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Acculturation, Behavioral Risk Factors, and Cardio-Metabolic Dysfunction in Mexican American Women Living in a Border Region

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor

of Philosophy

in

Clinical Psychology

by

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Professor Linda C. Gallo, Chair
Professor John P. Elder
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2011

The Dissertation of Karla Espinosa de los Monteros is approved and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

San Diego State University

2011

DEDICATION

To my parents who taught me what it means to be a hard worker and made sure I had every opportunity to succeed. I love you both very much and am extremely greatful for all of your support and encouragement.

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ABSTRACT OF THE DISSERTATION

Acculturation, Behavioral Risk Factors, and Cardio-Metabolic Dysfunction in Mexican American Women Living in a Border Region

by

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Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2011
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Acculturation has been associated with health behaviors, and to a lesser extent, health outcomes among Latinos; however, inconsistencies exist regarding the nature of these relationships. Moreover, little is known about the underlying mechanisms linking acculturation to Latino health outcomes. The current study examined the relationship between acculturation, behavioral risk factors, and cardio-metabolic dysfunction in Mexican American women, and evaluated the contribution of social and economic pathways to observed associations. Participants were a random sample of 302 Mexican American women (mean age 49.77 years), recruited from communities with wide-ranging socioeconomic status (SES) located on the United States (US) side of the Tijuana (Mexico) – San Diego (US) border. Women underwent a clinical exam and completed a battery of questionnaires including demographic (age, US exposure, education, and income), cultural (language acculturation, familism,

fatalism, religiosity), social (social support, sociability), and behavioral (leisure-time physical activity, sedentary behavior, walking, fruit and vegetable servings, and dietary fat) variables. Confirmatory factor analyses (CFA) and structural equation models (SEMs) were performed in the total sample. CFAs revealed single latent constructs for English language acculturation (childhood language, English proficiency, and adult language patterns), SES (education and income), resilient cultural values (familism and religiosity), and social resources (social support and sociability). SEMs showed statistically significant direct effects of English language acculturation to more sedentary behavior and resilient cultural values to more self-reported walking. In addition, the indirect effects of US exposure to more sedentary behavior through language acculturation, English language acculturation to more sedentary behavior through SES, and resilient cultural values to more fruit and vegetable servings through social resources were also significant (CFI = 0.90, RMSEA = .10, SRMR = 0.04). Finally, significant mediated effects were found for English language acculturation to lower cardio-metabolic dysfunction via higher SES, and higher SES to lower cardio-metabolic dysfunction via lower fatalism (CFI= .89, RMSEA = .11, SRMR = .04). Behavioral variables did not appear to mediate the acculturation and cardio-metabolic dysfunction relationship. Acculturation and related cultural variables were associated with behavioral risk factors and cardio-metabolic dysfunction in middle-aged Mexican American women. SES and social resources may represent relevant pathways in explaining these associations.

Introduction

For centuries, scholars have studied the changes that occur over time when people of different cultures come into ongoing contact; in modern times, these changes have been termed acculturation (Redfiled, Linton, & Herskovits, 1936). The processes and outcomes that encompass acculturation may include, but are not limited to, changes in behaviors, beliefs, values, social networks, and sociopolitical systems. Notably, these changes occur both at the group and individual level as well as within the incoming and host culture. In addition, what changes, the extent of the changes and their impact will depend on factors such as time, cultural distance (i.e., dissimilarity between cultures), characteristics of the sending and receiving societies, and individual level variables such as age, ethnicity, gender, and socioeconomic status (Berry, 1997).

Acculturation and Latino Health

In the US, interest in studying the influence of acculturation on health has increased concurrently with the rapid growth of immigrant populations, most notably the US Latino population which accounted for 56% of the nation's growth in the past decade (Pew Hispanic Center, 2011). Indeed, by 2050, Latinos are projected to comprise 29 percent of the total US population (Pew Hispanic Center, 2008). Enhancing our understanding of the role acculturation plays in the complex pattern of health risk and resilience observed in this cultural group is critical to the advancement of research on Latino health (Abraido-Lanza, Armbrister, Florez, & Aguirre, 2006). To date, most of the research on acculturation and Latino health has been limited to simplistic tests of main effects (Abraido-Lanza et al., 2006; Cabassa, 2003). Such work suggests that for Latinos, acculturation to US mainstream culture may be associated with the adoption of

deleterious health behaviors such as smoking, drinking, and poor nutritional choices (Ayala, Baquero & Klinger, 2008; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005) and with increased risk for obesity (Abraido-Lanza, Chao, & Florez, 2005; Gordon-Larsen, Adair, & Popkin, 2003; Vella, Ontiveros, Zubia, & Bader, 2011), diabetes (Kandula et al., 2008), and cardiovascular disease (Lutsey et al., 2008; Sundquist & Winkleby, 2000). Research findings in the area of acculturation and Latino health, however, are far from consistent, with several studies reporting protective effects of acculturation to US culture on Latinos' dietary practices (Ayala, Mueller, Lopez-Madurga, Campbell, & Elder, 2005; Elder et al., 1991; Espinosa de los Monteros, Gallo, Elder, & Talavera, 2008), physical activity levels (Espinosa de los Monteros et al., 2008; Perez-Escamilla & Putnik, 2007), utilization of preventive health services (Jurkowski & Johnson, 2005; Lara et al., 2005), and even obesity (Hazuda, Mitchell, Haffner, & Stern, 1991; Slattery et al., 2005), diabetes (Mainous, et al., 2006), and metabolic syndrome prevalence (Espinosa de los Monteros et al., 2008). Thus, although acculturation has repeatedly been demonstrated to influence health risk factors, and to a lesser extent, health outcomes among Latinos, research findings are inconsistent and warrant further study.

Limitations in the Literature on Acculturation and Latino Health

In part, discrepancies in the literature may reflect an absence of uniformity in the methods used to define and assess acculturation across studies (Cabassa, 2003). In public health, the most common approach to capturing acculturation is via demographic variables assumed to be related to the process, e.g., generation of immigration, nativity, and years in the US (Abraido-Lanza et al., 2006). This approach is appealing given that

demographic characteristics are easy to assess and are readily available in national epidemiological databases. However, demographic variables are merely proxy indicators of the process. Moreover, their use presupposes homogeneity in acculturation level within groups and limits acculturation to linear, unidimensional process– assumptions that contradict acculturation theory (Berry, 1997; Phinney & Flores, 2002).

Although not as frequently utilized as proxy demographic indicators, a variety of measures of psychological acculturation are also available (Yamada, Valle, Barrio, & Jeste, 2006). These measures are an improvement in that they attempt to assess multiple components of acculturation (e.g., changes to language patterns and social networks) and to examine differences within groups. However, differences between scales are vast, reflecting diverse theoretical frameworks, methods of measurement, and focus on cultural domains (Cabassa, 2003). Consequently, comparisons across studies are difficult (Ayala et al., 2008; Hunt, Schneider, & Comer, 2004). Moreover, most of the available measures tend to overemphasize language domains, assess the construct along a single continuum (ranging from immersion in culture of origin to immersion in host culture), and provide summary scores that negate the advantages of assessing multiple dimensions (Abraido-Lanza et al., 2006).

Equally problematic is the tendency for research on acculturation and Latino health to aggregate findings across diverse Latino subpopulations and environments. “Latino” is a broad category that incorporates a diverse group of people with distinct racial, cultural, and historical backgrounds. Failing to account for such differences could mask considerable heterogeneity resulting in misleading or inconclusive findings (Hunt et al., 2004; Rogler, Cortes, & Malgady, 1991). Moreover, even when studying individuals of

similar origin, the functional significance of acculturation must be considered within the context of demographic and environmental factors (Alegria et al., 2007; Siatkowski, 2007). It is well documented that patterns of health risk and resilience differ substantially for men and women and individuals belonging to different socioeconomic groups (Adler & Snibbe, 2003; MacIntyre, Hunt, & Sweeting, 1996; Winkleby, Kraemer, Ahn, & Varady, 1998). In addition, characteristics of the receiving community, such as regional and cultural proximity to the sending community may vary widely. Thus, the acculturation process, its outcomes, and their subsequent influence on health should be studied via methods that account for demographic and contextual factors that shape the acculturation experience (Abraido-Lanza et al., 2006; Thomson & Hoffman-Goetz, 2009).

Finally, although notable advances in acculturation theory have been achieved by scholars spanning diverse disciplines, to date, there exists a paucity of theoretically grounded research on acculturation and Latino health (Abraido-Lanza et al., 2006). Simplistic models testing the direct effects of acculturation on outcomes of interest are useful inasmuch as they highlight the relevance of the construct in shaping Latino health. However, this approach provides limited insight into how and why the relationship exists (Abraido-Lanza et al., 2006; Phinney & Flores, 2002). Efforts to uncover the underlying mechanisms linking acculturation to Latino health are warranted in order to help address discrepancies in the literature and to better inform public health efforts aimed at eliminating health disparities experienced by this fast growing segment of the US population (Abraido-Lanza et al., 2006; Cabassa, 2003; Hunt et al., 2004).

Potential Mechanisms Linking Acculturation to Health

Language Acculturation. Among the various components of acculturation, overt changes, and in particular those that pertain to language, have received most attention in the literature (Matsudaira, 2006). Language is an integral component of culture necessary for effective socialization and interaction (Youdelman, 2008). Thus, language acculturation (e.g., level of English proficiency, Spanish retention, and the pattern of use of each language) can be seen as a central component of the construct reflecting and possibly driving other acculturation processes, and in turn, their subsequent influence on health.

In relation to health, language acculturation could influence Latino health outcomes through a variety of pathways. First, low English language acculturation could limit access to health education and services (Thomson & Hoffman-Goetz, 2009). For example, in the US, health literacy, i.e., one's ability to obtain, process, and understand the health information and services needed to make appropriate health decisions, has been shown to be particularly low among non-proficient English speakers (Britigan, Murnan, & Rojas-Guyler, 2009; Dubard & Gizlice, 2008; US Department of Health and Human Services, 2000). Moreover, non-proficient English speakers are less likely to use primary and preventive health care services, display lower medication or therapy adherence rates, and report less satisfaction with the health care services they receive than their English speaking counterparts (DuBard & Gizlice, 2008; Thomson & Hoffman-Goetz, 2009). Second, socioeconomic mobility is strongly associated with language acculturation, with English proficiency enabling access to education and economic opportunities which in turn are powerful determinants of health (Harmon, Castro, & Coe,

1996; Thomson & Hoffman-Goetz, 2009; Williams & Rucker, 1996). Finally, language acculturation could influence and/or reflect whom individuals interact with as well as how they interact. For example, monolingual Spanish-speaking Latinos may be restricted to smaller social networks limiting their access to health protective social resources outside of ethnic enclaves (Krause & Goldenhar, 1992; Thomson & Hoffman-Goetz, 2009). However, inasmuch as these limitations also minimize exposure to deleterious health behaviors of the host culture (e.g., unhealthy dietary habits), low English language acculturation may also be health protective (Morenoff & Lynch, 2004).

