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The Effects of Cultural Orientation Change on Metabolic Health in a Sample of Mexican  
Immigrants to the United States

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A dissertation submitted to the faculty of  
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in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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## ABSTRACT

### The Effects of Cultural Orientation Change on Metabolic Health in a Sample of Mexican Immigrants to the United States

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Studies have identified metabolic health factors to be a major concern in Mexican-Americans, including Mexican immigrants to the United States (U.S.). Acculturation stress has been hypothesized to be a factor in the development of many health-related concerns in this population. Specifically, previous studies have shown that acculturation stress contributes to health concerns, including metabolic health concerns (e.g., diabetes, metabolic syndrome). The primary purpose of this study was to examine the relationship between cultural orientation, a measure of acculturation designed to provide more information than traditional acculturation measures, and metabolic health outcomes. Specific acculturation-related stressors (social support, job-related stress, and depression) were hypothesized mediators in this relationship among a convenience sample of 98 foreign-born Mexicans living in Utah County, Utah controlling for age, gender, socio-economic status (SES), and years in the U.S. Data were collected twice with a three-year interval to examine change over time. Changes in these constructs were examined through the use of Growth Modeling with Bayesian estimation. The Acculturation Rating Scale for Mexican-Americans (ARSMA-II) was used to measure Anglo Cultural Orientation and Mexican Cultural Orientation. Standard blood analyses were used to measure metabolic health outcomes, which included glycosylated hemoglobin (HbA1c), insulin, and glucose. The Interpersonal Support Evaluation List (ISEL-12) was used to measure social support, the Job Content Questionnaire (JCQ) was used to measure job-related stress, and the Center for Epidemiological Studies-Depression Scale (CES-D) was used to measure depression. No change was identified in Anglo Cultural Orientation or Mexican Cultural Orientation over time in the majority of subjects. A positive relationship between Anglo Cultural Orientation and HbA1c was found, as was a negative relationship between Mexican Cultural Orientation and HbA1c. Mediation analyses showed a mediation effect of depression on the relationship between Anglo Cultural Orientation and glucose. Implications of findings, limitations, and directions for future research are discussed.

Keywords: metabolic health, acculturation, cultural orientation, Acculturation Rating Scale for Mexican Americans (ARSMA-II), HbA1c, insulin, glucose, Interpersonal Support Evaluation List (ISEL-12), Job Content Questionnaire (JCQ), Center for Epidemiological Studies-Depression Scale (CES-D), immigrants, Mexican, foreign-born.

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## **The Effects of Cultural Orientation Change on Metabolic Health in a Sample of Mexican Immigrants to the United States**

### **Metabolic Health Concerns**

Metabolic health problems, including the metabolic syndrome and diabetes, contribute to a variety of health problems and may also result in an increased risk of morbidity and mortality (National Diabetes Statistics, 2007). Research on these problems has revealed a number of problems associated with metabolic health concerns, and of notable importance is research studying the effects of metabolic health problems on other future health problems (Alberti et al., 2009; American Diabetes Association, 2011; Hao, Wu, Wang, & Liu, 2011; de los Monteros, Fallo, Elder, & Talavera, 2008; Morrison, Friedman, Wang, & Glueck, 2008; National Diabetes Statistics, 2007). Such research has shown that individuals with the metabolic syndrome have increased rates of cardiovascular problems and a greater likelihood of developing diabetes mellitus, especially Type II Diabetes (Alberti et al., 2009; Morrison, Friedman, Wang, & Glueck, 2008). The prevalence of the metabolic syndrome has increased over the past several years and current estimates place prevalence of the syndrome at 23.7% of all Americans (Ford, Giles, & Dietz, 2007), which represents a 6.7% increase from estimates performed in 2004. Also concerning is the current prevalence rate of Type II Diabetes, which is estimated to be approximately 7.9% (Mokdad et al., 2003). This estimate represents an 8.2% increase from 2000 to 2001. Among the problems associated with diabetes are increased rates of cardiovascular problems as well as vision problems, circulation problems, nerve damage, and psychiatric problems (American Diabetes Association, 2011).

Health problems associated with metabolic health concerns often arise as a result of high cholesterol and high glucose levels over time (Bhatnagar, Soran, & Durrington, 2008; Laakso, 1999). The health effects of high cholesterol are primarily due to atherosclerosis, the narrowing and hardening of arteries that accompanies a buildup of cholesterol in the blood. As low-density lipoproteins (LDL) build up in the blood, they form plaques, which begin to build up on artery walls. As this buildup occurs, the arteries become more narrow and, eventually, less elastic. Atherosclerosis often results in heart problems as well as problems with eye health, circulation, stroke, and other problems (Bhatnagar, Soran, & Durrington, 2008). Similarly, excess glucose in the body, as seen in persons with diabetes, also affects blood vessels and circulation (Laakso, 1999). Excess glucose can attach to proteins in blood vessels, making them thicker and less elastic and can also result in an increased accumulation of LDL particles (Laakso, 1999). As vessels become thicker circulation is impaired, which can result in damage to the blood vessels that support the body's nerves. Gradually, diabetic neuropathy, the gradual loss of sensation in extremities, can occur (Kanji, Anglin, Hunt, & Panju, 2010). The eyes are also often affected, as impaired blood flow to the retina can result in vision loss and blindness, as are the feet, which are prone to frequent infections and ulceration, which necessitates amputation in some patients.

Mexican-Americans are among those most affected by metabolic health concerns. In fact, a study on the prevalence of metabolic syndrome among various ethnic and racial groups in the U.S. found that Mexican-Americans had the highest prevalence rates of metabolic syndrome at 31.9% (Ford, Giles, & Dietz, 2007). These concerns represent only a few of those faced by Mexican-Americans, including those who have recently immigrated to the United States from Mexico.

## Acculturation Stress

Recent immigrants are especially susceptible to problems associated with the transition to American culture, especially the stress associated with the acculturation process (Larson, & Butler, 2006; Marmot & Syme, 1976; Slavik & Croake, 2006; Steffen, 2006; Vaeth & Willett, 2005; Vega et al., 1998; Vega, Sribney, Aguilar-Gaxiola, & Kolody, 2004). Acculturation, the process by which an individual adapts to life in a new, foreign culture, provides a multifaceted and often difficult experience for immigrants (Marmot & Syme, 1976; Steffen, 2006; Vaeth & Willett, 2005; Vega, Sribney, Aguilar-Gaxiola, & Kolody, 2004). Specifically, acculturation is associated with increases in blood pressure (BP), unhealthy changes in diet and physical exercise, increased financial problems, decreased social support, increased job demands, poor adaptation, low socioeconomic status (SES), and increased generalized stress (Marmot & Syme, 1976; Steffen, 2006; Steffen, Smith, Larson, & Butler, 2006; Vaeth & Willett, 2004). This generalized stress due to the transition to another country has been termed “acculturation stress” by Williams and Berry (1991). As they define it, acculturation stress consists of several factors associated with immigration, including decreased social support, lower SES, poor coping mechanisms, little knowledge of the new culture, and low expectations for the future. Each of these factors, they claim, contributes to the stress experienced by immigrants to the U.S. Additional research supports the importance of each of these changes as related to acculturation stress (Berry & Annis, 1974; Grzywacz, Quandt, Arcury, & Marin, 2005; Ritsner et al., 2000; Romero and Roberts, 2003; Santos, Bohon, & Sanchez-Sosa, 1998; Smart & Smart, 1995; Vega, Kolody, Aguilar-Gaxiola, Alderete, Catalao, & Caraveo-Anduaga, 1998; Wodarski, 1992; Zunzunegui, Forster, Gauvin, Raynault, & Douglas, 2006;). For our purposes, acculturation

stress will be defined as the chronic negative changes associated with negative aspects of acculturation as defined by Williams and Berry as opposed to acute stress reactions.

**Social support.** Research supporting the reality of acculturation stress is prevalent. Changes in social support are one aspect of the move to a new country that has been the subject of much research on acculturation. As immigrants arrive in a new country, they often lose close interpersonal relationships and family ties, including a loss of family support when adversity arises (Cislo, Spence, & Gayman, 2010; Smart & Smart, 1995). This loss often contributes to increased psychosocial stress in general and decreased feelings of control, which in turn can lead to greater isolation as such individuals accept the Hispanic belief that *la vida es dura*. When translated, this belief signifies that “life is hard” and should be accepted, meaning that a retreat from psychosocial support is preferable to seeking help from others. In fact, Wodarski (1992) reported that this loss of social support is often the most stressful aspect of acculturation, as without an established social network, immigrants often feel a sense of identity loss and find it difficult to fit in with the new culture. This aspect of acculturation stress is prevalent among Hispanic Americans. Latino culture emphasizes *familismo*, or strong feelings of attachment, loyalty, emotional support, and shared identity among family members (Marin & Marin, 1991; Vega, Kolody, Valle, & Weir, 1991). When social support is decreased, as occurs following immigration to a new country, Hispanic immigrants have been reported to experience higher levels of depressive symptoms, poorer emotional adjustment, and poorer social adjustment (Hovey & King, 1996; Schneider & Ward, 2003; Vega et al., 1991). The same is seen among Hispanic college students, who experience increased acculturation stress when parent and peer support is low and decreased acculturation stress when social support is high (Crockett, Iturbide, Stone, McGinley, Raffaelli, & Carlo, 2007).

**Job-related stress.** In addition to loss of social support, immigrants also experience stressful and difficult transitions to new jobs, further contributing to acculturation stress. Not only do many immigrants experience the challenge of language barriers and lack of education while looking for work, but the stress of the acculturation process alone can put Hispanic immigrants at a disadvantage when competing with nonstressed colleagues for work (Smart & Smart, 1995). Grzywacz and colleagues (2005), Santos (1998), and Zunzunegui and colleagues (2006) support this notion and found that obtaining jobs is a very stressful experience for immigrants, and that once jobs are obtained they are often more stressful in nature than jobs held by non-immigrants. Indeed, work conflict is often prevalent in jobs held by immigrants, adding to the stressful job transition (Santos et al., 1998). This stress is compounded by the finding that recent immigrants often experience chronic levels of underemployment or unemployment (Smart & Smart, 1995) and earn a lower income than non-immigrants (Borjas, 1985; Hammarstedt, 2001). This finding held even when immigrants had obtained advanced degrees in their native countries (Barringer, Takeuchi, & Xenos, 1990; Dadoo, 1997; Picot & Hou, 2003). This kind of stress has been strongly associated with poorer physical health as well as with a marked increase in psychiatric problems such as depression (Finch, Hummer, Kolody, & Vega, 2001).

**Depression.** Increases in psychiatric problems including depression have also been noted in response to acculturation stress. Increased stress associated with daily life in a new country has been cited as the source of decreased mental health and an increase in depressive symptoms following immigration (Slavik & Croake, 2006; Vega et al., 1998; Vega, Sribney, Aguilar-Gaxiola, & Kolody, 2004). In fact, a recent study found that immigrants rated themselves as having more than twice the number of mental health problems as non-immigrants (Singhammer & Bancila, 2011). Another study found that anxiety increased and self-esteem decreased with

acculturation stress (Cislo, Spence, & Gayman, 2010). Hovey and King (1996) linked acculturative stress to more depression, anxiety, and suicidality in Hispanic adolescent populations. Similar results have been found for college-aged individuals, who experience higher levels of academic, financial, and personal stress than do their Anglo counterparts (Quintana, Vogel, & Ybarra, 1991). Crockett, Iturbide, Stone, McGinley, Raffaelli, and Carlo (2007) reported that acculturative stress was associated with poorer psychological functioning—specifically, higher levels of both anxiety and depressive symptoms—among Hispanic college students. In fact, Rodriguez et al. (2000) found acculturation stress predicted higher levels of general psychological distress among Hispanic students even after controlling for other forms of stress. Alderete, Vega, Kolody, and Aguilar-Gaxiola (1999) reported that among both male and female migrant farmworkers, those with higher levels of acculturation experienced more risk factors for future psychiatric disorders. When considering suicidality among immigrants, however, there are mixed results, indicating that suicidality varies based on ethnicity and country of settlement (Lipsikas & Makinen, 2010). Overall, however, research appears to point to the negative impact of acculturation stress on mental health.

