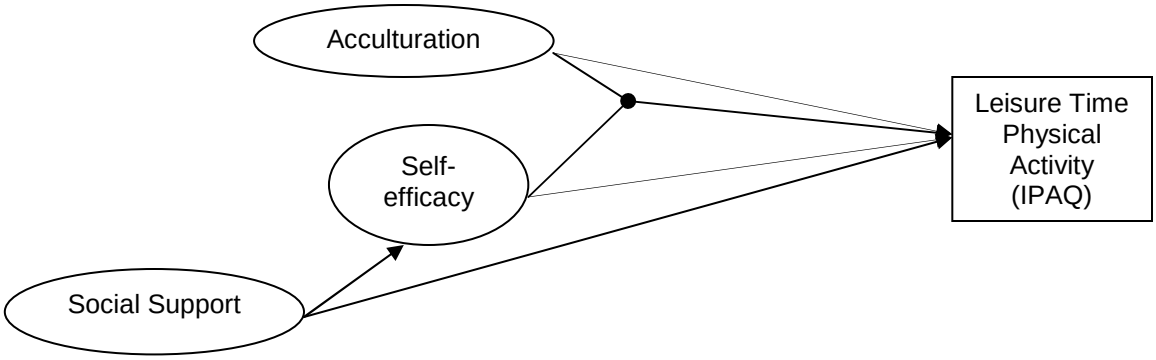

Figure 2.3. A priori model of individual correlates of LTPA with an interaction acculturation as a moderator.

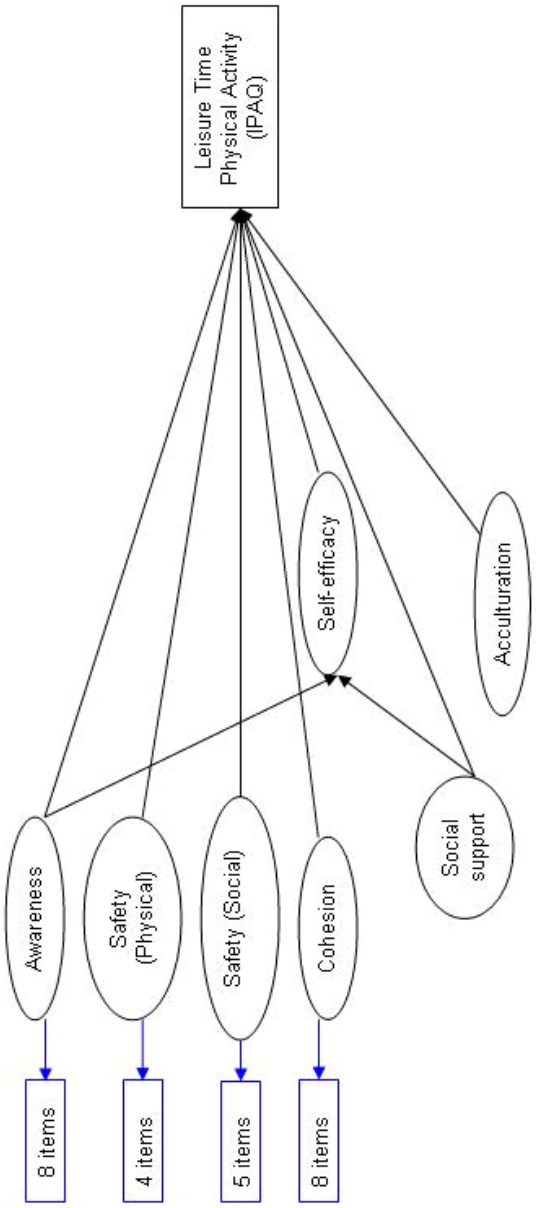

Figure 2.4. A priori model of individual, social and environmental correlates of LTPA.