Changes to Cultural Beliefs and Values. The degree to which individuals incorporate beliefs and values of the host culture and/or retain those of their culture of origin represents another potential mechanism driving acculturation's influence on Latino health (Cuellar, Arnold, & Gonzalez, 1995). It has been speculated that such changes may account for part of the variance observed in health risk behaviors associated with language acculturation and other proxy indicators of the process (e.g. US exposure, generational status); however, to date, there is a paucity of research that has directly tested the significance of these pathways (Abraido-Lanza et al., 2006; Thomson & Hoffman-Goetz, 2009). Notably, changes to cultural beliefs and values are difficult to capture given the complexity inherent to the study of subjective internal processes (Matsudaira, 2006). Moreover, preliminary research in the area suggests that cultural beliefs and values are more resistant to acculturation pressures than more superficial changes such as language acquisition and usage (Marin, Sabogal, Marin, & Otero-Sabogal, 1987; Matsudaira, 2006; Thomson & Hoffman-Goetz, 2009). Nonetheless, the importance of considering changes in this domain is highlighted by the fact that core

Latino beliefs and values such as familism, fatalism, and religiosity have been shown to contribute to risk behavior differentials as well as the availability of coping resources in the US Latino population (Franzini & Fernandez-Esquer, 2004; Urizar, Jr. & Sears, Jr., 2006).

Familism refers to an individual's commitment to their family and family relationships (Villarreal, Blozis, & Widaman, 2005). Although the concept of familism is universal, both the definition of family as well as views regarding family obligations differ significantly between Latino and Anglo-American cultures. Among Latinos, family generally refers to nuclear, extended, and fictive (i.e., individuals regarded as family who are unrelated by blood or marriage) family with loyalty and dependence to the family being highly valued and nurtured (Villarreal et al., 2005). In contrast, views of family within Anglo-American culture generally do not extend past the nuclear realm and independence from family members is often encouraged (Villarreal et al., 2005). For Latinos, the endorsement of high levels of familism is associated with greater amounts of social and financial support, and in turn, better health outcomes (McGlade, Saha, & Dahlstrom, 2004; Organista, Organista, & Kurasaki, 2003;). For example, several studies have found that higher levels of familism are associated with health protective behaviors such as greater utilization of preventive health services, medical adherence, more physically active lifestyles, and healthier dietary practices (Abraido-Lanza, Guier, & Revenson, 1996; Antshel, 2002; Morenoff & Lynch, 2004).

Fatalism refers to the general belief that all events, and in particular, the actions and occurrences that form an individual life, are determined by fate. When applied to health, fatalism is often operationalized as negative or pessimistic attitudes regarding

preventive health practices and disease outcomes (Abraido-Lanza et al., 2007). Racial and ethnic differences in fatalism have been identified with Latinos endorsing more fatalistic beliefs and attitudes towards health than their non-Latino White counterparts (Hubbell, Chavez, Mishra, & Valdez, 1996; Otero-Sabogal, Stewart, Sabogal, Brown, & Perez-Stable, 2003). Moreover, Mexican Americans are more likely to endorse fatalistic beliefs than most other Latino subgroups (Ramirez, Suarez, Laufman, Barroso, & Chalela, 2000). Substantial research indicates that individuals who score high on fatalism are less likely to engage in preventive health practices (Espinosa de los Monteros & Gallo, 2010; Suarez, Roche, Nichols, & Simpson, 1997). In addition, among Mexican American women, fatalism has been associated with increased risk for the metabolic syndrome (Espinosa de los Monteros et al., 2008). Notably, the relevance of fatalism in explaining Latinos' health behavior in the context of social and environmental constraints is unclear, and in fact, many scientists have cautioned against identifying fatalism as a barrier to Latino health without considering the numerous limitations (e.g., low education, poor access to health care, poverty) experienced by many in this population (Chavez, Hubbell, Mishra, & Valdez, 1997; Abraido-Lanza et al., 2007). Thus, fatalism may more accurately be conceptualized as a pathway linking SES to health than an independent cultural characteristic associated with health outcomes (Abraido-Lanza et al., 2007; Freeman, 1989; Ward, Guthrie, & Butler, 2009).

Although not specifically a cultural characteristic, religiosity is deeply rooted in Latino culture, with 95 percent of Mexicans and 94 percent of Latinos in the U.S reporting a religious affiliation (Espinosa, Elizondo, & Miranda, 2003). In general, studies suggest that religious involvement has a moderate, positive association with

Latino health (Franzini, Ribble, & Wingfield, 2005). For example, attending church once a week has been associated with lower risk of mortality among older Mexican Americans, healthier dietary practices, and increased physical activity after controlling for SES (Arredondo, Elder, Ayala, & Campbell, 2005; Hill, Angel, Ellison, & Angel, 2005). Franzini and Fernades-Esquer (2005) note that religiosity may impact health by providing a sense of social support and belonging, providing material and social aide, and encouraging health-protective behaviors.

In summary, although inconsistencies exist regarding the magnitude and direction of acculturation's effects on Latino health, acculturation may represent an important factor contributing to health outcomes in this at-risk population. Theoretically grounded research that accounts for both individual level (e.g., gender, SES, region of origin) and contextual factors (e.g., characteristics of receiving community) could help strengthen our understanding of how acculturation influences Latino health patterns. Such research should also move beyond tests of simplistic main effects to more sophisticated models that help uncover the underlying pathways driving observed associations between acculturation and Latino health outcomes.

The Current Study

The overarching question of interest in this research is to explore the construct of acculturation as it relates to Latino health, and more specifically Mexican American women's health. This work focused primarily on cardio-metabolic dysfunction as an integrative indicator of future cardiovascular disease (CVD) and diabetes risk given Mexican American women's disproportionate vulnerability to the metabolic syndrome (syndrome X, insulin resistance syndrome). The metabolic syndrome refers to an array of

cardio-metabolic dysregulations that affect individuals in a clustered fashion and are believed to directly promote the development of CVD and type II diabetes (Hutley & Prins, 2005). Although it has been variously defined, the metabolic syndrome generally describes the occurrence of central adiposity (i.e., elevated waist circumference) in combination with two or more of the following risk factors: elevated serum triglycerides, high systolic, or diastolic blood pressure, reduced high-density lipoprotein cholesterol, and hyperglycemia (Grundy et al., 2005). Mexican Americans, and particularly, Mexican American women (Salsberry, Corwin, & Reagan, 2007; Tonstad, Sandvik, Larsen, & Thelle, 2007), are at high risk for development of the metabolic syndrome with prevalence estimates of 51% to 54% in middle-aged Mexican American women, compared to 33% to 37% in non-Latino White women (Ford, 2005).

Preliminary research suggests that acculturation may be an important factor in explaining Mexican American women's vulnerability to the metabolic syndrome. For example, a study of Mexican American women living along the US/Mexico border found US acculturation to be associated with lower metabolic syndrome risk as captured by lifestyle factors (diet and physical activity) and overall prevalence of the syndrome (Espinosa de los Monteros et al., 2008). Notably, little is known about the potential mechanisms driving these associations. Moreover, the results of the study were based on a small, volunteer, clinic-based sample of low-income patients. The current study will build on this research by exploring the relationship between acculturation, health behaviors, and cardio-metabolic dysfunction in a larger, randomly selected community sample of middle-aged Mexican American women of varied socioeconomic backgrounds who were recruited from the US side of the San Diego -Tijuana border region. The

proposed research will also address some of the limitations in the literature on acculturation and Latino health by focusing on a specific high risk Latino subgroup (i.e., middle-aged Mexican American women living in a border region), assessing multiple domains of acculturation, and exploring the significance of theoretically relevant social and economic pathways in explaining the associations between acculturation and bio-behavioral risk factors.

Specific Aims of this Study

Aim One**:** To explore the nature and distribution of different domains of acculturation relevant to disease risk and resilience including how they relate to each other and to theoretically relevant social and economic mechanisms proximal to cardio-metabolic dysfunction (i.e., pathways A-H, refer to Figure 1).

Aim Two: To explore the relationship between acculturation domains and behavioral risk factors relevant to cardio-metabolic dysfunction. Building on the results from aim one, the relevance of social and economic pathways in explaining these associations will also be explored (i.e., pathways A-M, refer to Figure 1).

Aim Three: To explore the relationship between acculturation domains and cardio-metabolic dysfunction. Building on the results from aim one and two, the relevance of social, economic, and behavioral pathways in explaining these associations will also be explored (i.e., pathways A-Q, refer to Figure 1).

Due to limited and inconsistent research in this area, the study is primarily exploratory and explicit directional hypotheses for all pathways tested were not asserted in advance. However, US exposure was expected to relate directly to higher English language acculturation, and directly and indirectly (through higher English language

acculturation) to the endorsement of less Mexican-oriented cultural beliefs and values (i.e., familism, fatalism, and religiosity). In turn, language acculturation and Mexican-oriented cultural beliefs and values were expected to relate directly and indirectly (through social, economic, and behavioral pathways) to cardio-metabolic dysfunction. Structural equation modeling was utilized to test the relationships outlined in the proposed model (refer to Figure 1).

Method

Participants

The current study was based on data from an epidemiological examination of socio-emotional factors in CVD risk and included 302 Mexican American women of diverse socioeconomic backgrounds randomly recruited from communities on the US side of the Tijuana (Mexico) - San Diego (US) border. Women were eligible to participate in the parent study if they were of Mexican descent, between 40 and 65 years of age, and able to read and write in English or Spanish. Exclusionary criteria included history of CVD, diabetes, kidney disease, or other serious illness, pregnancy, taking medications with autonomic effects, shift work, or living in a group home situation. A total of six-hundred and fifty-six women were screened by telephone, 363 of those screened (55.3%) were eligible based on the criteria outlined above. Of the eligible participants, 321 (88.4%) agreed to participate. This study includes 302 women who completed the psychosocial, behavioral, and physical assessments.

Procedure

Participants were randomly recruited via targeted telephone and mail procedures from San Diego communities with high densities of Mexican American residents and wide-ranging SES. Eligible women who agreed to participate were scheduled for a series of in-home assessments. During the initial visit, bilingual/bicultural research assistants obtained written informed consent and provided women with a self-administered survey battery in their preferred language. During the second visit, resting blood pressure readings, anthropometric measurements, and a 12-hour fasting blood draws were

conducted by a trained research technician and a licensed phlebotomist. All procedures for this study were approved by San Diego State University's Institutional Review Board.

Measures

US exposure. Exposure to the US was assessed by calculating the percent of each participant's life that was spent in the US (i.e., years in the US/participant's age x 100).

Language acculturation. Hazuda's Acculturation Scales I-III (1988) were used to assess the following components of language acculturation: childhood experiences with English versus Spanish language (Scale I); adult proficiency in English (Scale II); and adult pattern of English versus Spanish language usage (Scale III). Scale I consists of two items assessing participant's first language and language spoken at home during childhood. Scale II consists of three items in which respondents rate how well they speak, read, and understand spoken English on a scale ranging from 1, not at all, to 4, very well. Scale III consists of ten items assessing respondent's pattern of English vs. Spanish usage across situations and social networks. Response choices range from 1, only Spanish, to 5, only English. The Hazuda Acculturation Scales were developed and validated in a population-based sample of Mexican American adults ages 25-64 years (Hazuda, Stern, & Haffner, 1988). These scales have been shown to be reliable with alpha coefficients ranging from 0.85-0.95 (Hazuda, 1994). Spanish language versions of the scales were created and validated by the scales' authors via forward and back translation procedures. In this sample, analyses of internal consistency revealed adequate to good reliability across these scales (αs = 0.74, 0.94, 0.92, for scales I-III, respectively). Participants were categorized into four acculturation strata (1= low acculturation, 2 = med/low

acculturation, 3 = med/high acculturation, 4 = high acculturation) based on cut off scores set forth by Hazuda and colleagues (Hazuda, 1994).