### **Immigrant Health**

Finally, increased acculturation stress is associated with poor health outcomes among immigrants. Poor health habits, including an increase in tobacco and alcohol consumption (Sarnoff, Adams, Shauffler, & Abrams, 2001), have also been shown to increase following immigration (Gregory-Mercado et al., 2006). These poor health habits have also been shown to be associated with increased obesity rates among immigrants (Dey & Lucas, 2006). These results are consistent with research on health outcomes of immigrants to the United States, specifically. While immigrants to the U.S. are a generally healthy population (Gorman, Ecklund,

& Heard, 2010) even in spite of lower SES (Escobar et al., 2002; Wei et al., 1996), their health has been shown to decrease as time in the U.S. increases (Dixon, Sundquist, & Winkleby, 2000; Forrester, Cooper, & Weatherall, 1998; Marmot & Syme, 1976; Sundquist & Winkleby, 1999; Vega et al., 2004; Wei et al., 1996). Immigrants with the lowest level of acculturation have been shown to be the healthiest (Gorman, Read, & Krueger, 2010).

There may also be behavioral changes that accompany immigration that negatively impact health. For example, acculturation to the U.S. has often been associated with poor nutritional choices among immigrants (Bermudez, Falcon, & Tucker, 2000; Dixon, Sundquist, & Winkleby, 2000; Neuhausser, Thompson, Coronado, & Solomon, 2004), although findings on this subject have also yielded mixed results (Abraido-Lanza, Armbrister, Florez, & Aguirre, 2006; Ayala, Mueller, Lopez-Madurga, Gampbell, & Elder, 2005; Balcazar, Castro, & Krull, 1995; Satia-Abouta, Patterson, Neuhausser, & Elder, 2002). The same can be said for research on acculturation and obesity and physical activity levels (Abraido-Lanza, Armbrister, Florez, & Aguirre, 2006; Abraido-Lanza, Chao, & Florez, 2005; Goel, McCarthy, Phillips, & Wee, 2004; Slattery et al., 2007). It is important to note, however, that there have been some findings supporting the notion that immigrants with the highest access to and utilization of health care have worse health; this may be because individuals were unaware of health problems until they were provided with access to medical care (Gorman, Read, & Krueger, 2010). Despite this caveat and the mixed results of studies of acculturation and health, it appears that acculturation and health remain important areas of research study.

In addition to the behavioral changes that contribute to increased health problems with acculturation, stress alone has been shown to contribute to or exacerbate health problems (see Coyne, Zhou, Thompson, & Versi, 2003; DeLongis, Folkman, & Lazarus, 1988; Lin & Enzel,

1989). The impact of acculturation stress appears to be especially relevant when the transition is from a non-Westernized nation, such as Mexico or Japan, to a Westernized nation, such as the United States (U.S.) (Farley, Galves, Dickinson, & Perez, 2005; Marmot & Syme, 1976; Steffen, 2006; Steffen et al., 2006; Williams & Berry, 1991). This is likely related to a greater emphasis on individualistic cultural values such as levels of achievement orientation and competition (Spence, 1985; Steffen, 2006; Triandis, 1995). There are several hypotheses surrounding the differences in factors relating to acculturation between non-Western cultures and Westernized cultures. These include the transition to more demanding jobs, less job security, lower access to healthy foods, and an overall more stressful lifestyle (Marmot & Syme, 1976; Steffen, 2006). Ben-Ari and Lavee (2004) posit that individualist cultures tend to have self-originating stress, whereas collectivist cultures have collectively originating stress. Thus, one important aspect of stress in a collectivist society is the focus on the self as a part of the community, including whether they believe their role in the community to be meaningful. Therefore, as an individual makes the transition to an individualistic society from a collectivist one, he or she gradually shifts from an external sense of identity to a focus on the self, which has been shown to negatively affect sense of self as well as increase psychiatric problems, such as depression and anxiety disorders (Slavik & Croake, 2006; Vega et al., 1998; Vega, Sribney, Aguilar-Gaxiola, & Kolody, 2004). The sense of community is often altered or lost, resulting in loss of social support and a decrease in subjective well-being (Wodarski, 1992).

### **Mexican Immigrants to the U.S.**

Mexican immigrants to the United States are one group that is subjected to both acculturation stress and the added hardship associated with a move from a collectivistic culture to an individualistic one. This group has been the subject of much research on acculturation

stress, and rightly so. According to the latest census data, Mexican immigrants to the U.S. represent 30.7% of all immigrants to the U.S. and are the largest immigrant group currently in the U.S. ([www.migrationinformation.org](http://www.migrationinformation.org), 2011). The importance of research performed with this group is not limited to the prevalence of this population, however. Mexican-Americans are also prone to a number of negative outcomes particular to this group that make them an important one to study. Despite the finding that Mexican immigrants to the U.S. are generally healthier in some ways than U.S.-born Mexicans and Whites (Lorenzo et al., 2005; Steffen, 2006; Sundquist & Winkleby, 1999; Vaeth & Willett, 2005), steep declines in both physical and mental health have been noted as Hispanics become more acculturated. For example, Vega, Kolody, Aguilar-Gaxiola, Alderete, Catalano, and Caraveo-Andagua (1998) reported the rates of psychiatric disorders to be much lower among Mexicans and recent Mexican immigrants to the U.S. when compared with immigrants who have been in the U.S. longer or who were born in the U.S. Vaeth and Willett (2005) found that blood pressure was positively correlated with acculturation, with the least acculturated immigrants having the lowest blood pressure and the most acculturated having the highest blood pressure. The American Diabetes Association (2005) estimates that as many as one in ten Latinos have diabetes, with the percentage of Latinos with diabetes estimated from 8.2 % to 9.5% (see also National Diabetes Education Program, 2005). Finally, Hispanic females living in the U.S. have higher diabetes mortality rates when compared to their non-Latino white counterparts and their Mexican national counterparts (Baesconde-Garbanati, Portillo, & Garbanati, 1999).

Despite these risk factors there are a number of protective factors against acculturation stress, one of which is the maintenance of one's original cultural identity, either fully or in part (Steffen, 2006). Mexican immigrants to the U.S. endorsing a Mexican cultural orientation have

lower blood pressure and greater overall cardiovascular health (Steffen, 2006). Adolescents who reported higher Mexican cultural orientation and lower Anglo cultural orientation had fewer behavioral problems and better academic engagement (Gonzales et al., 2008). Mexican cultural orientation has also been shown to have an indirect effect on depression, with higher Mexican cultural orientation correlating with lower levels of depression (Armenta, 2003). However, the longer an individual is in the new country, the more this original cultural orientation is generally lost. Steffen (2006) found that the longer Mexican immigrants are in the U.S., the more they begin to adopt the Anglo cultural orientation. This occurs concurrently with a progressive loss of their Mexican cultural orientation. As immigrants lose their Mexican cultural identity and adopt the Anglo cultural identity, they are at higher risk for a variety of physical and emotional problems (Dixon, Sundquist, & Winkleby, 2000; Steffen, 2006; Vega, Sribney, Aguilar-Gaxiola, & Kolody, 2004).

In the current study, we will be focusing on the impact of adopting an Anglo cultural orientation on health. Research has shown that recent immigrants to the U.S. generally have better health than their non-immigrant counterparts (Farley, Galves, Dickinson, & Perez, 2005; Gorman, Ecklund, & Heard, 2010; Popkin & Udry, 1998). However, as their time in the U.S. increases there is a growing disparity in health status, morbidity, and mortality in racial and ethnic minority groups when compared with Caucasians in the U.S., with racial minorities becoming substantially less healthy than Caucasians over time (Myers & Rodriguez, Taylor & Zimmet, 1983). This observation is also true for Mexican immigrants to the U.S. For example, Espino and Maldonado (1990) found a positive relationship between acculturation and hypertension in older Mexican-Americans. Peek et al. (2010) found that the longer Mexican immigrants are in the U.S. the greater the likelihood that they will lose their culture-related

protective health effects. Available research further supports the notion that the movement toward an Anglo cultural orientation has negative impacts on health. One study found that eating disorder behaviors, while insignificant among individuals orienting toward Mexican culture, were found to be significant among individuals who had become oriented toward Anglo culture (Cachelin, Phinney, Schug, & Striegel-Moore, 2006). Another study found an increase in self-reported physical health conditions with an increase in Anglo cultural orientation, although the subjective nature of this study is important to note (Perez, 2008).

Diabetes, among other metabolic health problems, is a particularly relevant topic when studying Mexican Americans. According to recent data Mexican-Americans are approximately twice as likely to develop diabetes as their non-Latino white counterparts (American Diabetes Association, 2011). Non-insulin dependent diabetes (type 2 diabetes) is associated with increased risk of cardiovascular disease, kidney disease, vision problems including blindness, amputations, dental diseases, prenatal complications, limited mobility, and increased mortality (National Diabetes Statistics, 2007). Minorities, including Mexican-Americans, are disproportionately affected by diabetes than their Caucasian counterparts (Carter et al., 1996). In addition to higher prevalence rates, Mexican-Americans are also subject to more complications from diabetes than Caucasians (Carter et al., 1996). For example, Mexican-Americans with diabetes are twice as likely to develop blindness and seven times more likely to develop end-stage renal disease than Caucasians with diabetes. They are also more likely to die from the disease than are Caucasians. In addition to the clear health problems associated with metabolic health, diabetes has also been shown to contribute to the risk of developing depression (Anderson, Freedland, Clouse, & Lustman, 2001; Black, 1999; Culpepper, 2002).

Despite the findings indicating that cardiovascular health decreases as acculturation increases there is some evidence that this relationship is curvilinear rather than linear, with increased acculturation, independent of SES, eventually resulting in a reduced prevalence of diabetes among Mexican-Americans (Hazuda, Haffner, Stern, & Eifler, 1988). Stern et al. (1991) offered a theory regarding this curve, proposing that as acculturation becomes more stable, people attempt to live healthier lives by avoiding unhealthy habits (i.e., increased intake of calories, fats, and refined sugars; decreased intake of fiber and complex carbohydrates; decreased physical activity) that are typically associated with the initial stages of acculturation.

Another metabolic problem that has been the source of research on Hispanics is the metabolic syndrome, a grouping of health risks, including central adiposity, hypertriglyceridemia, reduced HDL cholesterol, high resting blood pressure, and hyperglycemia that have been shown to increase the likelihood of developing diabetes, cardiovascular disease, cognitive decline, and other problems (Hao, Wu, Wang, & Liu, 2011; de los Monteros, Fallo, Elder, & Talavera, 2008). Diagnosis of the syndrome generally requires individuals to meet criteria for at least three of the risk factors. Mexican-Americans are at a particularly high risk for the development of this syndrome. Ford (2005) reported that the prevalence of the metabolic syndrome in Mexican-American women is estimated at 51-54%, while estimates of the metabolic syndrome among non-Latino white women are only 33-37%. Poor diet, including low nutrient intake, and lack of physical exercise among Mexican-Americans has been cited as an important factor in the development of the metabolic syndrome (American Heart Association, 2006; Hutley & Prins, 2005).

Available research on this syndrome and other metabolic health concerns as affected by acculturation has been mixed. Hazuda, Haffner, Stern, and Eifler (1988) determined that

increased acculturation was accompanied by a decline in both obesity and diabetes, obesity, rather than acculturation, was found to be a more important determinant of this relationship. And while de los Monteros, Gallo, Elder, & Talavera (2008) similarly found that U.S. acculturation was associated with health-enhancing behaviors and subsequent decreased risk of meeting the clinical criteria for the metabolic syndrome, Ross, et al. (2011) reported no significant correlation between acculturation score and HbA1c levels. However, this study required that participants have a pre-existing diagnosis of type II diabetes mellitus for inclusion in the study. Contrastingly, Ahluwalia, et al. (2007) found that Mexican immigrants to the U.S. who reported lower U.S. acculturation were less likely to have a high BMI and less likely to perceive themselves as overweight, indicating that as Mexican Americans adopt aspects of the dominant U.S. culture, they may be at increased risk for major chronic diseases, including type 2 diabetes. Carter-Pokras, Zambrana, Yankelovich, Estrada, Castillo-Salgado, & Ortega (2008) found that the longer Mexican-born immigrants are in the U.S., the more likely they are to engage in behaviors that are not health-promoting, resulting in poorer health outcomes. Vella, Ontiveros, Zubia, and Bader (2011) also found that increased acculturation was related to multiple metabolic syndrome features as well as an increased risk of metabolic syndrome. It is important to note that both the de los Monteros (2008) and Vella, et al. (2011) studies relied solely on female subjects in their analyses. The relationship between acculturation and metabolic health concerns may be much more complex, however, than these studies have determined. For example, one study determined that although initial acculturation is associated with decreased health habits as individuals “modernize,” adapting to U.S. habits of increased intake of total calories, fat, and refined sugars, among others, there may be an additional “postmodernization” or “postwesternization” process. This subsequent development indicates

that whereas obesity and other poor health behaviors may be the primary implication of westernization, as individuals become even more affluent and acculturated they may become increasingly health conscious, taking steps to reverse some of the previously acquired negative health habits, resulting in improved health (Stern, Knapp, Hazuda, Haffner, Patterson, & Mitchell, 1991). Although the metabolic syndrome has recently been utilized frequently in the literature, the current study will utilize the continuous variables associated with the syndrome (e.g., insulin level, glucose level) rather than the presence or absence of metabolic syndrome, as this is, of necessity, a dichotomous variable.