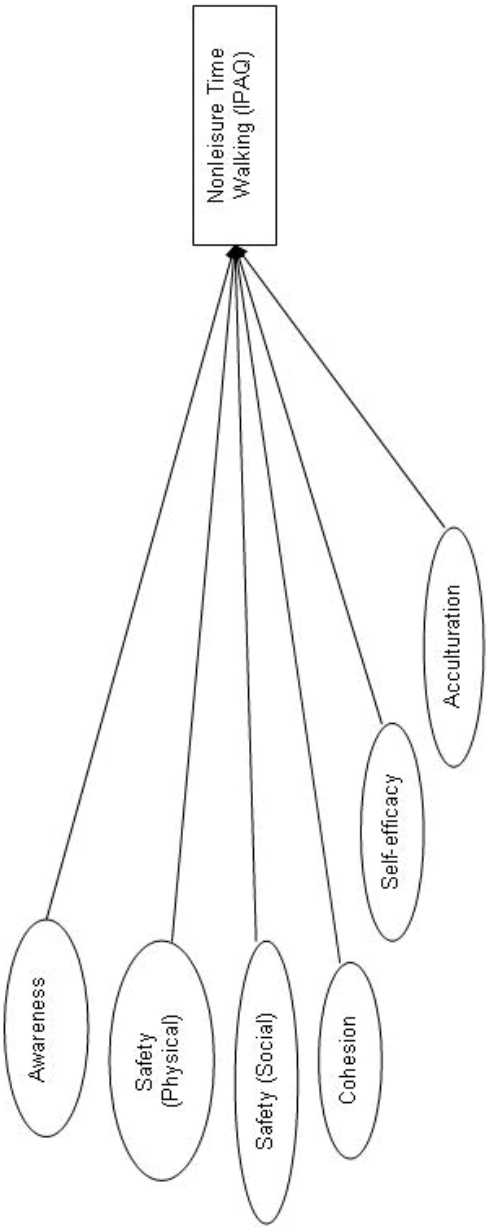

Figure 2.5. A priori model of the individual, social and ecological correlates of nonleisure time walking.

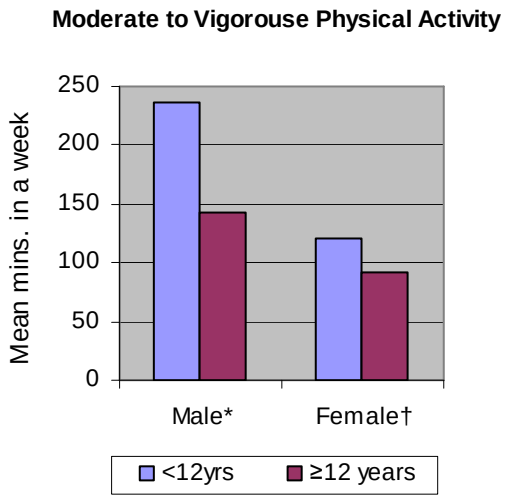

Figure 4.1. Acculturation (years living in the U.S.) differences in total mean number of minutes of moderate-to-vigorous PA after stratifying by gender. **T-test* analysis significant at p<.05, †marginally significant

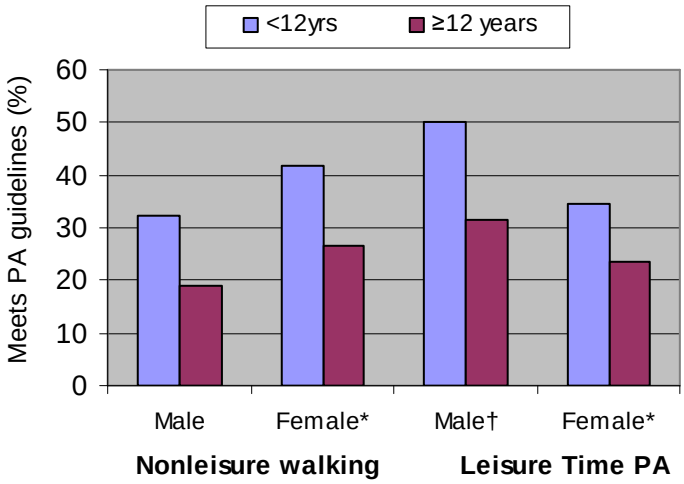

Figure 4.2. Acculturation (years living in the U.S.) differences in nonleisure and leisure time PA at recommended levels after stratifying by gender. *Chi-square statistic significant at p<.05, †marginally significant

Confirmatory Factor Analysis

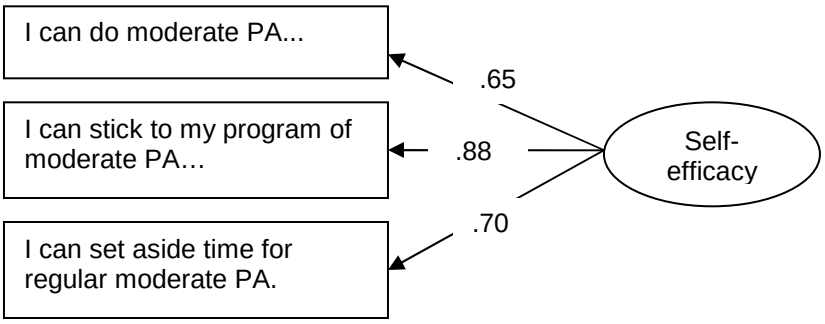

Figure 4.3. Parameter estimates for confirmatory factor analytic model of self-efficacy for PA. Model just-identified