Mexican-oriented cultural beliefs and values. Hazuda's Acculturation Scale IV was utilized to assess the value participants place on preserving their Mexican-cultural origin (Hazuda et al., 1988). The scale consists of three items assessing the importance participants place on their children being knowledgeable of Mexican history and observing Mexican customs and holidays. Responses on this scale range from 1, not important at all, to 5, very important. The scale has been shown to be reliable with a reported alpha coefficient of 0.76 (Hazuda, 1994). In this sample, this scale demonstrated adequate internal consistency ($\alpha = 0.73$). For more information about this scale refer to the previous section.

Attitudinal familism, i.e., participant's attitudes regarding the importance of family, was assessed via a 5-item scale which was validated on a nationally representative sample of Latino adults from varied countries of origin (Villarreal et al., 2005). Items for this 5-item scale were derived from two separate familism scales (Gaines, et al., 1997; Gil, Wagner, & Vega, 2000). Items for these scales were translated into Spanish via forward and back translation procedures by the scale authors. Participants indicate their ideological beliefs about family on 5-point scale ranging from 1, strongly disagree, to 5, strongly agree. The scale has been shown to have good internal consistency, $\alpha = .82$, face validity, and a factor structure that holds across Latin American country of origin and language of administration (Villarreal et al., 2005). In the current sample, the scale demonstrated good internal consistency ($\alpha = 0.85$).

Four items derived from the fatalism subscale of the Multiphasic Assessment of Cultural Constructs-Short Form (Cuellar et al., 1995) were used to assess fatalism. The original scale was translated via forward and back translation procedures and validated by the scale's authors (Cuellar et al., 1995). The four-item version that was utilized in this study was adapted for a study that examined the role of psychosocial and cultural predictors in explaining Latina's utilization of cancer screening services and demonstrated good internal consistency ($\alpha = 0.84$; Arredondo, 2004). In the current sample, internal consistency was adequate ($\alpha = 0.73$).

Finally, religiosity was assessed via two items assessing organizational religiosity and one assessing the value participants place on religion. Items assessing organizational religiosity were derived from a scale developed by Strawbridge and colleagues based on the Social Network Integration Scale (Strawbridge, Shema, Cohen, Roberts, & Kaplan, 1998). Specifically, participants reported the frequency of religious service attendance as well as their participation in other activities at a place of worship. The item assessing value placed on religion was derived from a measure utilized in a Latin American study on aging (Inter-University Consortium for Political and Social Research, 2000). Respondents indicated the value they place on religion on a 4-point scale ranging from 1, not important, to 4, very important. All items were translated by bilingual/bicultural staff members via a multistep process that included forward and back translation procedures and review by committee to ensure semantic equivalence. Exploratory factor analyses with direct oblimin rotation revealed that all items loaded onto one factor (eigenvalue = 1.97, 52.13% of variance explained; factor loadings > 0.56) Thus, items were

standardized and a composite score was created to reflect participants' religiosity. Internal consistency for this short scale was $\alpha = 0.74$.

Socioeconomic status. Educational attainment was categorized as follows: (1) less than 9th grade; (2) 9th-11th grade; (3) high school diploma or equivalent; (4) some college; (5) bachelors degree; and 6) graduate or professional degree. Gross household income was assessed on an ordinal scale in increments of $500.

Interpersonal resources. Social support was measured with the 12-item version of the widely used Interpersonal Support Evaluation List (ISEL 12; Cohen, Mermelstein, Kamarck, & Hoberman, 1985). The ISEL 12 is available from the author's website at the following address: http://www.psy.cmu.edu/~scohen/scales.html. This scale measures overall perceived support across the following three dimensions: availability of a confidante (appraisal support), social group (belonging support), and material aid (tangible support). Response choices range from 0, definitely false, to 3, definitely true. A Spanish version of the full ISEL had previously been developed for a Venezuelan sample, using forward and back translation procedures that included reconciliation by the study team after translation occurred (Bastardo & Kimberlin, 2000). This measure was the basis for the 12-item version administered in the current study, with minor modifications made by a committee of bilingual/bicultural Mexican Americans. Internal consistency in the current sample was high for this scale ($\alpha = 0.94$).

The extent to which respondents maintain close or supportive contacts with friends and family was assessed via the Sociability subscale of the well known and validated Social Network Integration Scale (Berkman & Syme, 1979). Respondents were asked about the number of close relatives and friends they have as well as their frequency

of contact with them. A total sociability score was calculated with more weight placed on family contacts. The total score was then categorized into three groups with lower scores reflecting smaller social networks and fewer contacts. Scores on the sociability scale have been shown to predict mortality rates across age and gender groups (Berkman & Syme, 1979). All of the items were translated by bilingual/bicultural staff members via a multistep process that included forward and back translation procedures as well as a review by a bilingual committee to ensure semantic equivalence.

Behavioral factors associated with energy balance. Two brief screening instruments (27-items) developed by Block and colleagues (Block, Gillespie, Rosenbaum, & Jenson, 2000) and culturally adapted and translated in previous studies (Ayala et al., 2005) were used to assess dietary patterns. These measures assess the daily consumption of fruits and vegetables (servings) and total fat (grams). Response choices range from 0 (less than once a week) to 5 (two or more times a day). Estimates of macro-nutrient intake based on these short screeners are highly correlated with those obtained from the full-length, well-validated Block Food-Frequency Questionnaire (Block, Gillespie, Rosenbaum, & Jenson, 2000).

Two subscales from the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003) were used to assess walking and sedentary behavior. Walking was measured across the following four domains: leisure time, domestic activities, work, and transportation. A total score for walking was calculated by multiplying the duration (in minutes) and frequency (in days) of activity reported for each category, and then summing these values across domains. Walking scores were then categorized into the following three groups based on guidelines set forth by the Department of Health and

Human Services (2009): no walking; some walking but does not meet guidelines; meets guidelines. Sedentary behavior (i.e., too much time sitting) was measured by asking participants to specify the time spent in sitting activities during a typical week. Sedentary behavior was examined as a continuous variable with higher scores reflecting more sedentary lifestyles. The IPAQ has been validated in 12 countries and has demonstrated adequate reliability and validity (Craig et al., 2003). The scale was translated into Spanish via forward and back translation procedures (Craig et al., 2003).

Finally, leisure-time physical activity was assessed via the Leisure Time Exercise Questionnaire (Godin, Jobin, & Bouillon, 1986). The scale is a simple measure of the frequency and intensity of leisure-time physical activity and has demonstrated adequate reliability and concurrent validity (Godin et al., 1986). Respondents were instructed to report how many times per week they engaged in strenuous, moderate, and mild exercise for more than 15 minutes during their free time. A total score was calculated by multiplying the frequency of weekly exercise by its metabolic equivalent based on intensity (i.e., 9, strenuous, 5, moderate, and 3, mild; Godin et al., 1986). Items were translated by bilingual/bicultural staff members via a multistep process that included forward and back translation procedures and a review by a bilingual committee to ensure semantic equivalence.

Cardio-metabolic dysfunction. Cardio-metabolic dysfunction was assessed via a composite score based on the number of metabolic syndrome components – i.e., blood pressure, waist circumference, plasma glucose, triglycerides, high density lipoprotein cholesterol – that met The Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program's high-risk clinical criteria (National Cholesterol

Education Program (NCEP) Expert Panel on Detection, 2002) with modifications set forth by the American Heart Association and the National Heart, Lung and Blood Institute (Grundy et al., 2005). Cut off scores were as follows: waist circumference > 88 cm; fasting triglycerides ≥ 150 mg/dL; fasting high density lipoprotein cholesterol < 50 mg/dL; systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85 mmHg; and fasting glucose ≥ 100 mg/dL. Consistent with these guidelines, individuals who did not display high values for a component but were on drug treatment for a related condition (e.g., elevated glucose or hypertension) were presumed to meet criteria for the component in question. The composite score ranged from 0 (no components) to 5 (five components) with higher scores indicating more cardio-metabolic dysfunction. We chose to use a continuous indicator of cardio-metabolic dysfunction rather than a categorical indicator of metabolic syndrome prevalence, given the fact that only healthy women who were not taking autonomically-active (i.e., having an effect on the autonomic nervous system) medications were selected for the current study. Thus, it was felt that a dichotomous indicator of metabolic syndrome prevalence would under-represent the degree and variability of cardio-metabolic risk in this sample. A similar approach towards measuring biological risk for CVD and related disorders has been used in prior studies (Crimmins, Kim, Alley, Karlamangia, & Seeman, 2005; Merkins, Basurto-Davila, et al., 2009; Seeman et al., 2008).

Covariates. Self-reported date of birth was utilized to calculate age at assessment. Dichotomous variables (coded 0, 1) were created to indicate menopausal status (participants who reported no menstruation for the past 12 months were considered post-

menopausal) and whether individuals had some form of medical insurance (e.g., private insurance, Medical or Medicaid vs. no insurance/pay out of pocket).

Analyses

Descriptive statistics were calculated and all variables were examined for deviations from normality. Preliminary analyses revealed that the variables representing religiosity, social support, and familism were markedly positively skewed and the distributions for sedentary behavior, child language preference, and physical activity were markedly negatively skewed. Log transformations were conducted for all variables, except for physical activity, which was categorized into quintile groups due to a large number of individuals who reported engaging in no physical activity. To facilitate the interpretation of all results, all covariates and predictors were standardized (i.e., mean =0, SD =1) prior to being entered into models.

Based on bivariate correlational analyses, the following decisions were also made prior to model testing (refer to Table 2). First, the scale measuring Mexican cultural values was dropped from all analyses because it was not associated with the other indicators of cultural beliefs and values and related only weakly to the outcomes of interest. Second, although fatalism was not associated with familism and religiosity, it was maintained in models as an independent variable given evidence in the literature for its association with health (Espinosa de los Monteros & Gallo, 2010; & Niederdeppe & Levy, 2007), as well as its significant associations with language acculturation, SES and cardio-metabolic dysfunction in this sample. Third, given that the observed associations between all behavioral indicators were not strong enough to represent one latent variable (lowest r = 0.02, highest r = 0.28; for more information, refer to Table 2), the decision

was made to keep each indicator as a separate variable in the model. This decision also enabled the examination of the unique associations between each behavioral indicator and the socio-cultural variables in the model.

A four-factor confirmatory factor analysis was specified for all socio-cultural variables. Factors were specified as follows: (a) English proficiency, childhood language, and language use patterns (language acculturation); (b) religiosity and familism (resilient cultural values); (c) education and income (SES); (d) social support and sociability (social resources). Subsequently, a series of structural equation modeling analyses (SEMs) were conducted to test aims 1 through 3. Model 1 explored the relationships between all socio-cultural variables (i.e., pathways A-H). Building on the results of Model 1, Models 2 and 3 explored the relationships between socio-cultural variables and behavioral risk factors (Model 2, pathways A-M) and cardio-metabolic dysfunction (Model 3, pathways A-Q). Secondary analyses were conducted to determine whether significant behavioral pathways mediated the relationships between socio-cultural factors and the cardio-metabolic dysfunction (pathways A-R). Age was specified as a covariate for all models. Menopausal status and health insurance coverage were specified as additional covariates for Model 3 and all secondary analyses.