While several studies have been performed to assess the relationship between metabolic disorders and various stressors, including job stress, social support, and depressive symptoms, no studies were found to study this relationship in Mexican immigrants, specifically. However, existing research on the relationship between social support and metabolic health concerns has revealed a negative correlation. Zhang, Norris, Portland, Gregg, and Beckles (2007) reported the risk of death related to diabetes decreased as level of social support increased, with those individuals reporting the highest level of social support having the lowest risk of death. Huang, Song, Li, Li, Wu, and Li (2001) found that among individuals with type II diabetes and depression, a social support intervention improved glucose metabolism. Individuals who were not provided with the social support intervention did not experience these results. Among diabetic African-Americans, social support has been associated with better weight control, better control of fat and calorie intake, and lower diastolic blood pressure (Rees, Karter, & Young, 2010). The same study found that among diabetic whites, higher reported social support was associated with lower LDL cholesterol. In addition to findings supporting better health outcomes among those with increased social support, findings also support the notion that individuals with

more social support are better at managing their diabetes. African-Americans with type II diabetes had improved blood glucose monitoring and perceived quality of life related to their diabetes when they were more satisfied with their level of social support (Tang, Brown, Funnell, & Anderson, 2008). Similarly, a study on glycemic control among Latinos with type II diabetes revealed that subjects with higher perceived social support resources had better diabetes self-management (Fortmann, Gallo, & Philis-Tsimikas, 2011).

There is also a relationship between metabolic disorders and job-related stress. Vrijkotte, Vrije, Van Doornen, and De Geus (1999) found that some aspects of work-related stress were associated with poorer metabolic health outcomes. Chandola, Brunner, and Marmot (2006), as part of a fourteen-year longitudinal study, found that employees who experienced chronic work-related stress were more than twice as likely as those without work stress to develop the metabolic syndrome. Finally, shift work, which was defined as more stressful than other types of work, was found to be significantly associated with metabolic syndrome, even after controlling for other sources of stress as well as for diet (Esquirol, Bongard, Mabile, Jonnier, Soulat, & Perret, 2009).

Finally, a relationship also exists between metabolic disorders and psychiatric symptoms, including depression. Three studies performed in Finland found similar results: A more than two-fold risk for a future diagnosis of the metabolic syndrome was found for females who reported depressive symptoms at baseline (Vanhala, Jokelainen, Keinanen-Kiukaanniemi, Kumpusalo, & Koponen, 2009), non-depressed men and women with the metabolic syndrome at baseline were twice as likely to have depression symptoms at a seven-year follow-up (Koponen, Jokelainen, Keinanen-Kiukaanniemi, Kumpusalo, & Vanhala, 2008), and, especially in men, there is an association between long-term depressive symptoms and the metabolic syndrome

(Viinamaki et al., 2009). A study performed in Italy also found the metabolic syndrome to be associated with increased depressive symptomatology among a group of community-dwelling older women (Laudisio, Marzetti, Pagano, Pozzi, Bernabei, & Zuccala, 2009).

Due to the high prevalence of diabetes and the metabolic syndrome among Mexican Americans as well as the potential impact of increased acculturation stress on these problems, the current study aims to extend the findings regarding the positive relationship between acculturation in Mexican immigrants to the U.S. and cardiovascular problems and to shed light on the contradicting findings surrounding the relationship between acculturation and metabolic health concerns. Specifically, the current study aims to examine the impact of acculturation on metabolic health. One of the most effective and efficient measures of metabolic health is the glycated hemoglobin, or HbA1c (Lippi & Targher, 2010; Selvin et al., 2010; Santos-Rey, Fernandez-Riejos, Mateo, Sanchez-Margalet, & Goberna, 2010). HbA1c is the measure of the proportion of glycated hemoglobin to hemoglobin in the body, and is measured using a simple blood test. This method of measuring blood glucose is considered superior to other methods (i.e., fasting glucose, glucose tolerance test) because instead of offering the current glucose level, it is simple to obtain and offers a view of the patient's overall glucose for the past several weeks.

As stated previously, currently available studies examining the relationship between acculturation and metabolic health concerns have revealed a complex and unclear picture of the direction of this relationship. While several studies (Fisher-Hoch et al., 2010; Hsin, La Greca, Valenzuela, Moine, & Delamater, 2010; Kanat et al., 2011; Merkin, 2009) were found to examine HbA1c in Mexican-American patients, few studies were found to examine differences between Mexican-Americans based on acculturation (Ahluwalia, Ford, Link, & Bolen, 2007; de los Monteros, Gallo, Elder, & Talavera, 2008; Ross, Franks, Hall, Young, & Cardarelli, 2011;

Vella, Ontiveros, Zubia, & Bader, 2011). In an attempt to further explore this relationship and to contribute to the current, conflicting, body of research, the current study will measure acculturation using cultural orientation measures and will include subjects without pre-existing diagnoses. The current study will examine the relationship between acculturation of Mexican immigrants to the U.S. and metabolic health. Specifically, the current study will measure the impact of cultural orientation on HbA1c, glucose, and insulin over time.

### **Rationale and Purpose of Study**

As referenced above, Steffen (2006), among others, has hypothesized a relationship between the acculturation of Mexican immigrants to the U.S. and various health problems, including hypertension. There are few empirical studies in the literature that have examined the relationship between acculturation and metabolic health factors in Mexican immigrants to the U.S. Most studies examining the relationship between acculturation and health have focused on the impact of stressors (i.e., acculturation stress) on health rather than on the individual's level of acculturation itself on health. This area of study is important considering the high prevalence of diabetes and related health problems among Mexican-Americans. By gaining information about the relationships between acculturation and changes in metabolic health, we hope to further understand the impact of acculturation on immigrants to the U.S. In addition, the high occurrence of diabetes among Mexicans makes HbA1c an important health factor to study; if we can gain a greater understanding of the negative changes associated with the transition and stressors that contribute to the decline in metabolic health we hope to be able to perform research to identify specific acculturative stressors (i.e., changes in diet, exercise, work stress, etc.) that may best explain this phenomenon. We hope to contribute to research promoting protective factors, including those that may contribute to a healthier immigration process.

## Hypotheses

Hypotheses for the current study are as follows:

1.
  - a. It is hypothesized that Anglo Cultural Orientation will increase over time, with significantly higher levels of Anglo Cultural Orientation at the three-year follow-up data collection period.
  - b. Higher levels of Anglo Cultural Orientation will be associated with poorer metabolic health; that is, higher Anglo Orientation will predict higher levels of Hba1c, glucose, and insulin.
2.
  - a. Mexican Cultural Orientation will decrease over time, with significantly lower levels of Mexican Cultural Orientation at the three-year follow-up data collection period.
  - b. Higher levels of Mexican Cultural Orientation will be associated with better metabolic health; that is, higher Mexican Orientation will predict lower levels of Hba1c, glucose, and insulin.
3. The relationship between cultural orientation and metabolic health will be mediated by acculturation stress; that is, the hypothesized mediators, job-related stress, social support, and depression, will explain the relationship between the cultural orientation variables (Anglo Cultural Orientation and Mexican Cultural Orientation) and the metabolic health variables (HbA1c, glucose, and insulin).

The hypothetical model using major study variables, including mediation variables, is provided in Figure 1 below.

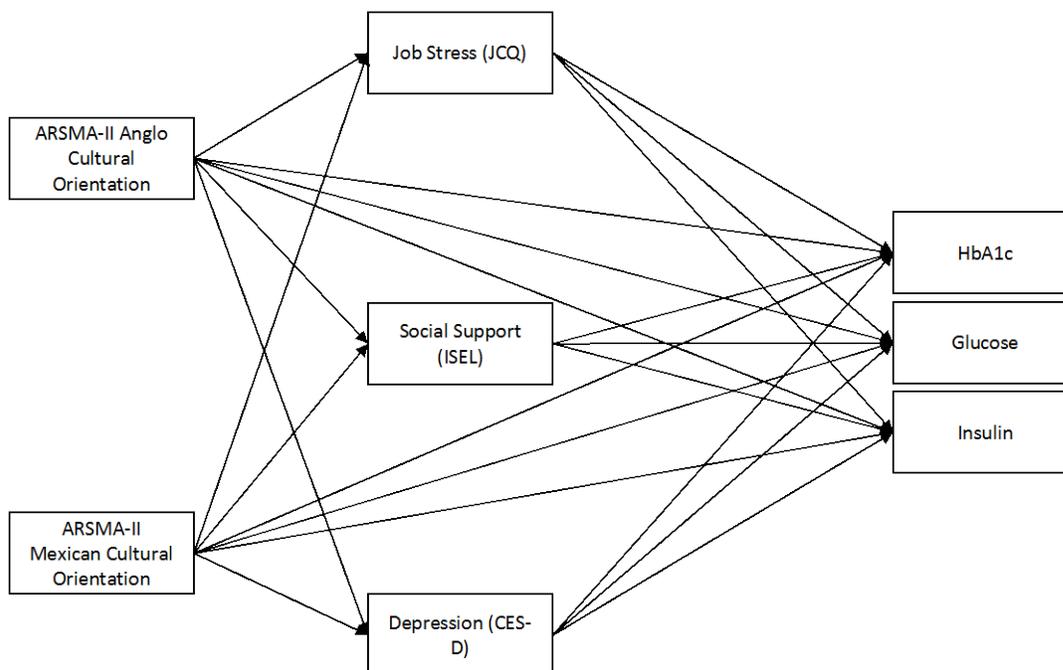


Figure 1

## Methods

### Participants

Participants for the study were recruited from the community through Spanish language television, radio, newspaper advertisements, and announcement placed in Hispanic markets, churches, ESL programs, and community centers. There were two phases of data collection, with an average of three years interval between data collection times one and two. Participants were paid \$175.00 for their participation each time they participated. Three hundred eleven participants were recruited, ages 18-60, with 56% being female. Of those 311 participants, only 99 were available for time two of the study, and one participant was excluded from analyses due to abnormally high levels on several variables, resulting in a total of 98 participants. All participants were born in Mexico and currently reside in the United States. Exclusionary criteria

included pregnancy, tobacco use, current diabetes diagnoses, and participants taking blood pressure medication. Informed consent was obtained prior to enrollment into the study.

### **Procedures**

Participants were asked to come to the BYU Comprehensive Clinic having abstained from food for the past 12 hours. Upon arrival, participants' blood was drawn by a trained phlebotomist, after which the blood was sent to the BYU Student Health Center for analysis. After blood was drawn, the participants were weighed with a balance-beam, eye-level scale and measured using a measuring scale mounted to the balance. Procedures were applied identically at both time points.

Questionnaires were given to the participants to fill out during their free time over the next 24 hours after their blood sample collection. These questionnaires were in Spanish and included scales measuring objective SES, subjective SES, job distress/strain, overall stress, perceived racism/discrimination, cultural orientation, social support, length of stay in the United States, physical activity, smoking/drinking habits, and mental health. Participants returned the completed questionnaires the next day at the same time that they arrived the first day.