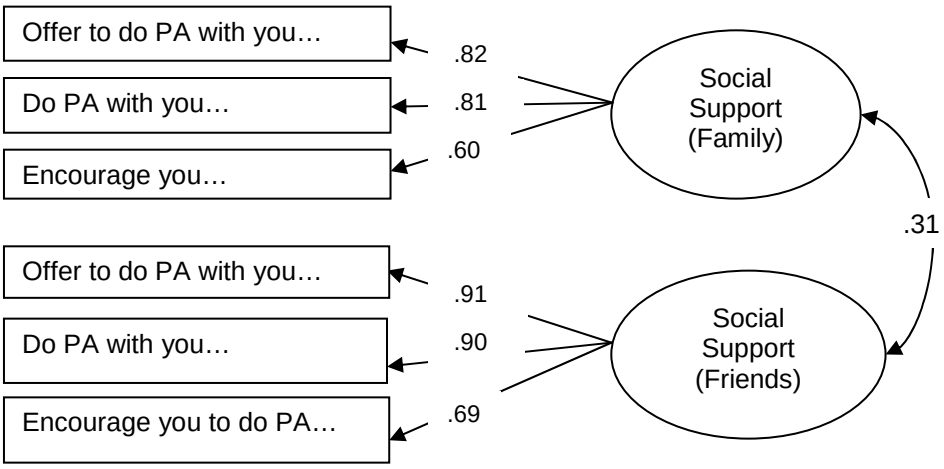

Figure 4.4. Parameter estimates for confirmatory factor analytic model of PA social support from family and friends (X^2= 60.50, df= 8, CFI= 0.97, RMSEA = 0.10, SRMR= 0.05).

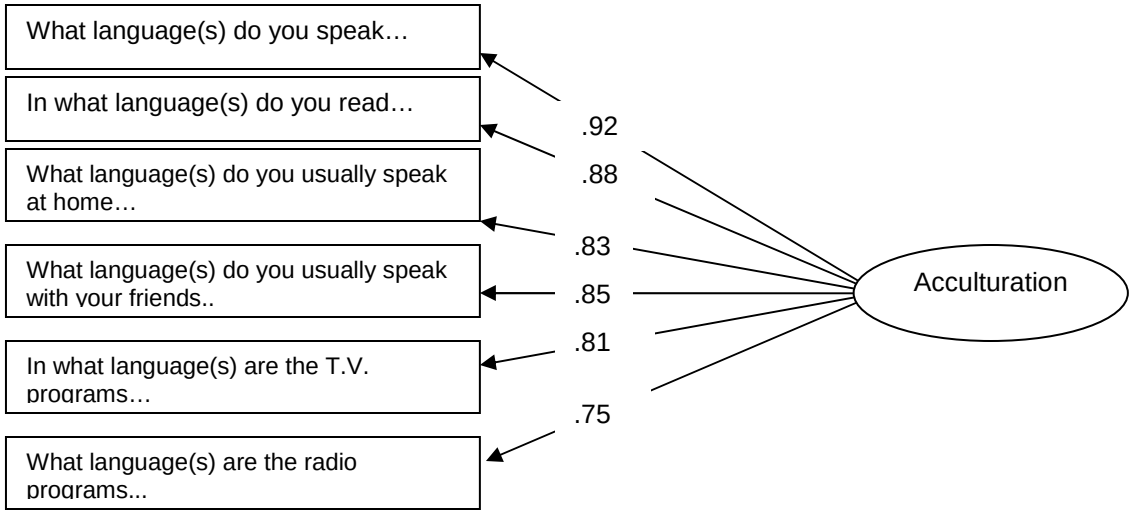

Figure 4.5. Parameter estimates for confirmatory factor analytic model of acculturation (X^2=73.18, df= 9, CFI= .98, RMSEA= .10, SRMR= .02).