The maximum likelihood robust (MLR) estimation procedure employed by MPlus (Muthén & Muthén, 2006) was used to estimate model parameters. This procedure provides a chi-square test statistic [Yuan-Bentler T_2 (Y-Bχ^2); Yuan & Bentler, 2000] and standard errors that are adjusted for multivariate non-normality and missing data. Three descriptive fit indexes were used across analyses: the comparative fit index (CFI; Bentler, 1990), the root mean square error of approximation (RMSEA; Steiger, 1990), and the

standardized root mean square residual (SRMR; Hu & Bentler, 1999). All three parameters represent descriptive fit indices of overall model fit, with CFI values of 0.90 or more and RMSEA and SRMR values of 0.05 or less being indicative of good fit. RMSEA and SRMR values between 0.05 and 0.08 are indicative of acceptable fit (Chen, 2007).

Minimal missing data was evident; 98% of participants had complete data, and bivariate statistical analyses revealed no statistically significant differences in target study variables for those with missing versus complete data (all *p*s > .05).

Results

Descriptive Statistics

Means and standard deviations for all the observed variables are presented in Table 1, and bivariate correlations in Table 2. On average, women were 49.77 years old (SD = 6.54). Seventy-five percent of participants were foreign-born, with the average age at time of migration being 22.70 (SD = 10.60). Approximately, 34% of the participants did not complete high school or receive a GED, 24% reported an annual household income of less than $21,000, and 52% were post-menopausal.

Model Testing

Measurement models and interfactor correlations. Model fit was acceptable for the four-factor model of socio-cultural variables according to two of the three descriptive fit indices used, Y-Bχ^2(df= 22) = 91.70, $p < 0.05$, CFI = 0.91, RMSEA = 0.10, SRMR = 0.06. All standardized factor loadings were statistically significant and are presented along with the inter-factor correlations among the four latent variables in Table 3. Given that 3 of the 4 latent variables identified (i.e., SES, social resources, and resilient cultural values) were comprised of fewer than 3 observed variables, and the fact that such latent variables are considered to be unstable in structural equation modeling (Kline, 2010), Bartlett factor scores (utilizing principle axis factoring and oblimin rotation) were created separately for each construct in SPSS and used in subsequent analyses. The results of these analyses were as follows: education and income loaded onto one factor identified as SES (eigenvalue = 1.48, 48.06% of variance explained; factor loadings = .64); familism and religiosity loaded onto one factor identified as cultural values (eigenvalue = 1.17, 17.28% of variance explained; factor loadings = 0.42); and finally,

social support and sociability loaded onto one factor identified as social resources (eigenvalue = 1.66, 41.43% of variance explained; factor loadings = 0.69).

Structural Equation Models. Next, the three SEMs were tested. Model 1 fit reasonably well according to two of the three descriptive fit indices used, Y-Bχ^2(df=18) = 107.44 , $p < .05$, CFI = 0.90, RMSEA = 0.12, SRMR = .05. Standardized structural/path coefficients for Model 1 are presented in Figure 2 and described below according to the proposed sequence of the model. After accounting for age, US exposure was a significant and positive predictor of English language acculturation ($\beta = 0.67$) but was not significantly related to resilient cultural values ($\beta = 0.01$). English language acculturation was a significant positive predictor of SES ($\beta = 0.55$), but not a significant predictor of fatalism, resilient cultural values, or social resources ($\beta = -0.03, 0.01, 0.06$, respectively). Resilient cultural values were a significant positive predictor of social resources ($\beta = 0.37$). SES was a significant negative predictor of fatalism ($\beta = -0.30$) and a significant positive predictor of social resources ($\beta = 0.47$). Finally, MacKinnon's asymmetric confidence intervals (MacKinnon, Fritz, Williams, & Lockwood, 2007) indicated that the following mediated effects were statistically significant: (a) US exposure to SES via English language acculturation (95% asymmetric CI = 0.03 to 0.04); (b) English language acculturation to fatalism via SES (95% asymmetric CI = -0.24 to -0.10); (c) English language acculturation to social resources via SES (95% asymmetric CI = 0.08 to 0.22; refer to Figure 2). R-square values for all endogenous variables were as follows: language acculturation (0.45, $p < 0.001$); SES (0.31, $p < 0.001$); resilient

cultural values (0.01, $p > 0.05$); social resources (0.23, $p < 0.001$); and fatalism (0.10, $p < 0.01$).

Model 2 tested the relationship between socio-cultural variables and behavioral factors related to cardio-metabolic function. Model 2 fit reasonably well according to two of the three descriptive fit indices used, Y-Bχ^2 (df=34) = 134.93 , $p < .05$, CFI = 0.90, RMSEA = .10, SRMR = 0.04. All pathways are presented in Figures 3-7[1] and significant pathways are described below. As previously noted, after accounting for age, US exposure was a significant positive predictor of English language acculturation (β = 0.67). In turn, English language acculturation was a significant positive predictor of SES (β = 0.55) and sedentary behavior (β = 0.21). SES was a marginally significant positive predictor of sedentary behavior (β = 0.13). Finally, resilient cultural values significantly and positively predicted walking behavior (β = 0.12) and social resources (β = 0.12). In turn, social resources were a significant positive predictor of fruit and vegetable servings per day (R^2 = 0.19). Significant mediated effects were found for the following compound structural paths: (a) Resilient cultural values to servings of fruit and vegetables per day via social resources (95% asymmetric CI = 0.02 to 0.12; refer to Figure 4); (b) US exposure to sedentary behavior via English language acculturation (95% asymmetric CI = 0.05 to 0.23; refer to Figure 7). No other pathways reached statistical significance. R-square values for all endogenous variables were as follows: language acculturation (0.44, $p < 0.001$); SES (0.31, $p < 0.001$); resilient cultural values (0.01, $p > 0.05$); social resources (0.23, $p <0.001$); fatalism (0.10, $p < 0.01$); sedentary behavior (0.10, $p < 0.01$); fruit and vegetable servings (0.06, $p < 0.05$); walking (0.06, $p <$

0.05); leisure-time physical activity (0.06, $p < 0.05$); total fat in diet (0.08, $p < 0.01$).

Building on previous results, Model 3 tested the relationships between socio-cultural factors and the cardio-metabolic dysfunction after accounting for age, menopausal status, and medical insurance access. Model fit was acceptable according to one of the three descriptive fit indices used, Y-Bχ^2 (df=26) = 127.42, $p < .05$, CFI= .89, RMSEA = .11, SRMR = .04. All pathways are presented in Figure 8, and significant pathways are described below. US exposure was a significant positive predictor of English language acculturation ($\beta = .67$), which in turn was a significant positive predictor of SES ($\beta = .55$). SES was a statistically significant negative predictor of cardio-metabolic dysfunction ($\beta = -.18$) and a statistically significant negative predictor of fatalism ($\beta = -.31$). In turn, fatalism was positively associated with cardio-metabolic dysfunction ($\beta = .12$). Significant mediated effects were found for the following compound structural paths: (a) English language acculturation to cardio-metabolic dysfunction via SES (95% asymmetric CI = -0.18 to -0.02; refer to Figure 8); (b) SES to cardio-metabolic dysfunction via fatalism (95% asymmetric CI = -0.10 to 0.0001; refer to Figure 8). No other pathways in the model reached statistical significance. Secondary analyses revealed that behavioral factors did not mediate the relationship between acculturation and cardio-metabolic dysfunction. R-square values for all endogenous variables were as follows: language acculturation (0.46, $p < 0.001$); SES (0.31, $p < 0.001$); resilient cultural values (0.01, $p > 0.05$); social resources (0.28, $p < 0.05$); fatalism (0.10, $p < 0.01$); and cardio-metabolic dysfunction risk score (0.09, $p < 0.001$).

Discussion

The current study explored the relationship between acculturation, behavioral risk factors, and cardio-metabolic dysfunction in middle-aged Mexican American women living near the Tijuana (Mexico) - San Diego (US) border. The study sought to address some of the limitations in the literature on acculturation and health, by focusing on a specific high risk Latino subgroup (i.e., middle-aged Mexican American women living in a border region), assessing multiple domains of acculturation, and exploring the significance of theoretically relevant social and economic pathways in explaining acculturation and cardio-metabolic dysfunction relationships.

The first aim of the study was to explore how different domains of acculturation related to each other and to social and economic variables that could mediate the association between acculturation and cardio-metabolic dysfunction. As expected, women reporting greater exposure to the US also reported higher English language acculturation. However, US exposure and English language acculturation were not associated with any of the indicators of cultural beliefs and values included in this study (i.e., familism, fatalism, and religiosity). It has been speculated that changes to cultural beliefs and values may account for some of the variance in health risk associated with US exposure and language-based measures of acculturation (Cuellar, Arnold, & Gonzalez, 1995). However, to the writer's knowledge, only one study to date has empirically explored this question and its findings did not support the mediating role of cultural beliefs and values (Minnis et al, 2010). This is consistent with the findings of the current study that suggest that at least in Mexican American women living near the US-Mexican border, the relationship between these proxies of acculturation and health may be

independent of changes in these domains. These findings also support the notion that cultural beliefs and values are more resistant to acculturation pressures than more superficial changes such as language acquisition and usage (Marin, Sabogal, Marin, & Otero-Sabogal, 1987; Thomson & Hoffman-Goetz, 2009 ; Matsudaira, 2006). It is also possible that the close proximity to Mexico may encourage continued contact with Mexico, which would also reinforce these beliefs and values.

The magnitude of the association between English language acculturation and socioeconomic status was very large and statistically significant. Thus, the influence of English language acculturation on participants' health profiles may to a large extent be attributable to the social and economic opportunities available to those who are better integrated into US mainstream culture. Although childhood language use, adult pattern of Spanish vs. English language usage, and English proficiency were all significantly associated with SES, it is interesting to note that the magnitude of the association between English language proficiency and SES (i.e., education and income) was more than twice as large as the relationship of SES with the other two markers of language acculturation. Thus, it appears that language barriers are what most strongly relate to the socioeconomic opportunities available to Mexican American women living in this region.

Higher English language acculturation was also directly – and indirectly via SES – related to more social resources as captured by perceived social support and sociability (i.e., the maintenance of close and supportive contacts with friends and family). Social support and social integration are thought to influence health, and specifically CVD risk and outcomes, indirectly via their effect on behavioral patterns associated with health risk (e.g., physical activity, diet, and utilization of health care services), as well as more

directly through their impact on physiological mechanisms involved in the development and progression of illness (e.g., inflammatory processes and allostatic load; Berkman, 1985; Cohen, 1988; Loucks et al., 2006; Reblin & Uchino, 2008). Thus, for women residing near the US-Mexico border, English language acculturation may result in increased access to protective social resources beyond those attributed to higher SES, potentially by expanding women's access to social networks outside of ethnic enclaves. As expected, women who reported more resilient cultural values, as captured by religiosity and familism, also endorsed more protective social resources.