### **Measures**

**Cultural orientation.** The Acculturation Rating Scale for Mexican-Americans, Revised (ARSMA-II) is a self-assessment instrument designed to measure an individual's cultural orientation toward Mexican and Anglo cultures (Cuellar, Arnold, & Maldonado, 1995). Four specific areas are assessed using the ARSMA-II: (a) language use and preference, (b) ethnic identity and classification, (c) cultural heritage and ethnic behaviors, and (d) ethnic interaction. In addition, the ARSMA-II attempts to measure four modes of acculturation (integration, assimilation, separation, and marginalization) that were proposed by Berry (1980). The measure

consists of two scales, a Mexican Orientation Scale (MOS) and an Anglo Orientation Scale (AOS). The MOS consists of 17 items, measuring general Mexican orientation (e.g., “I enjoy speaking Spanish.”), Affiliation (e.g., “My friends, while growing up, were of Mexican origin.”), and Language (e.g., “I enjoy listening to Spanish language music.”). The AOS consists of 13 items, measuring general Anglo orientation (e.g., “I speak English.”), Affiliation (e.g., “My friends now are of Anglo origin.”), and Language (e.g., “I enjoy English language TV.”). Participants are asked to respond using a Likert-type scale from 1 (“not at all”) to 5 (“extremely often or almost always”) (Cuellar, Arnold, & Maldonado, 1995). Items on each subtest are summed and divided by the number of items in order to yield mean AOS and MOS scores. Low scores on the AOS and MOS indicate low Anglo and Mexican orientations, respectively. Psychometrics of these scales are sound: The Mexican Orientation Scale (MOS) has a reliability (Cronbach alpha) of .88 and the Anglo Orientation Subscale (AOS) has a Cronbach alpha of .83. Strong construct validity, concurrent validity, and convergent validity have also been demonstrated (Cuellar, Arnold, & Maldonado, 1995).

**Job-related Stress.** Job-related stress was measured using the Job Content Questionnaire (JCQ) (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick, 1998). This measure consists of 29 questions and is designed to assess psychological demands, decision latitude, social support, physical demands, and job insecurity. According to Karasek et al. (1998) the measure is designed to assess the high demand/low control/low support model of job strain development and can be used to predict individuals’ risk of work stress, job related illness, and other illnesses related to exposure to different work settings. Sample questions include, “In my job, I have to work very hard,” and “My supervisor helps me do my job.” Items are scored on a Likert scale of either 1 to 4 or 1 to 5, depending on the sub-scale, with possible responses

ranging from “never” to “always” (Schnall, Schwartz, Landsbergis, Warren, & Pickering, 1992). The job stress score is then derived by subtracting the decision latitude score from the psychological demands score, with a negative number indicative of lower job stress. The JCQ demonstrates good psychometrics in both English and Spanish with validity coefficients of .73 for women and .74 for men (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick 1998).

**Depressive Symptoms.** Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is a 20-item questionnaire that is used to assess depressive symptoms over the past week in the general population (Radloff, 1977). Items of the scale are related to symptoms associated with depression, with a cut-off point of 16-22 generally indicating likely depression. The measure is a self-rating of the frequency of the symptoms on a four-point Likert scale ranging from “rarely or none of the time (less than one day)” to “most or all of the time (5-7 days). Sample questions include, “I feel sad” and “I talk less than usual”. A score above 16 typically places the respondent in the “likely depressed” group. The Spanish version of the CES-D has been found to have good reliability, with a Cronbach alpha between .80 and .86, and adequate concurrent validity, with validity coefficients between .47 and .64 (Masten, Caldwell-Colbert, Alcala, & Mijares, 1986).

**Social Support.** Social support was measured using the Interpersonal Support Evaluation List (ISEL-12), a self-administered twelve-question questionnaire. The ISEL consists of statements about the perceived availability of potential social resources for respondents to mark their agreement with each (Cohen & Hoberman, 1983; Cohen, Memelstein, Kamarck, & Hoberman, 1985). The scale utilizes a four-point Likert-type scale, with responses ranging from “definitely false” to “definitely true.” Items fall into one of three subscales: the “tangible” subscale is intended to measure perceived availability of material aid; the “appraisal” subscale is

intended to measure the perceived availability of someone to talk to about problems; the “belonging” subscale is intended to measure the perceived availability of people to do things with. However, the current study only utilized the overall ISEL score, which demonstrates a Cronbach alpha of .77. Sample ISEL questions include, “I feel like there is no one with whom I can share my problems and fears” and “When I need suggestions about how to deal with my problems, I know someone that I could talk to.” Authors of the ISEL reported good psychometric properties. Validity estimates range from .46 to .74 compared with other measures of social support (Cohen, Memelstein, Kamarck, & Hoberman, 1985). Reliability was .60 for the least reliable subscales and .92 for the most reliable subscale. Test-retest reliability was .80 (Cohen, Memelstein, Kamarck, & Hoberman, 1985).

**Glycated Hemoglobin (HbA1c).** HbA1c is the measure of the proportion of glycated hemoglobin to hemoglobin in the body, and is measured using a simple blood test. The test yields a number, which indicates an average of the individual’s blood glucose level over the previous 120 days, which is the average life span of a red blood cell. This method of measuring blood glucose is considered superior to other methods (i.e., fasting glucose, glucose tolerance test) because instead of offering the current glucose level, it offers a view of the patient’s overall glucose for the past several weeks. According to the American Diabetes Association (2014), HbA1c levels greater than or equal to 6.5% are indicative of diabetes and levels between greater than or equal to 5.7% and less than 6.5 percent are in the prediabetes range. Levels below 5.7% are considered normal. However, many specialists encourage patients to maintain levels below 48 mmol/mol (6.5%) (Currie et al., 2010). Because low HbA1c levels can be indicative of many hypoglycemic episodes, and do not, therefore, necessarily indicate better glycemic control, the current study will utilize HbA1c as a continuous variable.

**Fasting Glucose.** Blood glucose was measured following a twelve-hour fasting period and was obtained via blood sample. The test yields a number, which generally falls into one of three ranges. Blood glucose levels between 70 and 99 mg/dL are in the normal range, levels between 100 and 125 indicate impaired fasting glucose and are considered in the pre-diabetic range, and levels above 125 are abnormal and considered indicative of diabetes.

**Insulin.** Insulin level was measured following a twelve-hour fasting period and was obtained via blood sample. The test yields a number, with scores between five and 25 considered normal. Levels above 25 are indicative of hyperinsulinemia. Higher levels of fasting insulin are indicative of insulin resistance and are found in individuals with uncontrolled diabetes or pre-diabetes.

**Socioeconomic Status.** Socioeconomic status (SES) was calculated utilizing two indicators: years of education and income. SES was treated as a latent construct with formative and reflective indicators, following Bollen and Lennox (1991).

**Additional Measures.** Other characteristics were assessed through more straightforward measures. Obesity was assessed by calculating the Body Mass Index of each participant (kg/m<sup>2</sup>). Smoking/alcohol consumption was assessed with two questions about the frequency of smoking/drinking behaviors. Length of stay in the U.S. was determined by asking participants how long they have lived in the U.S.

## Analysis

**Participant characteristics.** Descriptive statistics of the variables included in this study were conducted to better understand the population of our study. In order to determine whether any of the demographic variables help explain the high attrition rate, *t*-tests were performed comparing the information of those who did not participate in time two data collection to those

who participated in both data collection points. To determine whether age or gender helped to explain the attrition from time one to time two, *t*-tests were performed using the dependent variables HbA1c and glucose, comparing the ages and genders of those who completed only time one of data collection to those who completed both data collection points. This was done because the data did not contain separate entries for gender or age at time two.

**Changes over time—growth mixture modeling.** To test hypotheses 1a and 2a and to determine whether there were sub-groups with different data patterns in the data, growth mixture modeling was performed. Growth mixture modeling is a method for identifying multiple unobserved sub-populations, or groups that differ in their pattern of change over time, within a single population. Growth mixture modeling in the latent variable modeling framework uses two latent variables (intercept and slope factors) to capture the average levels of the individuals' initial measurement and the change rate over time. Growth mixture modeling incorporates latent profile modeling with growth modeling to identify subgroups with different change trajectories. In the current study, the growth mixture modeling was conducted to examine changes over time in all variables and to determine whether sub-groups existed within the current study's population. Two separate growth mixture models were estimated to reduce model size and in order to accommodate the small sample size. The first model included three metabolic health variables (HbA1c, glucose, and insulin). The second model included Mexican Cultural Orientation, Anglo Cultural Orientation, JCQ, ISEL, and CES-D. To perform the modeling, the advanced latent variable modeling program Mplus (v7.11) was adopted. The Bayesian estimator was used to adapt to the small sample size and any non-normality of data distribution (Muthén & Asparouhov, 2012). No informative prior distributions of the parameters were specified, allowing the maximum likelihood estimates to be the priors. Posterior Predictive P-Values (PPP)

were currently the only model fit index in Bayesian estimation with Mplus, with a PPP greater than .05 indicating an acceptable fit and above .50 a very good fit. The estimation underwent a fixed fifty thousand iterations to converge at the default value of .05. Missing values were treated as unknown parameters in Bayesian estimation. Models of one to three classes were compared according to their classification quality (entropy), model fit, and interpretability.

**Predicting change in the metabolic health variables—conditional growth modeling.**

Conditional growth modeling was performed to examine which covariates predicted any changes in the metabolic health variables as described in hypotheses 1b and 2b. Conditional growth modeling is a subset of hierarchical linear modeling that is specifically designed for longitudinal analyses. This type of modeling analyzes growth curves, or the patterns of change across time both between and within individuals, allowing the identification of predictors of change over time as well as the rate of growth over time. Conditional growth modeling was chosen in order to obtain the largest amount of information from the data collected at two time points as possible while inserting predictors into the model. Intercepts (mean initial levels), slopes (mean rate of growth), and latent growth curves were estimated for all variables. The model was estimated for all the available cases with time two of each metabolic health variable (HbA1c, glucose, and insulin) as the dependent variable and each cultural orientation variable (Anglo Cultural Orientation and Mexican Cultural Orientation) and other covariates (job stress, social support, depression, SES, gender, age, and years in the U.S.) at time 1 as the independent variables. The three metabolic health variables were modeled separately to reduce the model size and to reduce the number of unknown parameters and to allow for better model fit. The two acculturation variables (Mexican Cultural Orientation and Anglo Cultural Orientation) were also included, respectively, to eliminate their multicollinearity. Consequently, six models were estimated in

total to test hypotheses 1b and 2b of this study, which were that 1b) Anglo cultural orientation would predict HbA1c, glucose, and insulin levels, with Anglo acculturation positively associated with HbA1c, glucose, and insulin and 2b) Mexican cultural orientation would predict HbA1c, glucose, and insulin, with Mexican cultural orientation negatively associated with HbA1c, glucose, and insulin.

**Bayesian analysis—mediation test.** In order to test for mediating effects of job-related stress, social support, and depression between cultural orientation and metabolic health, mediation tests were carried out using the Bayesian estimation for small samples. Bayesian analysis is a method of testing for direct and indirect effects without imposing the assumptions of other methods of testing for mediation effects. Unlike conventional mediation analyses, specifically, Bayesian analysis does not require that data be normally distributed and it works well with small sample sizes. The analysis was performed following the half-long research design (see MacKinnon, 2008 and Fritz & MacKinnon, 2008) using the models described previously. This design was chosen because it allows the hypothetical causal mechanism to be tested using half cross-sectional and half longitudinal data instead of the ideal of fully longitudinal data for robust mediation processes. In order to account for any changes in the hypothesized mediators at time two, both time one and time two for these variables were explored, respectively. The final effects reported in this study were estimated using the mediators at time two.

## Results

### Descriptive Statistics

As previously indicated, the total sample used in this study was comprised of 98 Mexican immigrants, with 52 (53.1%) female and 44 (44.9%) male. Average age was 36.6. Their ages

ranged from 20 to 62 years of age. ARSMA-II MOS and AOS scores (Cuellar et al., 1995), JCQ scores (Jarasek, 1998), and CES-D scores (Radloff, 1977), were reviewed for all participants. A description of the demographic characteristics of the sample participants is provided in Table 1.

Table 1

*Means and Standard Deviations for Demographic Variables at Time 1*

Variable	<i>M</i>	<i>SD</i>
Age	36.61	11.03
Annual Income (in thousands)	42.9	20.0
Years of Education	12.77	3.86
BMI	28.07	5.23
Years living in the U.S.	8.56	5.85

Descriptive statistics for each of the participants' metabolic variables, JCQ scores, CES-D scores, ISEL scores, and ARSMA-II MOS and AOS scores at both time 1 and time 2 are provided in Table 2. A description of baseline correlations between major variables is provided in Table 3.