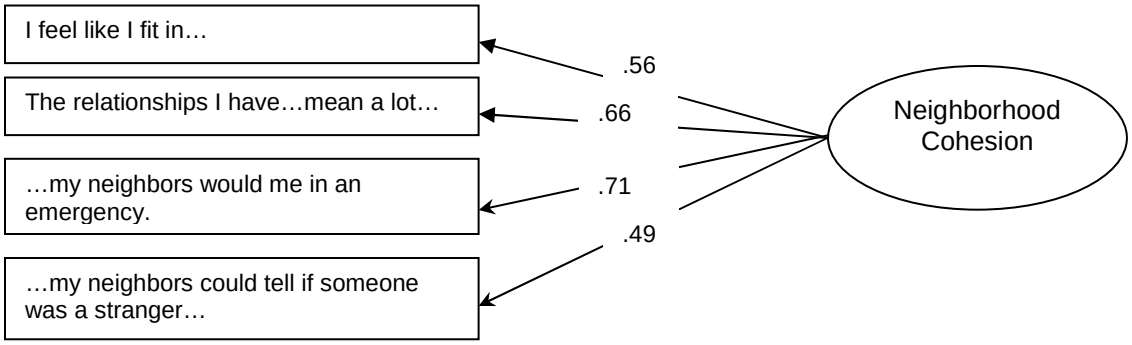

Figure 4.6. Parameter estimates for confirmatory factor analytic model of neighborhood cohesion ($X^{2=}$9.57, df= 2, CFI=.98, RMSEA=.07, SRMR=.02).

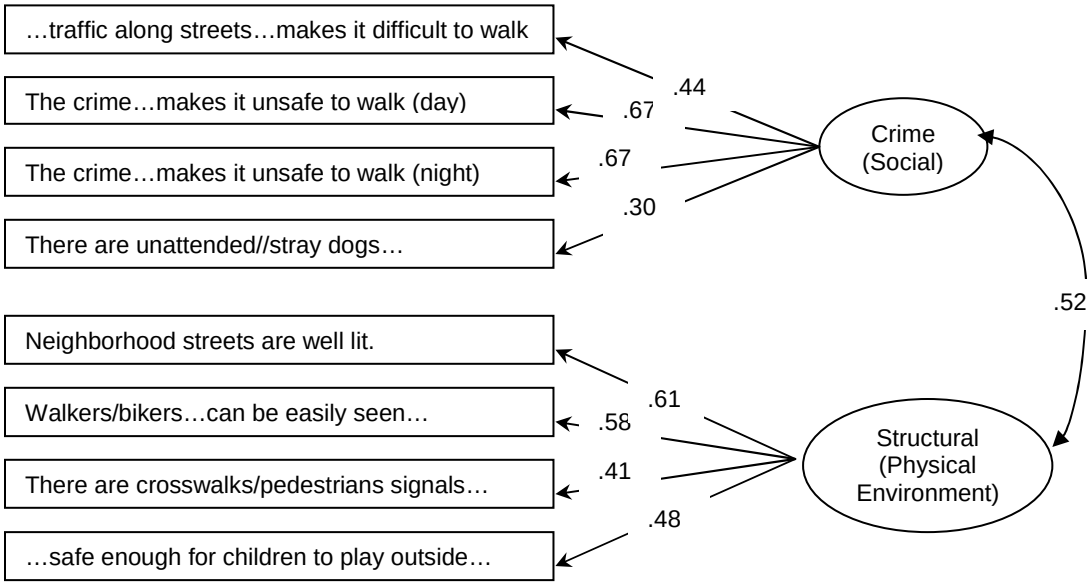

Figure 4.7. Parameter estimates for confirmatory factor analytic model of neighborhood safety (X^2 = 49.53, df= 19, p<.05, CFI=.95, RMSEA=.05, SRMR=.04).