Finally, fatalism was strongly inversely associated with SES, with more affluent women reporting less fatalistic beliefs than their lower SES counterparts. The association between English language acculturation and fatalism was completely explained by the association between English language acculturation and SES. Specifically, higher English language acculturation was associated with higher SES and in turn lower fatalism. Fatalism was not associated with any of the other cultural variables included in this study, including US exposure. In a recent review on fatalism and Latino health, Abraido-Lanza and colleagues (2007) cautioned against conceptualizing fatalism as a culture-bound belief that explains health behavior without considering how socioeconomic barriers (e.g., limited access to education, income, access to health promoting resources) shape the fatalistic perceptions of this population. These findings support this claim and suggest that for Mexican American women living near the US-Mexico border, fatalistic views may more accurately reflect the social and economic constraints associated with low US acculturation, than the cultural beliefs and values of this subset of the population.

The second aim of the study was to examine how cultural variables related to behaviors associated with cardio-metabolic dysfunction (i.e., dietary habits and energy expenditure), and if social and economic factors mediated any of the observed associations. In general, relationships differed depending on the cultural indicator and behavior examined. For example, higher US exposure and English language acculturation were significantly associated with more sedentary behavior, with SES emerging as one potential explanatory pathway. Sedentary behavior (i.e., too much time sitting) has been shown to influence health through mechanisms that are distinct from physical inactivity (i.e., too little exercise). A study that examined the associations between physical activity, sedentary behavior, and obesity found that individuals meeting recommended guidelines for physical activity but reporting high levels of sedentary behavior displayed equivalent risk for obesity as their less physically active but also less sedentary counterparts (Sugiyama, Healy, Dunstan, Salmon, & Owen, 2008). Moreover, independent of physical activity level, sedentary behavior has been associated with increased morbidity and mortality, an effect that is thought to be partially mediated by adverse changes in cardiovascular function, glucose tolerance, and lipoprotein lipase activity (Katzmarzyk, 2010; Hamilton, Hamilton, & Zderic, 2007). These studies highlight the importance of assessing sedentary behavior, independent of physical inactivity, in research aimed at understanding behavioral contributions to health outcomes.

To this author's knowledge this is the first study to examine the association between acculturation and sedentary behavior in adult Latinas. Research on acculturation and sedentary behavior in Latino minors suggests that sedentary behavior is most

prevalent in less acculturated groups (Singh, Yu, Siahpush, & Kogan, 2008). The fact that the pattern is reversed in adults may be explained by differences in the functional significance of SES for sedentary behavior across age groups. Whereas for children, higher SES may translate to increased accessibility to safe outdoor facilities that promote leisure-time physical activity (Liu, Probst, Harun, Bennett, & Torres, 2009), for adults, it may result in more time spent sitting in front of computers during work and leisure or commuting to and from work by car. These assertions are supported by this study's findings, and by previous studies on SES and adult sedentary behavior, which indicate that high educational attainment and white-collar occupations are risk factors for more sedentary lifestyles (Van Dyck et al., 2010).

English language acculturation was not significantly associated with leisure-time physical activity, however, the direction of the English language acculturation and leisure-time physical activity effect was consistent with prior research (i.e., a positive association between English language acculturation and leisure-time physical activity; Abraido-Lanza, et al., 2005; Berrigan, Dodd, Troiano, Reeve, & Ballard-Barbash, 2006; Crespo, Smit, Carter-Pokras, & Andersen, 2001). In addition, the endorsement of more resilient cultural values was directly associated with a higher likelihood of meeting health-enhancing physical activity guidelines via self-reported walking, and was associated indirectly with the consumption of more fruit and vegetable servings through increased access to social resources. It is interesting to note that these Mexican-oriented cultural values emerged as the only cultural variables significantly related to health protective behaviors, and that their effect on behavior was independent of US exposure and English language acculturation. This suggests that women living on the US side of

the US-Mexico border are able to maintain resilient cultural values regardless of how long they reside in the US or their level of English language acculturation. In turn, maintenance of these values appears to be associated with healthier dietary practices and more physically active lifestyles.

The third aim of this study was to examine how these cultural variables related to cardio-metabolic dysfunction, and to explore the roles of social, economic, and behavioral pathways in explaining significant associations. Higher English language acculturation was indirectly associated with cardio-metabolic dysfunction via its association with higher SES. Moreover, fatalism emerged as a potential pathway explaining the association between SES and cardio-metabolic dysfunction, with higher SES being associated with less fatalistic beliefs and in turn lower cardio-metabolic dysfunction. These results are consistent with prior research on acculturation and metabolic syndrome risk in Latinas living near the US-Mexico border (Espinosa de los Monteros et al., 2008), and yet, they conflict somewhat with dominant trends in the literature that have tended to associate US acculturation with deleterious health effects.

It has been theorized, but not always demonstrated, that US acculturation diminishes protective cultural practices and fosters the adoption of unhealthy behaviors (Negy & Woods, 1992; Landrine & Klonoff, 2004). Although this study's findings are consistent with the notion that Mexican-oriented cultural values are health protective, these results do not support the claim that US exposure or language acculturation are associated with significant changes in these cultural domains. In addition, behavioral factors (i.e., dietary habits, level of physical activity, and sedentary behavior) did not appear to mediate the acculturation and cardio-metabolic dysfunction relationship. On the

other hand, English language acculturation was strongly associated with socioeconomic status – a well-documented social determinant of health (Adler & Rehkopf, 2008; Gallo, Espinosa de los Monteros, Shivpuri, 2009; Seeman, Merkin, Crimmins, Koretz, Charette, & Karlamangla, 2008) – and it is that relationship that fully accounted for the US acculturation and cardio-metabolic dysfunction relationship. The fact that fatalism emerged as a potential pathway explaining the SES and cardio-metabolic dysfunction relationship is consistent with the theory that fatalism represents one mechanism linking SES to health (potentially through decreased self-efficacy in one's ability to exert control over life events; Straughan & Seow, 1998) rather than a cultural barrier to health.

Future Research Directions and Limitations of the Current Study

In sum, these results highlight the complexity of acculturation research and emphasize the need to move away from tests of simplistic main effects, to theoretically-driven research that helps uncover the underlying mechanisms driving acculturation and health relationships. These results also demonstrate the importance of considering the functional significance of acculturation within the context of environmental factors that shape the acculturation process. For example, in a border community such as San Diego County, mainstream culture represents a fusion of both Mexican and American cultural elements. Moreover, the close proximity to Mexico in this border region promotes continued contact with Mexico, which would also help maintain these beliefs and values. Therefore, it is not surprising that for women living in this border region, the endorsement of Mexican-oriented cultural beliefs and values was not dependent on length of US residency or level of integration into mainstream culture. Whether the same holds

for other demographic groups, and individuals settling in other border communities or cities more distant to their culture of origin, warrants further study.

Of equal importance is considering how the characteristics of sending communities influence the acculturation and health relationship. This study attempted to address this by only focusing on Latinos of Mexican origin. However, a more detailed examination of the characteristics of sending communities (e.g., rural vs. urban, border vs. mainland) would provide further insight into the acculturation and health dynamic, particularly in light of changes to behavioral (e.g., increased consumption of processed foods and use of automotive transportation) and biological (e.g., increased rates of obesity and related health conditions) risk profiles resulting from urbanization, economic growth, and globalization of food markets (World Health Organization, 2007). The importance of considering the latter is highlighted by recent epidemiological findings suggesting that from the year 2000 to 2006 the prevalence of metabolic syndrome in Mexico increased by up to 13% in adults under 60 years of age and by almost 20% for individuals living in metropolitan areas.

A notable strength of the current study is the representation of women from a wide-range of socioeconomic backgrounds. To date, most studies on acculturation and health have focused on low SES populations (Ayala et al., 2008), an important limitation given the well-established relationship between SES and health, and the strong interrelationship between acculturation and SES. Although this study models one way in which acculturation and SES could work together to shape Latino health outcomes, the acculturation and SES dynamic is likely to be more complicated than the tested model depicts. For example, an alternative model views SES as driving acculturation processes

such that the SES of immigrants at the time of migration may influence the efficiency in which they acculturate into mainstream culture. Although post-hoc analyses testing this alternate model did not support this hypothesis[2], the only way to truly compare these competing models is through longitudinal studies that enable the establishment of directionality. Moreover, it is possible that acculturation and SES work synergistically, so that change in one construct magnifies or buffers the effects of the other construct on health (Neggy & Woods, 1992). This is supported by research reporting significant moderating effects of acculturation on SES and health relationships (Gallo et al., 2009) as well as SES on acculturation and health relationships (Buenrostro, 2006). Thus, future studies that explore more complicated relationships via prospective designs with multiple measures of both SES and acculturation are warranted.

Although this study's approach towards the conceptualization and measurement of acculturation represents a marked improvement on prior research, it is not without limitations. Unfortunately, this study did not include an acculturation measure that allowed for Mexican and US mainstream cultural orientation to be independently assessed, limiting conclusions that could be made about the acculturation strategies –e.g., integration, assimilation, separation, and marginalization – that are most beneficial or detrimental to Latinas' cardio-metabolic risk profiles[3]. With that said, the fact that high English language acculturation and strong endorsement of Mexican-oriented cultural values were both associated with lower risk for cardio-metabolic dysfunction suggests that developing strong ties to both cultures (i.e., utilizing integration acculturation strategies) may provide the most health benefits for Mexican American women living in a border region. However, including an orthogonal measure of acculturation in future

research would enable a more dynamic examination of the acculturation and health relationship.

In addition, future studies should consider conducting a more exhaustive evaluation of the role of cultural beliefs and values in explaining health risk and resiliency patterns in this population. For example, cultural constructs such as communalism (Abdou et al., 2010), *simpatia* (Unger et al., 2006), and inequitable gender roles or machismo (Evans & Turner, 1990; Pulerwitz, Michaelis, Verma, &Weiss, 2010; Golman, Diaz, & Kim, 2009) have been demonstrated to also impact health behavior in Latino populations. Therefore, assessing these constructs in future research would allow for a more comprehensive examination of the role that cultural orientation plays in explaining health risk patterns in this population.

Although the probability of reverse causation is unlikely for some of the relationships studied (e.g., cardio-metabolic dysfunction and health behaviors are unlikely to influence an individual's cultural orientation), the possibility that SES may impact acculturation processes, or that poor health could influence fatalistic beliefs or limit available social and economic opportunities, cannot be ruled out. In addition, measurement error introduced by the self-report assessments of physical activity and dietary screeners utilized in this study may have attenuated associations with these important behaviors. Future studies should consider utilizing more comprehensive nutritional intake measures as well as objective indicators of physical activity in order to provide a better picture of the associations among acculturation, health behaviors, and cardio-metabolic dysfunction. The exclusion of non-literate women is an important limitation to this study; thus, efforts should be made to utilize assessment methods that

enable the inclusion of this at-risk subpopulation. Finally, the results of this study are based on a sample of healthy Mexican-American women. Including a wider distribution of health risk factors in future studies would provide a more accurate picture of the acculturation and cardio-metabolic dysfunction relationship.