Of the 98 total subjects, the availability of blood data (HbA1c, glucose, insulin) varied due to high attrition from time 1 to time 2 as well as the late addition of the HbA1c test to the blood analyses. Participants in the study had generally normal levels of HbA1c at Time 1, with 64 participants (65.3%) having HbA1c levels under 5.7%. Thirty-one individuals (31.6% of participants) demonstrated pre-diabetic levels of HbA1c and 3 individuals (3.1%) had HbA1c levels above 6.5%, indicative of diabetic levels of HbA1c. However, at Time 2, only 41 individuals (41.8%) demonstrated normal levels of HbA1c, with 53 individuals (54.1%) in the pre-diabetic range and 4 individuals (4.1%) in the diabetes range.

Table 2

*Descriptive Statistics for Metabolic Health Variables, JCQ, CES-D, ISEL, and ARSMA-II AOS and MOS*

Variable	Min	Max	<i>M</i>	<i>SD</i>
HbA1c	4.56	7.10	5.59	.40
HbA1c time 2	4.80	9.20	5.79	.53
Glucose	68.42	179.00	90.49	12.58
Glucose time 2	53.00	190.00	92.10	16.79
Insulin	-1.90	48.00	10.77	7.91
Insulin time 2	.36	33.60	9.52	6.86
JCQ	-2.58	1.96	-.82	.81
JCQ time 2	-2.42	.83	-.83	.75
CES-D	3.00	41.00	15.97	9.05
CES-D time 2	-2.95	46.00	15.34	8.80
ISEL	20.00	51.74	38.07	6.58
ISEL time 2	16.86	51.90	37.90	7.02
ARSMA-II MOS	1.67	4.00	3.19	.48
ARSMA-II MOS time 2	1.85	4.00	3.16	.51
ARSMA-II AOS	.50	4.00	2.25	.82
ARSMA-II AOS time 2	.40	3.70	2.31	.83

Table 3

*Correlations between Major Variables at Time 1*

Variable	HbA1c	Glucose	Insulin	ARMSA-II AOS	ARMSA-II MOS	JCQ	ISEL	CES-D
HbA1c	1	.39**	.12	-.02	.15	.09	-.04	-.01
Glucose	.39**	1	.251*	-.20*	-.16	-.22*	-.05	.04
Insulin	.12	.25*	1	-.09	.09	-.26*	.04	-.06
ARMSA-II AOS	-.02	-.20*	-.09	1	-.07	.24*	.36**	-.17
ARMSA-II MOS	.15	-.16	.09	-.07	1	-.17	-.01	-.22*
JCQ	.09	-.22*	-.26*	.24**	-.17	1	.02	.19
ISEL	-.04	-.05	.04	.36**	-.01	.02	1	-.38**
CES-D	-.01	.04	-.06	-.17	-.22*	.19	-.38**	1

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$

Participants in the study also demonstrated normal levels of fasting plasma glucose at Time 1, with 89 individuals (90.8%) demonstrating glucose levels under 100mg/dl. Eight individuals (8.2%) demonstrated pre-diabetic levels of glucose at Time 1 and only one individual (1.0%) had diabetic levels of glucose at Time 1. At Time 2, the number of individuals in the normal range for glucose decreased to 79 (80.6%), the number of individuals in the pre-diabetic range increased to 17 (1.3%), and the number of individuals in the diabetic range increase to two (2.0%).

Insulin levels at Time 1 were found to be in the normal range for most participants, with 92 individuals (93.9%) under 25.0. Six individuals (6.1%) were found to be in the hyperinsulinemia range. At Time 2, only three individuals (3.1%) were found to be in the hyperinsulinemia range, with 95 individuals (96.9%) in the normal range.

Analyses comparing the demographic variables of those individuals who only participated in time one of the data collection to those who participated in both data collection time points showed no significant difference between groups in any demographic variable. Age of participants at time one who had completed both time points of data collection, when compared to age of individuals who were missing time two data for HbA1c, demonstrated no significant difference between groups ( $p = .94$ ). Similarly, no significant difference between groups was found for age of participants who completed both data time points at time one compared with age of individuals who were missing glucose at time two ( $p = .75$ ). The same analyses were performed for gender, with similar results. Gender of individuals with two data points was compared with gender of individuals who were missing HbA1c and glucose at time two. No significant difference between groups was found using these variables for HbA1c ( $p = .77$ ) or for glucose ( $p = .71$ ). *T*-tests were also performed to compare individuals who completed both time points of data collection to those who completed only time one for annual income, and, again, there was no significant difference between groups ( $p = .09$ ), nor was there a difference between groups for years of education ( $p = .74$ ). These findings suggest that the attrition level cannot be explained by these demographic variables and are summarized in Table 4 below.

Because participants in the current study appeared to have lower levels of Anglo Cultural Orientation than those observed in Cuellar and colleagues' (1995) normative data, a *t*-test was performed to determine whether the difference observed was statistically significant. The ARSMA-II Anglo Orientation Scores in the current dataset were compared to the mean of the ARSMA-II Anglo Orientation Score of first-generation Americans as reported in Cuellar et al. (1995). Compared to the normative sample of first generation Americans from Mexico for the ARSMA-II AOS and MOS, the participants in the current study had significantly lower levels of

Table 4

*Mean Comparisons of Individuals who Completed Both Data Collection Points and those who Participated in Time One Data Collection*

Variable	<i>M</i> , present at both time points	<i>M</i> , present only at time one	<i>t</i>	<i>df</i>
Age (by missing HbA1c at time 2)	36.35	36.47	-.08	330
Age (by missing glucose at time 2)	36.09	36.56	-.32	330
Gender (by missing HbA1c at time 2)	1.46	1.44	.29	331
Gender (by missing glucose at time 2)	1.46	1.44	.37	331
Annual Income (in tens of thousands)	43.72	39.40	1.68	290
Years of Education	12.89	12.68	.33	289

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Anglo Cultural Orientation ( $t = -12.50$ ,  $df = 97$ ,  $p < .001$ ). An additional  $t$ -test was performed to compare the average income of the current study with the average income of two comparable studies. This additional analysis was performed following the observation that the current sample demonstrated a seemingly high average yearly income. The two studies that were selected to provide a comparison were chosen because they were performed within approximately ten years of the current study, they used a similar population, and they provided data about annual income of participants. The first study used to compare groups was Mulvaney-Day, Alegria, and Sribney (2006), who examined social cohesion, social support, and health among Latinos living in the U.S. When compared with the annual income data provided by Mulvaney et al., our means did not differ significantly ( $t = .22$ ,  $df = 97$ ,  $p = .83$ ). However,

when compared with the annual income data provided by Finch, Hummer, Kolody, and Vega (2001), the current study's participants had a significantly higher income, overall ( $t = 20.13$ ,  $df = 97$ ,  $p = <.001$ ). The fact that Mulvaney and colleagues used a Latino group that included participants from various Spanish-speaking nations as well as the fact that the Mulvaney group had a number of participants with an income level above \$90,000 per year may explain the higher overall mean of participants in the 2006 study. The Finch et al. study utilized a sample much more similar to that used in the current study, that is, Mexican-born individuals living in the U.S.

### **Growth Mixture Modeling of Dependent, Independent, and Mediating Variables**

Growth mixture modeling was performed in order to determine whether there were sub-populations, or groups of individuals within the population that differed in their response patterns, and to determine whether meaningful change had taken place within these sub-populations in the variables from time one to time two. Two separate models were created to reduce the model size and to allow for our small sample size. The first model consisted of the metabolic health variables (HbA1c, insulin, and glucose) and had an entropy of .96 and a posterior predictive probability (PPP;  $p = .08$ ), indicating acceptable model fit. Two heterogeneous subgroups (classes) were identified in the first model that differed in their growth patterns. The first of the two classes consisted of 81 individuals (86.6% of the total population). This first group demonstrated a significant decrease in insulin from time one to time two ( $\gamma = 9.93$ , change = -2.22,  $p = .001$  (LB -3.68, UB -.75)) and a significant increase in HbA1c from time one to time two ( $\gamma = 5.58$ , change rate = .15,  $p = .01$  (LB .02, UB .27)). No significant change was noted between glucose at times one and two ( $\gamma = 89.61$ , change rate = .93,  $p = .34$  (LB -3.47, UB 5.23)). The second class consisted of 13 individuals (13.4% of the total

population). This second class demonstrated a significant increase in insulin from time one to time two ( $\gamma = 13.99$ , change rate = 8.78,  $p = .01$  (LB 1.42, UB 16.25)). Neither HbA1c ( $\gamma = 6.00$ , change rate = .22,  $p = .13$  (LB -.18, UB .65)) nor glucose ( $\gamma = 98.01$ , change rate = 3.26,  $p = .32$  (LB -8.50, UB 19.55)) changed significantly from time one to time two in the second class. A summary of growth mixture modeling findings for model one is provided in Table 5.

Table 5

*Growth Mixture Modeling Initial Means, Change Rates, and Confidence Intervals for Model 1*

Latent Class Number	Variable name	<i>n</i>	Initial Score (mean)	Change Rate	Confidence Interval (Lower Bound, Upper Bound)
1	Insulin	81	9.93	-2.22***	-3.68, -.75
1	HbA1c	81	5.58	.15**	.02, .27
1	Glucose	81	89.61	.93	-3.47, 5.23
2	Insulin	13	13.99	8.78**	1.42, 16.25
2	HbA1c	13	6.00	.22	-.18, .65
2	Glucose	13	98.01	3.26	-8.50, 19.55

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

The second growth mixture model was comprised of the cultural orientation variables (Anglo Cultural Orientation and Mexican Cultural Orientation) and stress variables (social support, job-related stress, and depression). This model also identified two heterogeneous subgroups (classes) that differed in their growth patterns. However, the second identified class consisted of only three cases. Class one ( $n = 94$ ) showed no significant change from time one to time two in Anglo Cultural Orientation ( $\gamma = 2.25$ , change rate = .07,  $p = .12$  (LB -.06, UB .21)) or Mexican Cultural Orientation ( $\gamma = 3.18$ , change rate = .06,  $p = .43$  (LB -.13, UB .11)). This model also demonstrated no significant change from time one to time two for job stress ( $\gamma = -.86$ , change rate = .04,  $p = .36$  (LB -.20, UB .27)), social support ( $\gamma = 38.02$ , change rate = .00,  $p =$

.50 (LB -1.91, UB 1.87)), or depression ( $\gamma = 16.01$ , change rate =  $-.64$ ,  $p = .28$  (LB -3.02, UB 1.64)). The second identified class ( $n = 3$ ) did show significant change from time one to time two in Anglo Cultural Orientation ( $\gamma = 3.05$ , change rate =  $-2.66$ ,  $p = .03$  (LB -3.83, UB .01)) and Mexican Cultural Orientation ( $\gamma = 3.83$ , change rate =  $-1.46$ ,  $p = .03$  (LB -2.51, UB .03)), but no significant change in Job Stress ( $\gamma = -5.69$ , change rate =  $27.50$ ,  $p = .21$  (LB -41.89, UB 49.70)), Social Support ( $\gamma = 29.53$ , change rate =  $230.17$ ,  $p = .08$  (LB -1.91, 1.87)), or Depression ( $\gamma = 9.71$ , change rate =  $2.21$ ,  $p = .40$  (LB -16.80, UB 22.54)). However, due to the very small size of the second class of individuals ( $n = 3$ ), the second class was not considered a meaningful group for further exploration. A summary of growth mixture modeling findings for model two is provided in Table 6.