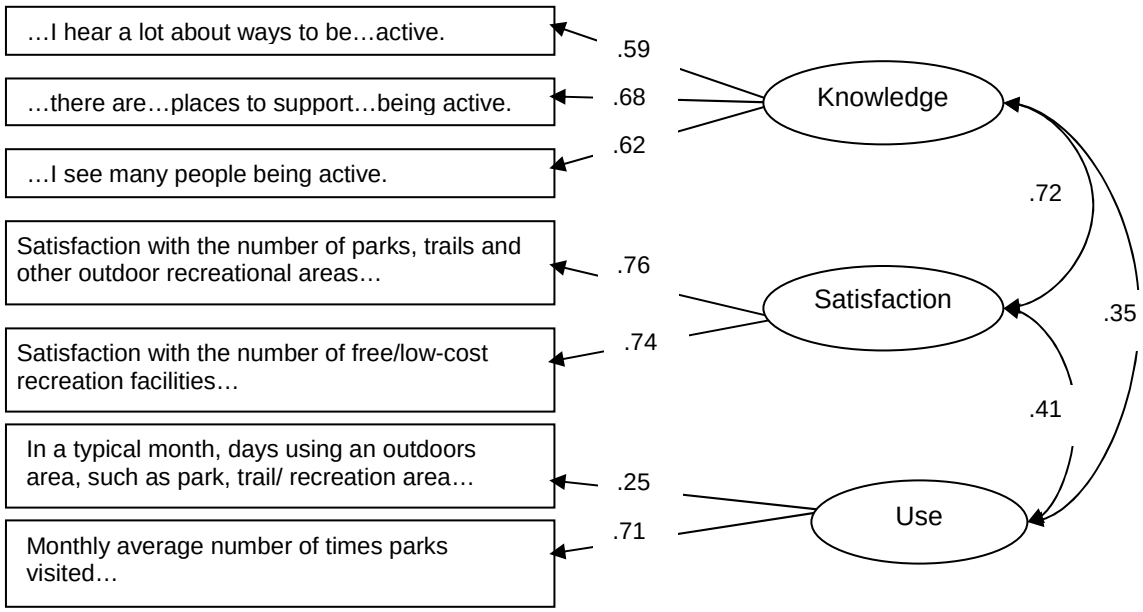

Figure 4.8. Parameter estimates for confirmatory factor analytic model of community resource awareness (X^2 = 17.58, df = 11, p>.05, CFI=.99, RMSEA=.03, SRMR=.03).

Structural Equation Modeling

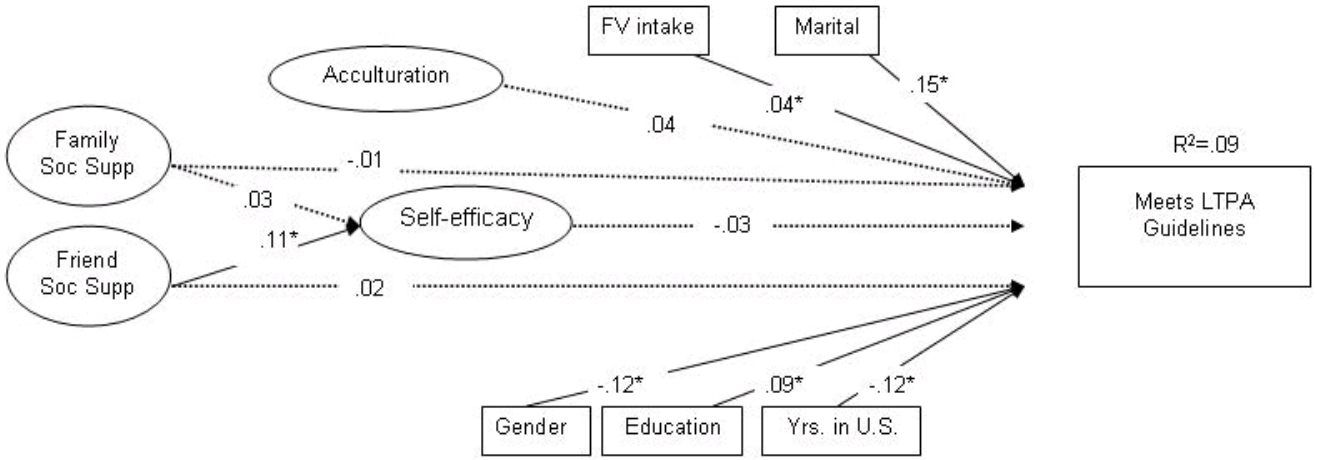

Figure 4.9. Structural equation model of individual level influences on meeting the recommended PA guidelines during leisure-time (X^2= 206.12, [df=156, p<.05], CFI =0.99, RMSEA=0.03, SRMR= 0.03). * Significant at |1.96|