Public Health Implications of Research Findings

Based on these results, public health efforts aimed at developing interventions for US Latino populations should consider the role of acculturation within the context of demographic (age, gender, SES) and environmental factors (characteristics of sending and receiving communities) that shape the functional significance of the construct as patterns of health risk and resilience associated with acculturation may vary based on these characteristics. Public health interventions targeted at populations similar to the one sampled in this study may be best served by addressing the socioeconomic and language barriers to health associated with low-acculturation. Such efforts should include programs aimed at improving access to health education and care for low-income monolingual Latinas. One way to achieve this goal is by considering educational limitations and language barriers in designing social marketing campaigns as well as providing linguistically appropriate services in health care settings. Given that fatalistic beliefs may represent one mechanism explaining the association between SES and cardio-metabolic dysfunction, interventions that empower low-income Latinas to take control over their health (e.g., by providing individuals with the information, resources, and skills necessary to take a more active role in improving their health) may be particularly effective in meeting the needs of this population.

Utilizing strategies that highlight the importance of family, promote perceived social support, and increase access to health protective social networks (such as religious organizations), may also augment the efficacy of public health interventions aimed at promoting healthy lifestyles in Latinas regardless of acculturation level or SES. Examples of relevant strategies that have been shown to be efficacious in the literature on Latino health include encouraging family involvement in behavioral interventions (Vincent, 2009), forming group exercise opportunities and work-out buddy systems (Hovell et al., 2008; Baquero et al., 2009), and utilizing community participatory research methods to design interventions embedded in well-established community organizations (Parikh et al., 2010).

Finally, social marketing, environmental, and policy innovations aimed at educating the public about the health risks associated with sedentary behavior while also providing individuals with opportunities and skills to maintain more physically active lifestyles at work and during leisure are warranted. Such studies should be particularly targeted at high acculturated affluent Latinas who may be at increased risk for leading highly sedentary lifestyles.

Conclusions

Independent of length of US residency or English language acculturation, the endorsement of Mexican-oriented cultural values was associated with healthier dietary practices and more physically active lifestyles in middle-aged Mexican American women living in a border region. Increased access to health protective social resources may represent one relevant pathway in explaining these associations. Although higher English language acculturation was associated with more sedentary behavior, it was also related

to lower cardio-metabolic dysfunction. SES emerged as an important factor explaining these associations, and in fact fully accounted for the English language and cardio-metabolic dysfunction relationship, in part through the association between SES and fatalism. Overall, these findings highlight the complexity of acculturation research and warrant further exploration of the influence of acculturation on cardio-metabolic function in this as well as other vulnerable populations (e.g., Mexican American males, non-Mexican origin Latinos). Such efforts may be instrumental to efforts aimed at understanding and eliminating ethnic disparities in CVD, diabetes, and related health outcomes.

Footnotes

[1]In order to simplify the interpretation of the results from Model 2, each behavioral outcome is presented in a separate figure despite the fact that all structural pathways were estimated simultaneously.

[2]A competing models for Aim 1 were tested where SES was included as a predictor of language acculturation rather than an outcome of language acculturation. All other proposed pathways remained unchanged. Model fit for this alternate model was poor according to all three descriptive fit indices used, Y-Bχ^2(df=24) = 252.45, df 36 , $p < .05$, CFI = 0.73, RMSEA = 0.18, SRMR = .12.

[3]Berry (1974, 1980) postulates that for non-dominant cultural groups, the acculturation strategy adopted by an individual will depend on their views regarding the importance of both maintaining their original cultural heritage and engaging in intercultural contact with other groups. The combination of these two values results in the adoption of one of four possible acculturation strategies/orientations: 1) integration (value placed on maintenance of original cultural heritage and contact with new culture); 2) marginalization (neither is valued); 3) assimilation (only contact with new culture is valued); and 4) separation (only maintenance of original cultural heritage is

Table 1. Sociodemographic Characteristics of Sample and Descriptive Statistics for all Study Variables, San Diego, California, 2006-2009

	Mean (SD)[a]	Range
Age (years)	49.77 (6.54)	40.00 - 65.00
Educational Attainment, N (%)		
< 9th grade	51 (16.90)	
Some High School	53 (17.50)	
High School Diploma/GED	36 (11.90)	
Some College	96 (31.80)	
Bachelors Degree	47 (15.60)	
Graduate/Professional Degree	47 (6.30)	
Annual Household Income, N (%)		
≤$21,000	72 (23.80)	
$21,001 – 33,000	51 (16.90)	
$33,001 – 51,000	83 (27.50)	
$51,001 – 75,000	42 (13.90)	
≥$75,001	54 (17.90)	
Own Home, N (%)	221 (73.20)	
Foreign born, N (%)	227 (75.20)	
US Exposure	0.66 (0.27)	0.09 - 100
Childhood Language	1.37 (0.88)	1.00 - 4.00
English Proficiency	3.02 (0.88)	1.00 - 4.00
Language Patterns	2.25 (0.99)	1.00 - 4.00
Mexican Cultural Values	1.53 (0.76)	1.00 - 4.00
Familism	18.02 (2.43)	8.00 - 20.00
Fatalism	10.23 (2.87)	4.00 - 16.00
Religiosity	7.01 (2.42)	1.00 - 10.00
Social Support	19.58 (6.69)	1.00 - 27.00
Sociability	2.01 (0.65)	1.00 - 3.00
Fruit /Vegetable (servings/day)	4.19 (2.07)	0.00 - 10.32
Dietary Fat (grams/day), N (%)	33.39 (5.48)	22.10 - 49.70
Physical Activity Level (mets)	19.38 (20.56)	0.00 – 149.00

Table 1 (continued)

	Mean (SD)[a]	Range
Walk, N (%)		
No Walking	44 (14.60)	
Meets DHHS Guidelines	195 (64.60)	
Sedentary Behavior (hours/day)	3.99 (2.34)	0.00 - 12.71
Post Menopausal, N (%)	158 (52.30)	
Cardio-Metabolic Dysfunction Score	144 (1.28)	0.00-5.00

Note. DHHS = Department of Health and Human Services. [a] Means (SD) are presented unless otherwise specified.

Table 2. Bivariate Associations Among all Observed Variables in SEM Models

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. US Ex																		
2. Ch. Lang	.50*																	
3. Eng Prof	.60*	.39*																
4. Lang Pat	.67*	.59*	.73*															
5. Mex Val	.-21*	-.15*	-.21*	-.26*														
6. Familism	.00	.10	.02	.08	.12													
7. Fatalism	-.07	-.06	-.28*	-.20*	.07	-.07												
8. Religion	.03	.13*	-.06	-.04	.06	.17*	.08											
9. Income	.37*	.26*	.49*	.43*	-.19*	.19*	-.24*	-.13*										
10. Edu	.26*	.23*	.58*	.51*	-.11*	.12*	-.31*	-.05	.48*									
11. Support	.15*	.15*	.22*	.22*	-.03	.44*	.01	.12*	.30*	.25*								
12. Social	.16*	.09	.18*	.16*	-.03	.29*	.05	.15*	.23*	.18*	.41*							
13. Exc	.02	.09	.17*	.17*	-.03	.07	-.12	.09	.14	.18*	.12*	.12*						

Table 2 (*continued*)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
14. Walk	.00	.07	-.01	.05	.02	.06	.02	.16*	.09	.00	.13*	.07	.33*					
15. Sedent	.18*	.19*	.24*	.25*	-.11	.01	-.07	.02	.17*	.22*	.15*	.05	-.04	.06				
16. Fat	.04	.10	.01	.01	.03	.03	.04	-.00	.01	.01	.03	.08	-.16*	-.01	.05			
17. Fru/Veg	-.13*	-.04	.01	-.01	.10	.17*	-.05	.06	.03	.07	.14*	.21*	.29*	.06	-.10*	.07		
18. CMD	-.04	.02	-.16*	-.13*	.10	-.00	.19*	.10	-.19*	-.18*	-.12	.05	-.22*	-.12*	-.06	.05	.01	

Note. Sample sizes ranged from n = 253-304; * $p < .05$. US Ex = US exposure; Ch. Lang = child language; Eng Prof = English proficiency; Lang Pat = adult language pattern; Mex Val = Mexican values; Religion = religiosity; Edu = education; Support = social support; Social = sociability; Exc = exercise; Walk = meets HEPA guidelines for health enhancing physical activity; Sedent = sedentary behavior; Fat = total fat in diet; Fru/Veg = servings of fruits and vegetables per day; CMD = cardio-metabolic dysfunction score.

Table 3. Factor loadings for the final measurement models and associations among latent variables

Latent Variables	Lang Acc	Cult Val	SES	SR
Factor Loadings				
Language patterns	1.00			
English proficiency	0.73			
Childhood language	0.59			
Familism		0.73		
Religiosity		0.24		
Income			0.66	
Education			0.73	
Social Support				0.76
Sociability				0.54
Correlations among latent factors (*r*)				
Lang Acc	---			
Cult Val	**0.08**	---		
SES	0.67	0.24	---	
SR	0.29	0.77	0.51	---

Note. Lang Acc = Language Acculturation; Cult Val = Resilient Cultural Values; SES = Socioeconomic Status; SR = Social Resources. All factors loadings were statistically significant ($p < 0.05$). Non-statistically significant ($p > 0.05$) correlations are **bolded**

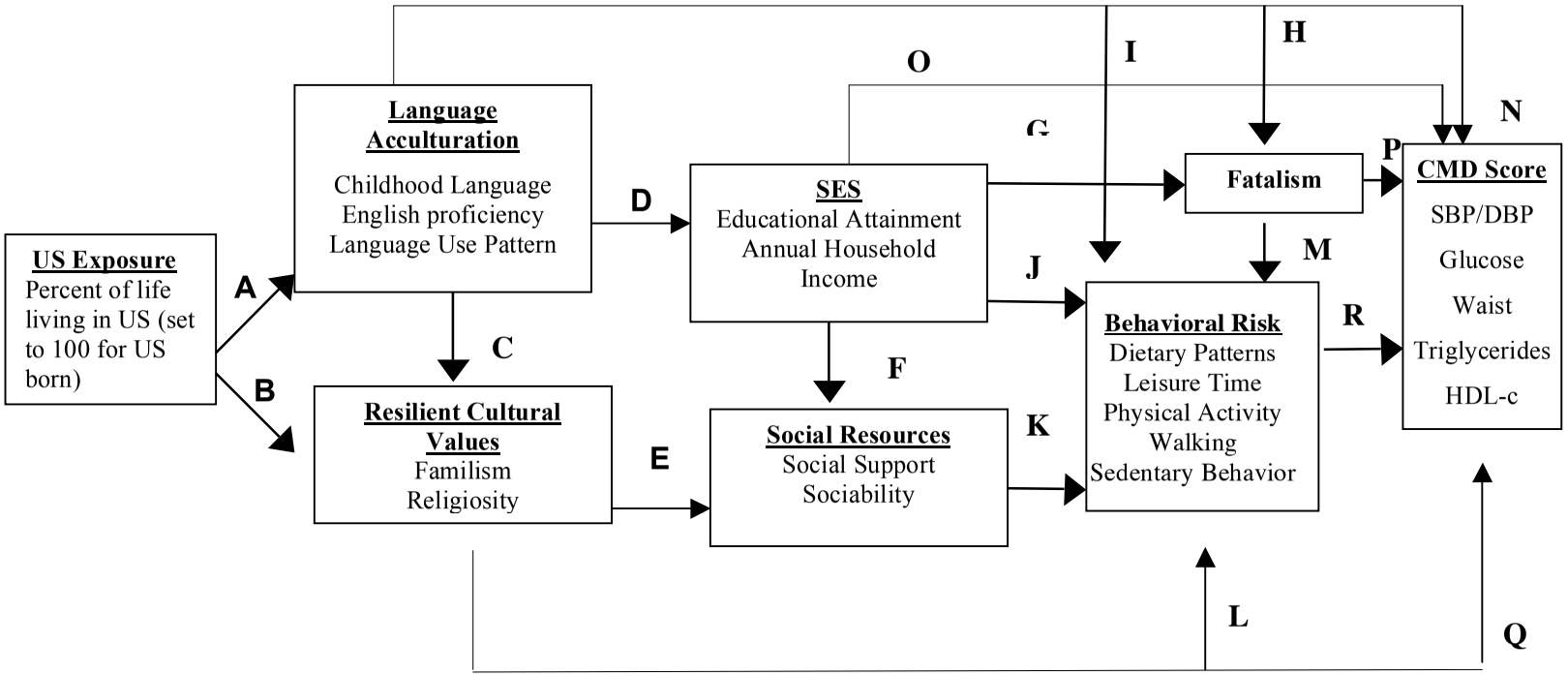

Figure 1. Possible direct and indirect associations between cultural variables, behavioral risk factors, and cardio-metabolic dysfunction.