### **Conditional Growth Modeling**

Conditional Growth Modeling was performed to test for changes in variables over time. The conditional growth model estimated to what extent the effects of cultural orientation and other covariates (age, gender, SES, and year in the U.S.) at time one predicted the changes of the metabolic health variables (HbA1c, glucose, and insulin) from time one to time two. Because growth mixture modeling revealed no significant change in the cultural orientation variables (Anglo Cultural Orientation and Mexican Cultural Orientation) over time, only the time one values of each cultural orientation variable were used in the conditional growth model. The overall model was separated into six models in order to reduce model size and to meet the needs of our small sample size. Intercepts and slopes, utilizing the longitudinal data available, were estimated for each model. Model 1 estimated the change in HbA1c over time as predicted by Anglo Cultural Orientation and other covariates at time 1. Model 2 estimated the change in glucose from time one to time two as predicted by Anglo Cultural Orientation and other

Table 6

*Growth Mixture Modeling Initial Means, Change Rates, and Confidence Intervals for Model 2*

Latent Class Number	Variable name	<i>n</i>	Initial Score (mean)	Change Rate	Confidence Interval (Lower Bound, Upper Bound)
1	Anglo Cultural Orientation	94	2.25	.07	-.06, .21
1	Mexican Cultural Orientation	94	3.18	.06	-.13, .11
1	Job Stress	94	-.86	.04	-.20, .27
1	Social Support	94	38.02	.00	-1.91, 1.87
1	Depression	94	16.01	-.64	-3.02, 1.64
2	Anglo Cultural Orientation	3	3.05	-2.66*	3.83, .01
2	Mexican Cultural Orientation	3	3.83	-1.46*	-2.51, .03
2	Job Stress	3	-5.69	27.50	-41.89, 49.70
2	Social Support	3	29.53	230.17	-96.36, 456.33
2	Depression	3	9.71	2.21	-16.80, 22.54

Note: \* $p < .05$ .

covariates at time 1. Model 3 estimated the change in insulin over time as predicted by Anglo Cultural Orientation and the other covariates at time 1. Model 4 estimated the change in HbA1c from time one to time two as predicted by Mexican Cultural Orientation and the other covariates at time 1. Model 5 estimated glucose over time as predicted by Mexican Cultural Orientation and the other covariates at time 1. Model 6 estimated insulin change over time as predicted by Mexican Cultural Orientation and the other covariates at time 1. Summary and results of these models are listed in Table 7 below. Sample sizes of each model were reduced due to missing values in all the independent variables and the requirement that all subjects have data points for all variables in each model. The PPP indicate that all the models fit the data very well.

Table 7

*Conditional Growth Model Summary*

Model Number	Dependent Variable	Main Predictor Variable	n	PPP value
1	HbA1c	Anglo Cultural Orientation	51	.37
2	Glucose	Anglo Cultural Orientation	54	.25
3	Insulin	Anglo Cultural Orientation	54	.40
4	HbA1c	Mexican Cultural Orientation	51	.28
5	Glucose	Mexican Cultural Orientation	54	.08
6	Insulin	Mexican Cultural Orientation	54	.50

**Hypothesis 1—Anglo Cultural Orientation and Metabolic Health.** The 1<sup>st</sup> conditional growth modeling examined the association of Anglo Cultural Orientation at time one with the change of HbA1c over time while controlling for other covariates. The results of this model showed that Anglo Cultural Orientation was positively associated with the change in HbA1c ( $\beta = .28, p < .05$ ), suggesting that higher levels of Anglo Cultural Orientation at time one were associated with a faster increase of HbA1c over time and that lower levels of Anglo Cultural Orientation at time one were associated with a slower increase of HbA1c over time. SES, age, and job-related stress were also found to be associated with the change in HbA1c, with  $\beta = .25$  ( $p < .001$ ),  $\beta = .60$  ( $p < .001$ ), and  $\beta = -.29$  ( $p = .02$ ), respectively. The relationship between HbA1c and job-related stress was in the opposite direction of that hypothesized. Social support ( $p = .27$ ), gender ( $p = .48$ ), and years in the U.S. ( $p = .24$ ) were not significant predictors of HbA1c in this model. However, depression approached significance as a predictor ( $\beta = .26, p = .06$ ). In summary, conditional growth modeling analyses supported hypothesis 1b for HbA1c, or, in other

words, higher Anglo Cultural Orientation at time one predicted faster positive change in HbA1c over time.

The 2<sup>nd</sup> conditional growth modeling examined the change of glucose as predicted by Anglo Cultural Orientation. Anglo Cultural Orientation at time one did not significantly predict glucose in the model ( $\beta = -.19, p = .12$ ). SES was the only significant predictor of glucose change ( $\beta = .26, p < .001$ ). Job-related stress ( $\beta = -.04, p = .39$ ), social support ( $\beta = -.11, p = .19$ ), depression ( $\beta = -.10, p = .23$ ), gender ( $\beta = -.06, p = .33$ ), age ( $\beta = -.18, p = .15$ ), and years in U.S. ( $\beta = .16, p = .11$ ) were not significant predictors of glucose in this model.

Findings from the 3<sup>rd</sup> model conditional growth modeling, which examined the relationship between insulin and Anglo Cultural Orientation, were similar to findings for model 2 in that Anglo Cultural Orientation at time one did not significantly predict change in glucose in the model ( $\beta = .24, p = .10$ ). SES ( $\beta = .11, p < .001$ ) and age ( $\beta = .30, p = .03$ ) were the only significant predictors of insulin change. Job-related stress ( $\beta = -.04, p = .40$ ), social support ( $\beta = -.09, p = .28$ ), depression ( $\beta = .01, p = .47$ ), gender ( $\beta = .17, p = .10$ ), and years in the U.S. ( $\beta = .03, p = .42$ ) were not significant predictors of insulin in this model.

Overall, hypothesis 1b was supported by findings from the 1<sup>st</sup> conditional growth modeling, with higher levels of Anglo Cultural Orientation at time one predicting greater positive change in HbA1c over time. Findings were not significant for the 2<sup>nd</sup> model (glucose) nor for the 3<sup>rd</sup> model (insulin). Findings for hypothesis 1b are summarized in Table 8.

**Hypothesis 2—Mexican cultural orientation and metabolic health.** The 4<sup>th</sup> conditional growth model examined the association of Mexican Cultural Orientation at time one with the change of HbA1c over time while controlling for other covariates. Only time one of Mexican Cultural Orientation was incorporated into the model because no significant change was found

Table 8

*Conditional Growth Model Estimates for Hypothesis 1b*

Covariate	Model 1 (Hba1c)	Model 2 (Glucose)	Model 3 (Insulin)
Anglo Cultural Orientation	.28*	-.19	.24
Job Stress	-.29*	-.04	-.04
Social Support	-.09	-.11	-.09
Depression	.26	-.10	.01
Gender	.00	-.06	.17
Age	.60***	-.18	.30*
Years in U.S.	-.15	.16	.03
SES	.25***	.29***	.11***

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

from time one to time two ( $p = .43$ ), as previously reported. The results of this model showed that Mexican Cultural Orientation was negatively associated with the change of HbA1c ( $\beta = -.39$ ,  $p < .001$ ), implying that lower levels of Mexican Cultural Orientation at time one were associated with faster increase of HbA1c; alternatively, higher levels of Mexican Cultural Orientation at time one were associated with slower increase of HbA1c. In addition, SES, age, and job-related stress were also found to be associated with the change of HbA1c, respectively at  $\beta = .18$  ( $p < .001$ ),  $\beta = .42$  ( $p < .001$ ), and  $\beta = -.28$  ( $p = .02$ ), although the relationship between HbA1c and job-related stress was found to be in the opposite direction of that hypothesized. Social support ( $\beta = -.07$ ,  $p = .31$ ), depression ( $\beta = .12$ ,  $p = .21$ ), gender ( $\beta = -.12$ ,  $p = .18$ ), and years in the U.S. ( $\beta = -.02$ ,  $p = .47$ ) were not significant predictors of HbA1c in this model. In summary, conditional growth modeling analyses supported hypothesis 2b for HbA1c, or, in other

words, lower Mexican Cultural Orientation at time one predicted greater positive change in HbA1c over time.

The 5<sup>th</sup> conditional growth modeling, which examined change in glucose as predicted by Mexican Cultural Orientation, suggested that Mexican Cultural Orientation at time one was not a significant predictor of change in glucose in the model ( $\beta = .08, p = .28$ ). SES was the only significant predictor of change in glucose over time ( $\beta = .22, p < .001$ ) as opposed to job-related stress ( $\beta = -.07, p = .30$ ), social support ( $\beta = -.17, p = .10$ ), depression ( $\beta = -.04, p = .38$ ), gender ( $\beta = -.06, p = .34$ ), age ( $\beta = -.08, p = .23$ ), and years in the U.S. ( $\beta = .08, p = .30$ ).

For model 6 of the conditional growth modeling, which examined the relationship between insulin and Mexican Cultural Orientation, Mexican Cultural Orientation at time one was, again, not found to be a significant predictor of change in insulin over time in the model ( $\beta = -.12, p = .19$ ). Similarly to findings from the other models, SES ( $\beta = .10, p < .001$ ) was the only significant predictor of insulin at time two. Other covariates were not significant predictors of insulin in this model, including job-related stress ( $\beta = .02, p = .44$ ), social support ( $\beta = -.01, p = .47$ ), depression ( $\beta = -.07, p = .31$ ), gender ( $\beta = .18, p = .09$ ), age ( $\beta = .18, p = .08$ ), and years in the U.S. ( $\beta = .14, p = .16$ ).

Overall, hypothesis 2b was supported by model 4 findings, with lower levels of Mexican Cultural Orientation at time one predicting higher levels of change in HbA1c over time.

Findings were not significant for model 2 (glucose) nor for model 3 (insulin). A summary of findings for Hypothesis 2 is provided in Table 9.

**Hypothesis 3—Mediation.** In order to test for mediating variables in the relationship between cultural orientation and metabolic health, three mediators (job-related stress, social support, and depression) were tested using the Bayesian estimation.

Table 9

*Conditional Growth Model Estimates for Hypothesis 2b*

Covariate	Model 4 (Hba1c)	Model 5 (Glucose)	Model 6 (Insulin)
MCO	-.39***	.08	-.12
Job Stress	-.28*	-.07	.02
Social Support	-.07	-.17	-.01
Depression	.12	-.04	-.07
Gender	-.11	-.06	.18
Age	.42***	-.08	.18
Years in U.S.	-.02	.08	.14
SES	.18***	.22***	.10***

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

There is a mediation effect of Anglo Cultural Orientation at time one on glucose at time two through CES-D at time two in 73 cases ( $p = .001$ ). The effect of Anglo Cultural Orientation on depression was negative and the effect of depression on glucose was positive, indicating that higher Anglo Cultural Orientation was associated with lower depression, and lower depression was associated with lower glucose. Although this finding does not support the hypothesized directionality of the relationship between Anglo Cultural Orientation and depression, it does support the hypothesized mediating effect of depression on glucose, that higher depression was associated with higher glucose and vice versa. The direct effect of Anglo Cultural Orientation at time 1 to glucose at time 2 was not significant. No other mediation effects or indirect effects were found.

## Discussion

The purpose of this study was to investigate the relationship between cultural orientation and metabolic health in a sample of first generation Mexican immigrants to the United States residing in Utah. Previous research on the impact of acculturation stress on health outcomes was utilized to form the hypothesis that acculturation stress would mediate the hypothesized relationship between cultural orientation and metabolic health. Specifically, it was hypothesized that Anglo cultural orientation would increase from time one to time two, a period of three years. In addition, it was hypothesized that Anglo cultural orientation would be positively related to HbA1c, glucose, and insulin, with higher Anglo acculturation associated with higher Hba1c, glucose, and insulin. Mexican cultural orientation was hypothesized to decrease from time one to time two, a period of three years, and that Mexican cultural orientation would be negatively associated with Hba1c, glucose, and insulin, with higher Mexican cultural orientation associated with lower Hba1c, glucose, and insulin. Finally, the relationship between cultural orientation (Anglo Cultural Orientation, Mexican Cultural Orientation) and metabolic health variables (HbA1c, glucose, insulin) was hypothesized to be mediated by acculturation stress; specifically, job stress, social support, and depression would mediate the relationship between cultural orientation and metabolic health.

Hypothesis 1b stated that higher levels of HbA1c, insulin, and glucose would be seen in individuals who endorsed higher Anglo Cultural Orientation. This hypothesis was supported by the findings, with Anglo Cultural Orientation positively related to HbA1c. Specifically, as hypothesized, Anglo Cultural Orientation predicted HbA1c in the positive direction, with increased Anglo Cultural Orientation scores predicting increased HbA1c values over time in Mexican immigrants to the U.S. The relationship between high levels of Anglo Cultural

Orientation and decreased metabolic health was hypothesized due to the body of research available on changes associated with acculturation to the U.S., which include decreased social support (Cislo, Spence, & Gayman, 2010), increased rates of cardiovascular disease (Marmot & Syme, 1976), the transition to more demanding jobs, less job security (Santos, Bohon, & Sanchez-Sosa, 1998), lower access to healthy foods (Gregory-Mercado et al., 2006), and poor health habits (Sarnoff, Adams, Shauffler, & Abrams, 2001), especially when contrasted with the lifestyle associated with a Mexican Cultural Orientation.