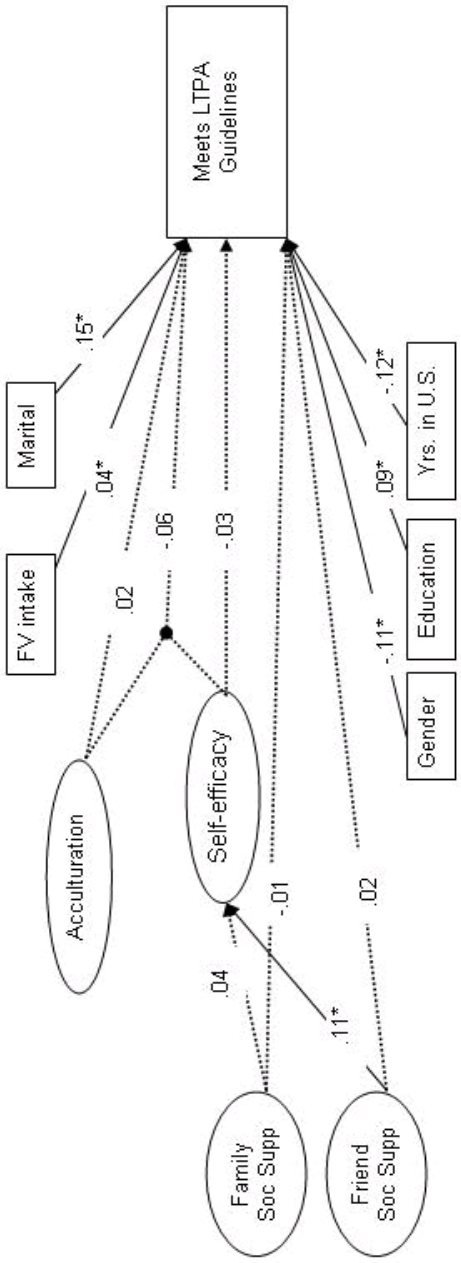

Figure 4.10. Testing an interaction between acculturation and self-efficacy in a structural equation model of individual-level influences on meeting the recommended levels of LTPA. * significant at |1.96|

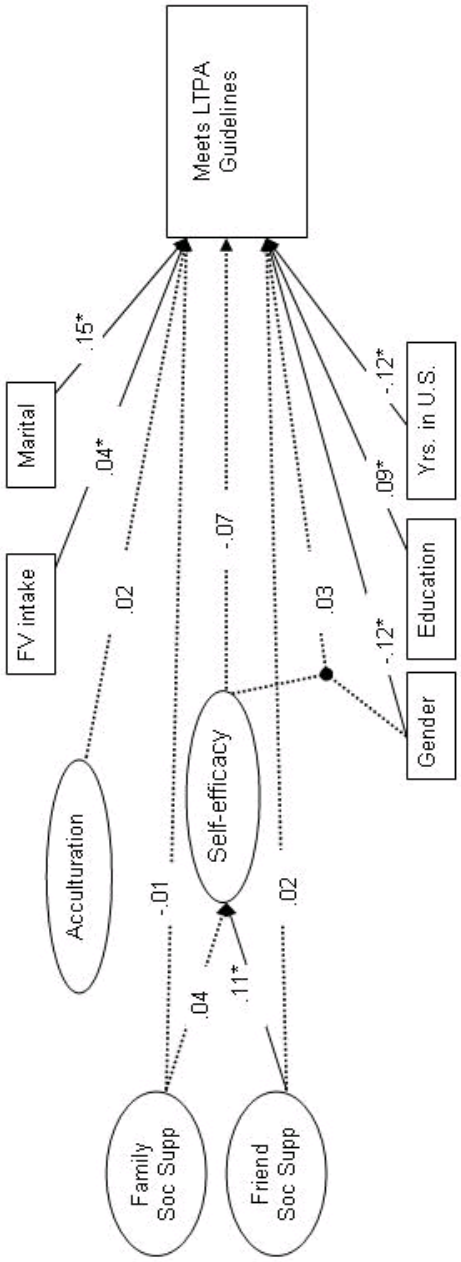

Figure 4.11. Testing an interaction between gender and self-efficacy in a structural equation model of individual-level influences on meeting the recommended levels of LTPA. * significant at |1.96|