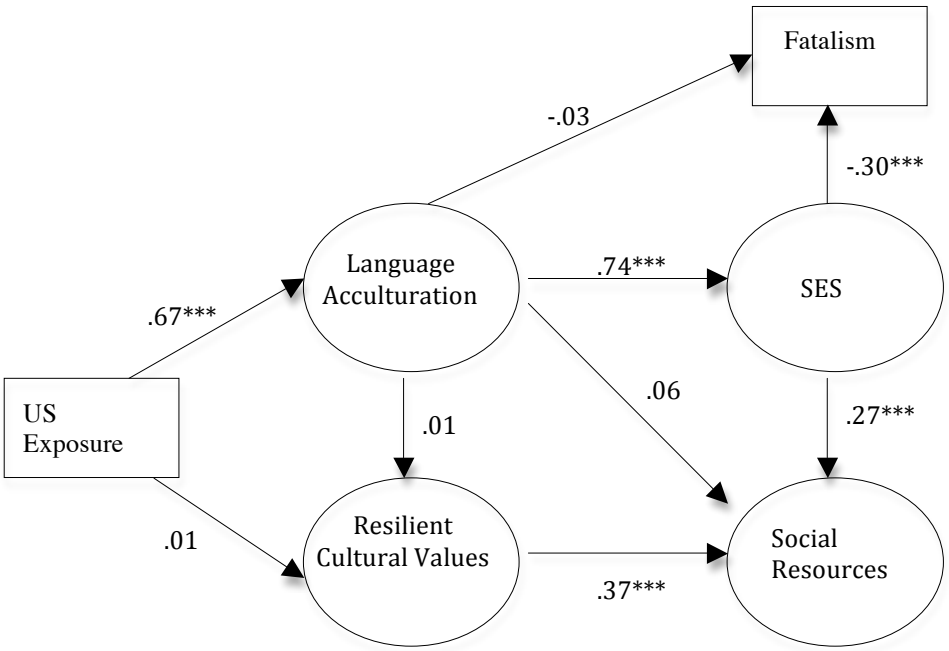

Figure 2. Results of analyses investigating the relationships between all socio-cultural variables (Aim 1). Note. Values presented are standardized structural/path coefficients. Analyses controlled for age (in years). * $p < .05$, ** $p < .01$, *** $p < .001$.

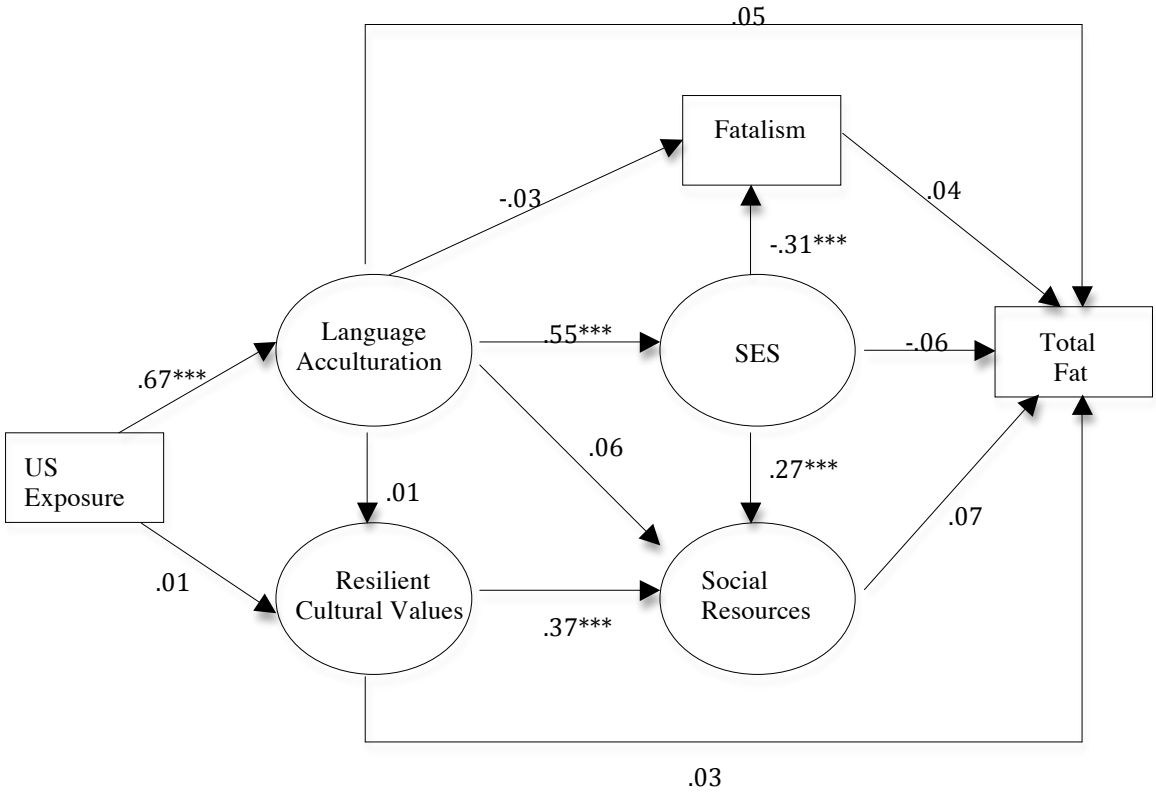

Figure 3. Results of analyses investigating the relationships between socio-cultural variables and total fat in diet (Aim 2). Note. Values presented are standardized structural/path coefficients. Analyses controlled for age (in years). * $p < .05$, ** $p < .01$, *** $p < .001$.

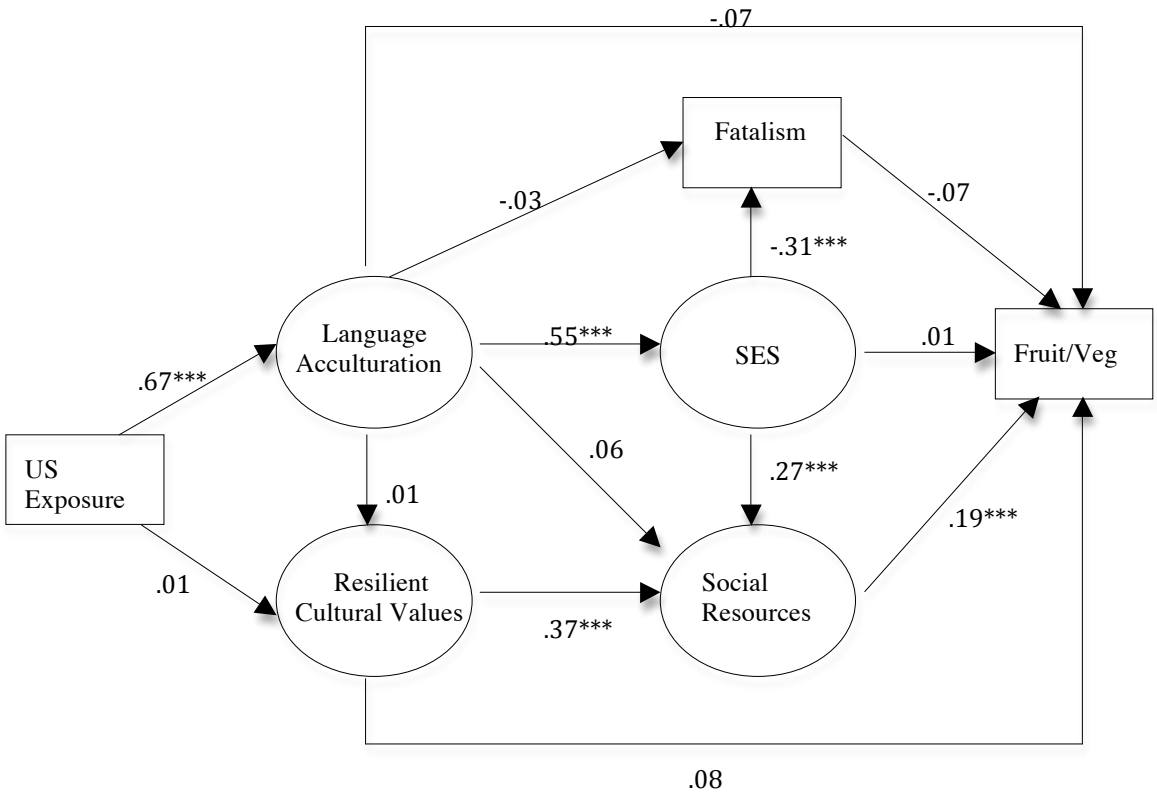

Figure 4. Results of analyses investigating the relationships between socio-cultural variables and fruit and vegetable servings per day in diet (Aim 2). Values presented are standardized structural/path coefficients. Note. Analyses controlled for age (in years). * $p < .05$, ** $p < .01$, *** $p < .001$.