Higher levels of HbA1c, which represents an overall view of the individual's metabolic health over the past 90 days or so, were predicted to be found in individuals who reported high adherence to an Anglo lifestyle and beliefs. Although neither insulin nor glucose was found to have the same relationship as did HbA1c with Anglo Cultural Orientation, this finding is important nonetheless. HbA1c has gained popularity in recent years as a measure of overall metabolic health due to its lack of sensitivity to immediate or acute blood sugar levels (see Selvin et al., 2010 and Santos-Rey, Fernandez-Riejos, Mateo, Sanchez-Margalet, & Goberna, 2010). In addition, because of the propensity certain cultural groups, including Mexican-Americans, have toward metabolic health disorders such as diabetes (see American Diabetes Association, 2011 and Carter et al., 1996), it is important to determine what factors impact metabolic health. The more that is known about HbA1c and the contributors to increased susceptibility to metabolic health disorders the better prevention and treatment plans can be developed with the goal of preventing such disorders in the future.

Socio-economic status (SES) was found to be a significant predictor of HbA1c, glucose, and insulin, with higher SES associated with higher levels of each of these metabolic health factors. This research appears to be commensurate with Finch, Hummer, Kolody, and Vega

(2001), who reported that SES is perhaps the strongest predictor of health outcomes in the U.S., other than age, with higher SES related to poor physical health. This is an important finding for this population, especially considering the research on the reversed social gradient (see Steffen, 2006; Ruiz, Steffen, & Smith, 2013). Research on this phenomenon demonstrates an unexpected relationship between SES and health in some non-Western societies, with low SES actually associated with better health (Bunker, et al., 1996; Cockerham, Hattori, Yamori, 2000). A recent meta-analysis on the subject found that Hispanic populations in the U.S. had a 17.5% lower mortality risk when compared with other racial groups, including non-Hispanic Whites (Ruiz, Steffen, & Smith, 2013). Hypothesized explanations for this reversed social gradient include the possible decrease in social resources and increased interpersonal stress that accompanies the acculturation process (Steffen, 2006). Also hypothesized by Steffen (2006) is the possibility that increasing SES may indicate that individuals have moved into less physically demanding jobs that, intuitively, contribute to decreased job strain and dissatisfaction. Therefore, the current study's findings regarding the relationship between SES and metabolic health factors appears to support these hypotheses, with increased socioeconomic status associated with higher levels of HbA1c, glucose, and insulin.

The analyses performed to study hypothesis one also revealed job-related stress to be a significant predictor of HbA1c, but in the opposite direction of that hypothesized. Based on previous research in this area, job-related stress was hypothesized to be related to poorer health outcomes, as it represents an important and well-studied element of acculturation stress (see Chandola, Brunner, & Marmot, 2006; Esquirol, Bongard, Mabile, Jonnier, Soulat, & Perret, 2009; and Vrijkotte, Wrije, Van Doornen, & De Geus, 1999). However, our findings suggest that in the current population, increased job stress was associated with lower levels of HbA1c.

This finding may be related to one of the unusual characteristics of our particular population, which consisted of individuals with very low reported levels of job-related stress. Indeed, the reported levels of job stress in our population, as reported on the JCQ (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick, 1998), were extremely low, overall. While Karasek, et al. reported JCQ means of .17 for men and .12 for women the current study yielded an average JCQ score of -.86, indicating that individuals involved in the current study reported more decision latitude than psychological demands overall. Finally, our study's average SES, comprised of income and years of education, was much higher than that reported in other similar studies, such as that reported in Mulvaney-Day, Alegria, and Sribney (2006), Finch, Hummer, Kolody, and Vega (2001), and Farley, Galves, Dickinson, and Perez (2005). This may represent a unique characteristic of the current population and may have affected the directionality of this relationship.

Other than age, no other variables were found to be meaningfully associated with metabolic health in the hypothesis one analyses. Age was found to be a significant predictor in the relationship between Anglo Cultural Orientation and metabolic health, but only for insulin. The relationship was positive, which is to be expected, with higher age associated with higher levels of insulin.

Hypothesis 2b was created in order to examine the other side of cultural orientation, that is, to determine whether the maintenance of a Mexican Cultural Orientation would serve as a protective element against metabolic health concerns. Similar to the findings for Anglo Cultural Orientation, HbA1c was the only metabolic health variable that was significantly associated with Mexican Cultural Orientation. Specifically, Mexican Cultural Orientation was found to be negatively associated with HbA1c values, supporting hypothesis 2b. An endorsement of a high

Mexican Cultural Orientation, which has been characterized by better health in some ways than U.S.-born Mexicans and Whites (Lorenzo et al., 2005; Steffen, 2006; Sundquist & Winkleby, 1999; Vaeth & Willett, 2005), collectively originating stress rather than self-originating stress (Ben-Ari & Lavee, 2004), a generally collectivist and external sense of identity (Slavik & Croake, 2006; Vega et al., 1998), lower blood pressure and greater overall cardiovascular health (Steffen, 2006), and lower levels of depression (Armenta, 2003), was hypothesized to serve as a protective buffer against poor metabolic health in hypothesis 2b.

Similar to the findings for Anglo Cultural Orientation, SES was another important predictor of metabolic health outcomes in the Mexican Cultural Orientation model. Again, there was a positive relationship between SES and HbA1c, glucose, and insulin. As previously mentioned, this relationship supports the current body of research on the reversed social gradient, with increased SES associated with poorer health outcomes. In addition to SES, both age and job-related stress also predicted HbA1c at time two. As expected, the relationship between age and HbA1c was positive, with increased age associated with increased HbA1c levels. However, as found in the hypothesis one analyses, the relationship between job-related stress and HbA1c was negative, occurring in the opposite direction of that hypothesized. Again, very low levels of job-related stress in the current study's population may help explain this finding, as may our participants' high SES and potential accompanying lower-stress jobs.

As stated previously, HbA1c has replaced other health measures to become one of the most valued tools in the diagnosis and treatment of diabetes, among other health concerns. Unlike fasting glucose and insulin levels, HbA1c is not overly sensitive to immediate changes in diet; rather, it represents a more well-rounded view of the individual's metabolic health over the previous 120 days, which is the average life span of a red blood cell. Therefore, the lack of

significant findings regarding the relationship between Mexican Cultural Orientation and glucose as well as between Mexican Cultural Orientation and insulin may have something to do with the sensitivity of these blood factors to recent changes in diet or to the rapid changes in these measured variables over the course of a day. Selvin et al. (2010) suggests that HbA1c was more strongly associated with risks of cardiovascular disease and death from any cause when compared with fasting glucose, a more traditional diabetes diagnostic test. Therefore, the lack of findings regarding insulin and glucose is not discouraging; rather, it complements the already-established reliability of HbA1c over these other health variables and the benefit of using a less time-sensitive variable when dealing with metabolic health concerns.

Early stages of the current study intended to explore the impact of cultural orientation *change* on metabolic health outcome. This was intended to provide more depth of information into the impact of the acculturation process in a longitudinal manner. However, as indicated in the results section, no significant change between Anglo Cultural Orientation, as measured using the ARSMA-II AOS (Cuellar et al., 1995), at time one and time two was found, disproving hypothesis 1a. Similarly, no significant change was found between Mexican Cultural Orientation at time one and time two, disproving hypothesis 2a. While disappointing, there may be several explanations for the lack of change in Anglo Cultural Orientation over time. One possible explanation involves our sample characteristics; specifically, because of our extremely high attrition rate from time one to time two, much less time two data was available than what was expected. Because there were far fewer participants at time two than anticipated, our efforts to detect meaningful change were impacted despite our attempts to statistically correct for attrition. In addition, the amount of time between the collection of data at time one and time two was only three years; it is expected that increased time between data collection periods would be

more indicative of accurate longitudinal change, especially considering that the mean length of time living in the U.S. was only 8.56 years. However, the length of years living in the U.S. may have independently contributed to our lack of findings in this area as well. Specifically, more measurable changes may be noted between the time individuals first arrive in the U.S. rather than those seen several years following immigration and future studies should consider gathering time one data from newly arrived immigrants in order to achieve the highest change in measures of acculturation.

The third hypothesis of the current study was created in an attempt to find mediators in the relationship between cultural orientation and metabolic health. The acculturation stress model, presented by Williams and Berry (1991), and accompanying body of research (see Berry & Annis, 1974; Grzywacz, Quandt, Arcury, & Marin, 2005; Ritsner et al., 2000; Santos, Bohon, & Sanchez-Sosa, 1998; Romero and Roberts, 2003; Smart & Smart, 1995; Vega, Kolody, Aguilar-Gaxiola, Alderete, Catalao, & Caraveo-Anduaga, 1998; Wodarski, 1992; Zunzunegui, Forster, Gauvin, Raynault, & Douglas, 2006;) suggest that stress is a characteristic element of the acculturation process; therefore, the current study attempted to measure the impact of specific stressors on health outcomes. A mediation model was utilized to determine the indirect effects of three stressors (job-related stress, social support, and depression), on the relationship between cultural orientation and metabolic health. Job stress, as measured using the Job Content Questionnaire (Karasek, Brisson, Kawakami, Houtman, Bongers, & Amick, 1998), was chosen because of the research showing that immigrants to the U.S. from Mexico and from other countries experience a variety of changes in employment and pay when they leave their country of origin and seek employment in the U.S. Because job stress is viewed as one of the most stressful elements of the acculturation process, it was included as a potential mediator in the

current model. Unfortunately, although it is still likely that job-related stress has some impact on the relationship between cultural orientation and metabolic health, job-related stress was not found to be a specific mediator in the relationship in the current study. One potential reason for the lack of a mediation effect is that the sample used in the current study reported very healthy levels of job stress overall as previously described. Other than a few individuals, those included in our study reported very low levels on the JCQ, indicating that they view their current work situation as having a good balance between psychological demands (negative job stress) and decision latitude (positive stress). In fact, the majority of our respondents returned negative scores, indicating that they view their current job as having more decision latitude than psychological demands.

Social support, measured using the Interpersonal Support Evaluation List (ISEL-12) (Cohen, Memelstein, Kamarck, & Hoberman, 1985), was also not found to be a significant mediator in the relationship between cultural orientation and metabolic health outcomes. Social support was chosen as a potential mediator in the relationship between cultural orientation and metabolic health in Mexican immigrants to the U.S. due to previous findings stating that as immigrants arrive in a new country, close interpersonal relationships are often lost, contributing to a loss of identity and difficulty adapting to a new culture (Cislo, Spence, & Gayman, 2010; Smart & Smart, 1995; Wodarski, 1992). One potential reason for the lack of a mediation effect despite the hypothesized importance of this stressor stands for each of the hypothesized mediation effects, that is, that the individuals recruited for our study had an average of 8.56 years in the U.S. at the commencement of data collection. It is likely that in that length of time following immigration individuals would have already established their social group, connected with others in a similar situation, and, in many cases, united with family members or even

formed new family bonds through marriage. Again, future studies should focus on recruiting newly immigrated individuals to best determine the impact of acculturation stressors, including social support, on health and other factors.

The only significant mediator in the current study was depressive symptoms as measured using the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977).

Depressive symptoms were found to mediate the relationship between Anglo Cultural Orientation and glucose, with higher Anglo Cultural Orientation associated with lower levels of depressive symptoms and lower depressive symptoms associated with lower glucose.

Depressive symptoms were hypothesized to be a major source of acculturation stress due to previous studies indicating the relevance of poor psychological functioning on acculturative stress and the negative effects of acculturative stress on psychological well-being. Although it was hypothesized that higher Anglo Cultural Orientation would be associated with higher levels of depressive symptoms following research by Alderete, Vega, Kolody, and Aguilar-Gaxiola (1999) and Cislo, Spence, and Gayman (2010), for example, the current study found that higher Anglo Cultural Orientation was associated with lower levels of depressive symptoms. However, it is important to note that most of the studies with findings relating acculturation to depression and other psychiatric concerns utilized Hispanic adolescent and college-age participants, for whom many psychological concerns first begin to manifest. This age group is potentially fundamentally much different from that of the current study, which had a mean age of 36.61. This age and stage of life difference may explain to some degree our finding, as may the previously described impact of our population's greater number of years in the U.S. and related adjustment to several stressors, including psychological ones, associated with acculturation effects. As hypothesized, however, higher levels of depression were associated with higher

levels of glucose, a finding that may be important when considering treatment options for immigrants as well as future metabolic health and prevention research.