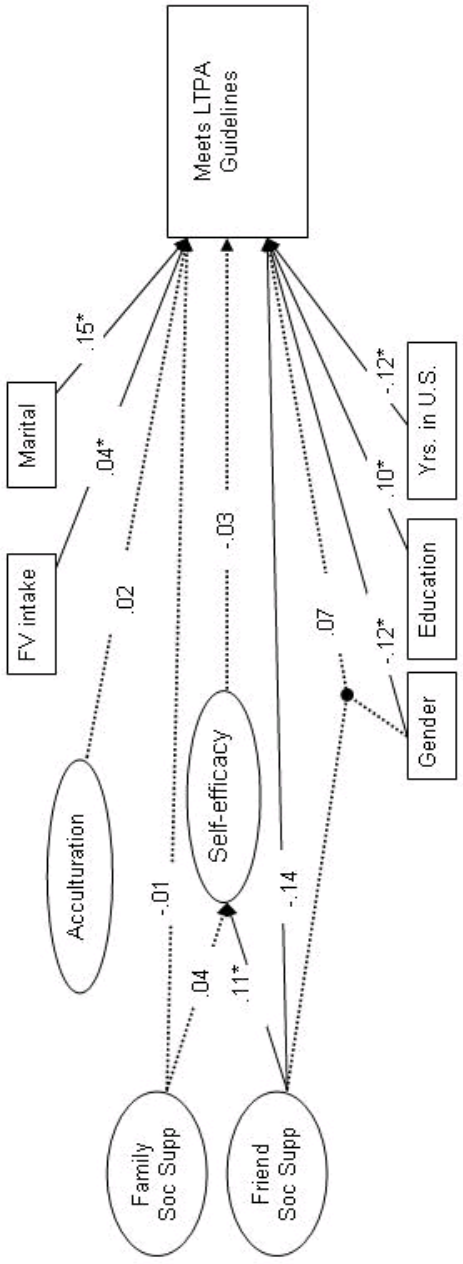

Figure 4.12. Testing an interaction between gender and PA social support from friends in a structural equation model of individual-level influences on meeting the recommended levels of LTPA. * significant at |1.96|

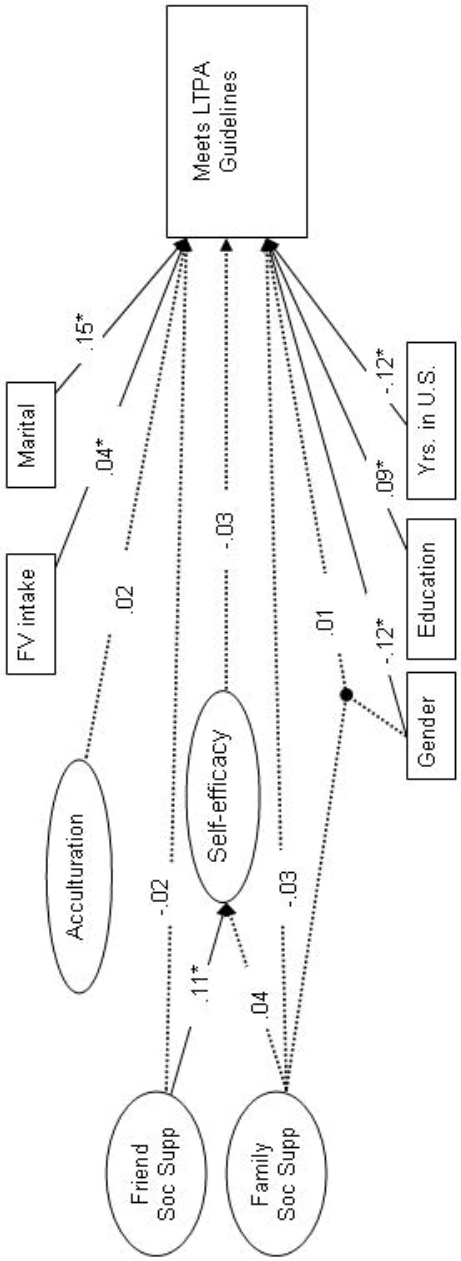

Figure 4.13. Testing an interaction between gender and PA social support from family in a structural equation model of individual-level influences on meeting the recommended levels of LTPA. * significant at |1.96|