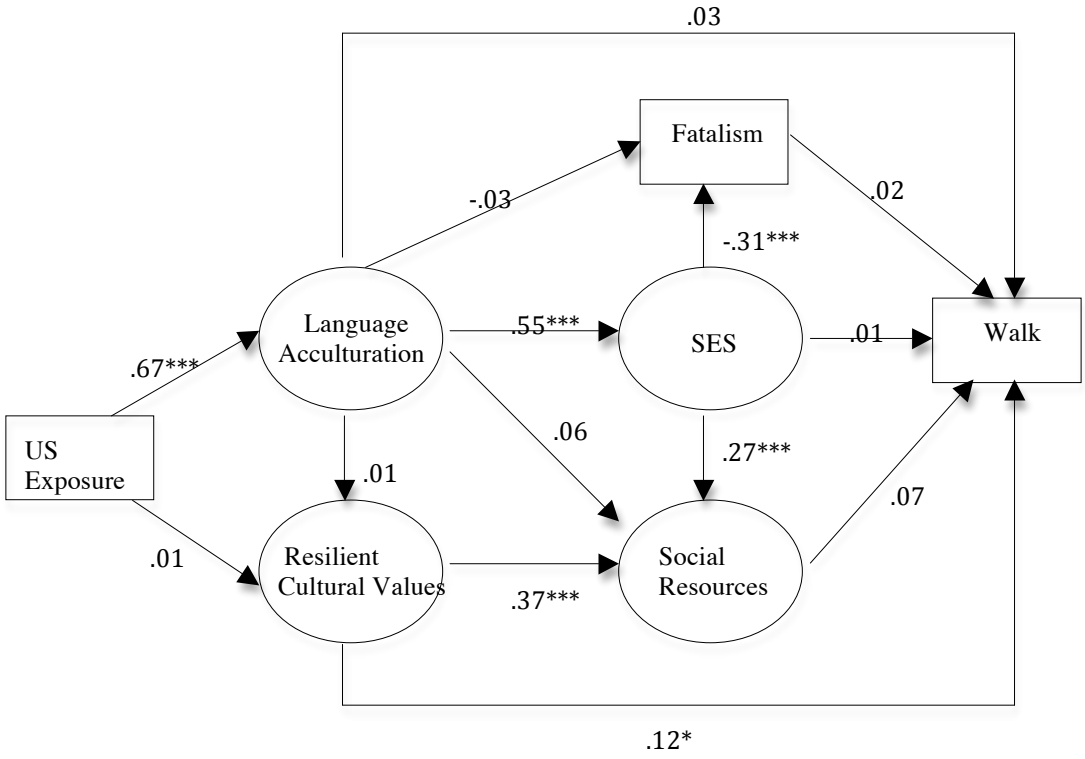

Figure 5. Results of analyses investigating the relationships between socio-cultural variables and walking (Aim 2). Note. Values presented are standardized structural/path coefficients. Analyses controlled for age (in years). * $p < .05$, ** $p < .01$, *** $p < .001$.

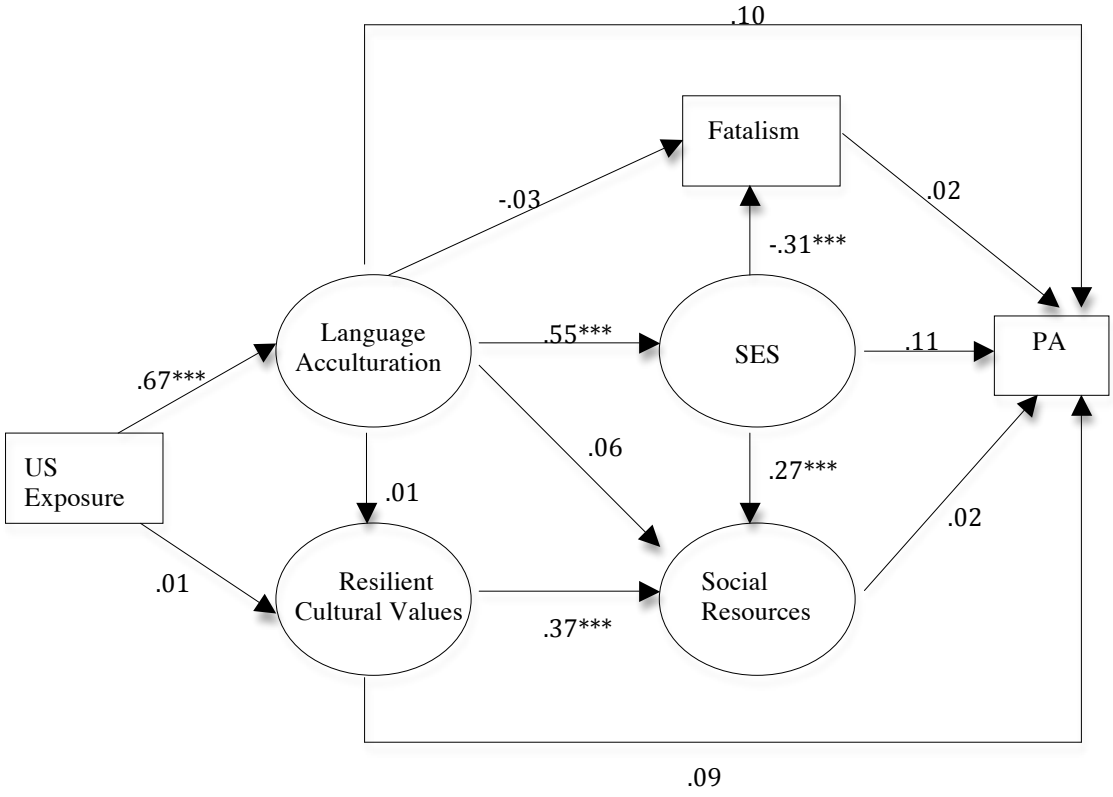

Figure 6. Results of analyses investigating the relationships between socio-cultural variables and leisure-time physical activity (Aim 2). Note. Values presented are standardized structural/path coefficients. Analyses controlled for age (in years). PA = Physical Activity. * $p < .05$, ** $p < .01$, *** $p < .001$

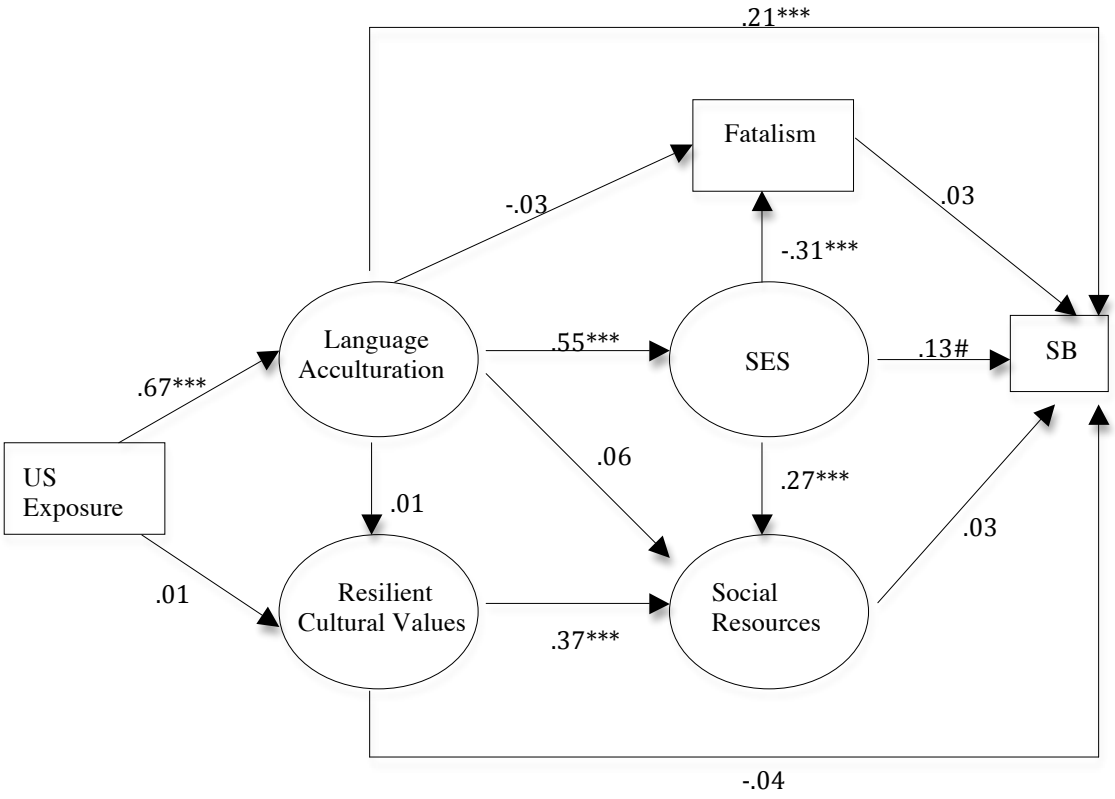

Figure 7. Results of analyses investigating the relationships between socio-cultural variables and sedentary behavior (Aim 2). Values presented are standardized structural/path coefficients. Note. Analyses controlled for age (in years). SB = Sedentary Behavior. * $p < .05$, ** $p < .01$, *** $p < .001$.

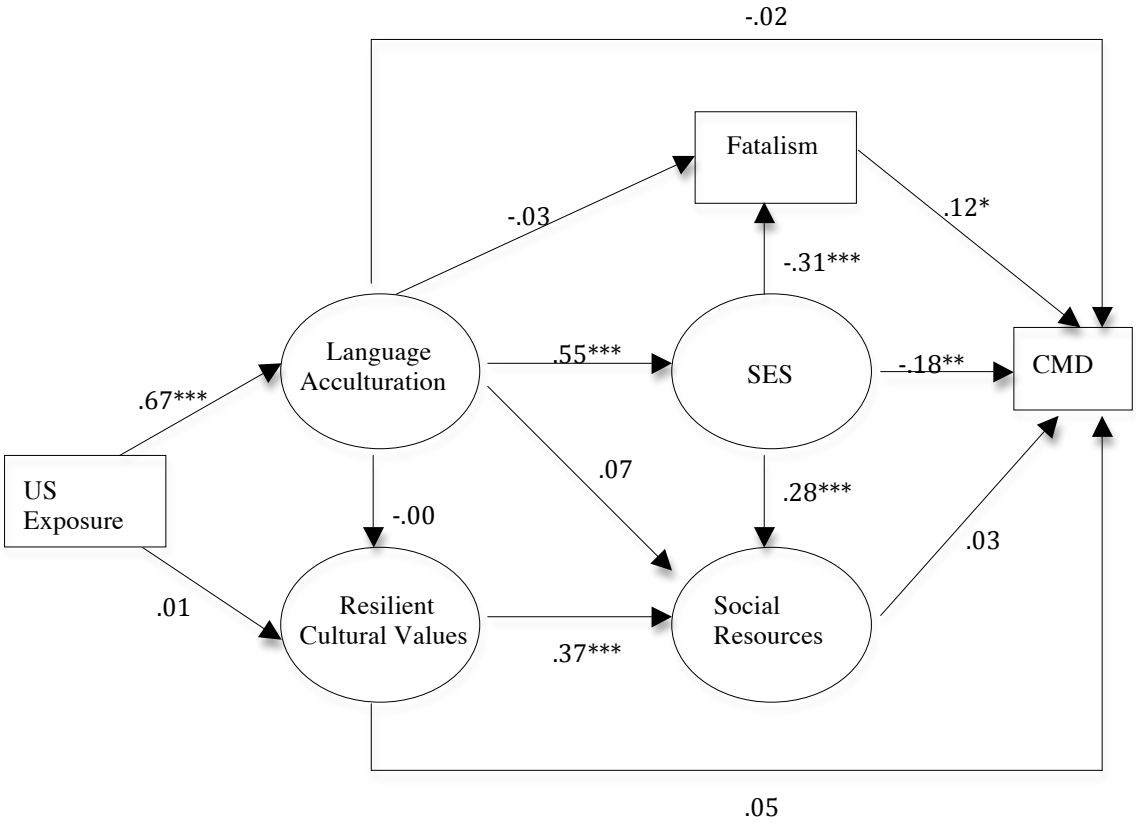

Figure 8. Results of analyses investigating the relationships between socio-cultural variables and cardio-metabolic dysfunction (Aim 3). Note. Values presented are standardized structural/path coefficients. Analyses controlled for age (in years), menopausal status, and access to healthcare. CMD = Cardio-Metabolic Dysfunction. * $p < .05$, ** $p < .01$, *** $p < .001$.

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