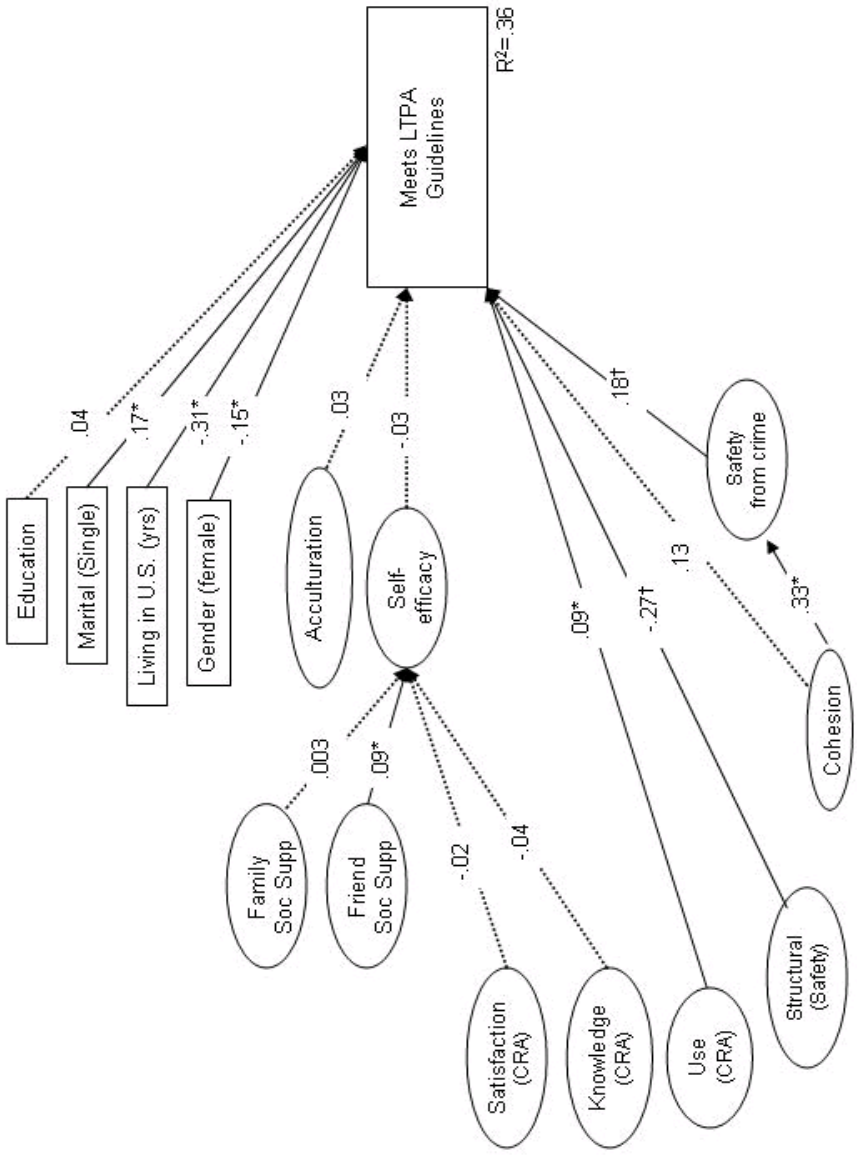

Figure 4.14. Structural equation model of individual, social and environmental level influences on meeting the recommended PA guidelines during leisure-time in a Latino community sample (X^2=735.85 [df= 635, p<.05], CFI= .97, RMSEA= .02, [95%CI=.01, .03], SRMR= .05). * significant at |1.96|; † marginally significant; CRA=community resource awareness

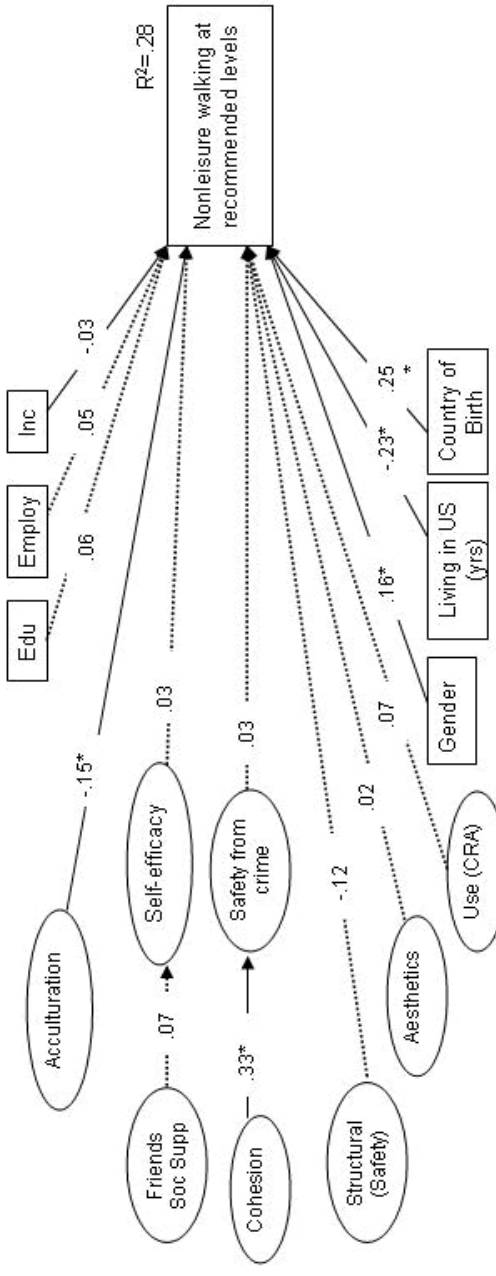

Figure 4.15. Structural equation model of individual, social and environmental level influences on active transportation in a Latino community sample (X^2 = 490.79 [df= 433, p<.05], CFI =0.98, RMSEA=0.02 [95%CI=.01, .03], SRMR= 0.05). * significant at |1.96|; CRA=community resource awareness

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