### **Limitations**

One of the major limitations of the current study was the unexpectedly small sample size. Unfortunately, we experienced a high attrition rate from time one to time two, which may have occurred as a result of several factors. Some of the potential factors that contributed to the attrition rate are inherent within our sample; we recruited Mexican-born individuals residing in an agricultural community, which lends itself to migration with the farming season. In addition, our sample was recruited from Utah County, Utah, which is home to two of the state's four major universities. This may have contributed to homogeneity in our sample in that many of the participants were college students who may have only been in the area to attend school. Further, the sample of immigrants in this study comprises a convenience sample, although the experimenters took measures to recruit as randomly as possible. It is also likely that there are characteristics common among those immigrants who chose to participate in our initial study that make the current study less generalizable than what is ideal. Further, Mexican immigrants were only tested in the U.S. Ideally, we would be able to study individuals before they immigrated to test for pre-existing differences. Finally, our sample of Mexican immigrants is also somewhat more affluent than other samples used in previous research (see Mulvaney-Day, Alegria, & Sribney, 2006, Finch, Hummer, Kolody, & Vega 2001, and Farley, Galves, Dickinson, & Perez, 2005). As mentioned previously, this may be due to the location of the study near two universities as well as the fact that the study took place in Utah, which may present different occupational opportunities for immigrants than some other states, especially those with higher numbers of native Spanish-speakers. While most of the previous studies utilizing Mexican

immigrants to the U.S. took place in border regions or in regions well-known for their diversity, Utah boasts neither of these characteristics, although the state is becoming increasingly culturally diverse. In short, our population's high SES and the unique characteristics of our study location may impact the generalizability of our research model and results.

Considering our sample, there was also likely some random heterogeneity of respondents due to common factors that may have led them to immigrate to the region. While this represents a threat to external validity and generalizability, this random heterogeneity also has the potential to introduce error into the study's statistical tests. In order to attenuate this threat we used a homogeneous population (i.e., immigrants to the U.S. from Mexico only).

Finally, the use of blood data, by nature of its acquisition, is also likely to add some degree of evaluation apprehension, with the possibility of inserting some state anxiety into data.

## **Conclusion**

In conclusion, this study produced evidence in support of a relationship between cultural orientation and metabolic health factors, although the findings were limited. Rather than finding a relationship between cultural orientation and various metabolic health factors, HbA1c was the only metabolic health factor found to be significantly related to both Anglo Cultural Orientation and Mexican Cultural Orientation. As hypothesized, higher Anglo Cultural Orientation was associated with higher HbA1c levels, and higher Mexican Cultural Orientation was associated with lower HbA1c levels. This finding supported the hypothesis that individuals who adopt a more Americanized lifestyle, characterized by increased stress, an emphasis on the individual rather than on the community, and a faster-paced way of living would experience increased risk of metabolic health concerns as measured using blood data. Also supported was the hypothesis that the maintenance of a Mexican lifestyle, characterized by a focus on family and community

over the individual, a paradoxically health-promoting lower SES, and a less stressful way of living would serve as a protective factor against metabolic health concerns as measured using blood data. The study also found evidence in support of a mediation relationship, although the mediation relationship was not as extensive as hypothesized. Specifically, while no mediation effects were found for social support or job-related stress, depression levels mediated the relationship between Anglo Cultural Orientation and glucose, with higher Anglo Cultural Orientation associated with lower levels of depression and lower levels of depression associated with lower glucose levels. Although the relationship between Anglo Cultural Orientation and depression was observed to be in the opposite direction of that hypothesized, the relationship between depression and glucose was observed to be as hypothesized, with higher depression levels associated with higher glucose levels. This indicates that unlike the other specific stressors included in the mediation hypothesis, low depression appeared to significantly impact the effect of high Anglo Cultural Orientation on glucose, and prevention and treatment of depression and other related mental health concerns may be an important aspect in the prevention and treatment of some metabolic health concerns.

This was the first known study to examine the relationship between cultural orientation and metabolic health concerns, specifically HbA1c, in a Mexican immigrant population. Given the steadily increasing population growth of Mexican immigrants to the U.S., more studies are needed to further assess the impact of the acculturation process on health outcomes, especially considering the genetic predisposition of Latin American peoples toward the development of diabetes and related disorders. The information found in this study may contribute to future studies on the impact of lifestyle changes accompanying the acculturation process that may be both detrimental and beneficial in nature. Future studies should continue to study potential

mediators in the relationship between acculturation stress and metabolic health outcomes and should focus on obtaining a much larger sample size. In addition, future studies should attempt to study changes in cultural orientation over time, the effects of such changes on health outcomes, and the impact of a bicultural orientation on these outcomes. Finally, such research should attempt to recruit newly immigrated individuals in order to maximize the possibility of change over time as well as to gather as much information regarding the immediate and long-term impact of the acculturation process.

## References

- Abraido-Lanza, A.F., Armbrister, A.N., Florez, K.R., & Aguirre, A.N. (2006). Toward a theory-driven model of acculturation in public health research. *American Journal of Public Health, 96*, 1342-1346.
- Abraido-Lanza, A.F., Chao, M.T., & Florez, K.R. (2005). Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Social Science and Medicine, 61*, 1243-1255.
- Adolphe, A., Cook, L.S., & Huang, X. (2009). A cross-sectional study of intima-media thickness, ethnicity, metabolic syndrome, and cardiovascular risk in 2268 study participants. *Mayo Clinic Proceedings, 84*, 221-228.
- Ahluwalia, I.B., Ford, E.S., Link, M., & Bolen, J.C. (2007). Acculturation, weight, and weight-related behaviors among Mexican Americans in the United States. *Ethnicity & Disease, 17*, 643-649.
- Alberti, K.G. et al. (2009) Harmonizing the metabolic syndrome. *Circulation, 120*, 1640-1645.
- American Diabetes Association (2011). Diabetes statistics for Latinos. Retrieved May 6, 2011, from <http://www.diabetes.org/news-research/research/research-database/transition-coaching-for-latino-diabetics.html>
- American Diabetes Association (2011). Living with diabetes: Complications. Retrieved June 22, 2011, from <http://www.diabetes.org/living-with-diabetes/complications/>
- American Diabetes Association (2014). Diagnosing diabetes and learning about prediabetes. Retrieved June 9, 2014, from <http://www.diabetes.org/are-you-at-risk/prediabetes/?loc=superfooter>

- Anderson, R.J., Freedland, K.E., Clouse, R.E., & Lustman, P.J. (2001). The prevalence of comorbid depression in adults with diabetes: A meta-analysis. *Diabetes Care*, *24*, 1069-1078.
- Andreadis, E.A., Tsourous G.I., & Tzavara C.K., Gorgiopoulos, D.X., Katsanou, P.M., Marakomichelakis, G.E., & Diamantopoulos, E.J. (2007). Metabolic syndrome and incident cardiovascular morbidity and mortality in a Mediterranean hypertensive population. *American Journal of Hypertension*, *20*, 558-564.
- Armenta, Y.L. (2003). Family allocentrism as a cultural buffer against dysphoria: A cross-cultural examination among Mexican, Mexican-American, and European-American college students. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, *63*, 6085.
- Ayala, G.X., Mueller, K., Lopez-Madurga, E., Campbell, M.R., & Elder, J. (2005). Restaurant and food shopping selections among Hispanic women in southern California. *Journal of the American Dietetics Association*, *105*, 38-45.
- Baezconde-Garbanati, L., Portillo, C.J., & Garbanati, J.A. (1999). Disparities in health indicators for Latinas in California. *Hispanic Journal of Behavioral Sciences*, *21*, 302-329.
- Balcazar, H., Castro, F.G., & Krull, J.L. (1995). Cancer risk reduction in Mexican-American women: The role of acculturation, education, and health risk factors. *Health Education Quarterly*, *22*, 61-84.
- Barringer, H.R., Takeuchi, D.T., & Xenos, P. (1990). Education, occupational prestige, and income of Asian Americans. *Sociology of Education*, *63*, 27-43.

- Ben-Ari, A. & Lavee, Y. (2004). Cultural orientation, ethnic affiliation, and negative daily occurrences, a multidimensional cross-cultural analysis. *American Journal of Orthopsychiatry*, 74, 102-111.
- Bermudez, O.I., Falcon, L.M., & Tucker, K.L. (2000). Intake and food sources of macronutrients among older Hispanic adults: Association with ethnicity, acculturation, and length of residence in the United States. *Journal of the American Dietetics Association*, 100, 665-673.
- Berry, J.W. & Annis, R.C. (1974). Acculturative stress: The role of ecology, culture, and differentiation. *Journal of Cross-Cultural Psychology*, 5(4), 382-406.
- Bhatnagar, D., Soran, H., & Durrington, P.N. (2008). Hypercholesterolaemia and its management. *British Medical Journal*, 337, a:993.
- Black, S.A. (1999). Increased health burden associations with comorbid depression in older diabetic Mexican-Americans: Results from the Hispanic Establishes Population for the Epidemiologic Study of the Elderly Survey. *Diabetes Care*, 22, 56-64.
- Bollen, K. & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin*, 110 (2), 305-314.
- Borjas, G. (1985). Assimilation, changes in cohort quality, and the earnings of immigrants. *Journal of Labor Economics*, 3, 463-489.
- Bunker, C.Ch., Okoro, F.I., Markovic, N., Thai, N., Pippin, B., Ackrell, M., Kuller, L.H. (1996). Relationship of hypertension to socioeconomic status in a West African population. *Ethnic Health*, 1(1), 33-45.

- Cachelin, F.M., Phinney, J.S., Schug, R.A., & Striegel-Moore, R.H. (2006). Acculturation and eating disorders in a Mexican American community sample. *Psychology of Women Quarterly, 30*, 340-347.
- Carter, J.S., Pugh, J.A., & Monterrosa, A. (1996). Non-insulin-dependent diabetes mellitus in minorities in the United States. *Annals of Internal Medicine, 125*, 221-232.
- Carter-Pokras, O., Zambrana, R.E., Yankelvich, G., Estrada, M., Castillo-Salgado, C., & Ortega, A.N. (2008). Health status of Mexican-origin persons: Do proxy measures of acculturation advance our understanding of health disparities? *Journal of Immigrant Minority Health, 10*, 475-488.
- Chandola, T., Brunner, E., & Marmot, M. (2006). Chronic stress at work and the metabolic syndrome: Prospective study. *British Medical Journal, 332*, 521-525.
- Cislo, A.M., Spence, N.J., & Gayman, M.D. (2010). The mental health and psychosocial adjustment of Cuban immigrants in South Florida. *Social Science and Medicine, 71*, 1173-1181.
- Cockerham, W.C., Hattori, H., & Yamori, Y. (2000). The social gradient in life expectancy: The contrary case of Okinawa in Japan. *Social Science & Medicine, 51(1)*, 115-122.
- Cohen, S. & Hoberman, H.M. (1983). Positive events and social supports as buffers of life change stress. *Journal of Applied Social Psychology, 13*, 99-125.
- Cohen, S., Memelstein, R., Kamarck, T., & Hoberman, H. (1985). Measuring the functional components of social support. In I.G. Sarason & B. Sarason (Eds.), *Social support: Theory, research and application* (pp.73-94). The Hague: Martinus Nijhoff.
- Coyne, K.S., Zhou, Z., Thompson, C., & Versi, E. (2003). This impact on health-related quality of life of stress, urge, and mixed urinary incontinence. *BJU International, 7*, 731-735.

- Crockett, L.J., Iturbide, M.I., Stone, R.A.T., McGinley, M., Raffaelli, M., & Carlo, G. (2007). Acculturative stress, social support, and coping: Relations to psychological adjustment among Mexican American college students. *Cultural Diversity and Ethnic Minority Psychology, 13*, 347-355.
- Cuéllar, I., Arnold, B., & Maldonado, R. (1995). Acculturation Rating Scale for Mexican Americans-II: A revision of the original ARSMA Scale. *Hispanic Journal of Behavioral Sciences, 17*, 275-304.
- Culpepper, L. (2002). Depression and chronic medical illness: Diabetes as a model. *Psychiatric Annals, 32*, 528-534.
- Currie, C.J., Peters, J.R., Tynan, A., Evans, M., Heine, R.J., Bracco, O.L.,...Poole, C.D. (2010). Survival as a function of HbA1c in people with type 2 diabetes: A retrospective cohort study. *The Lancet, 375*, 481-489.
- DeLongis, A., Folkman, S. & Lazarus, R.S. (1988). The impact of daily stress on health and mood: Psychological and social resources as mediators. *Journal of Personality and Social Psychology, 54*, 486-495.
- de los Monteros, K., Gallo, L. C., Elder, J. P., & Talavera, G. A. (2008). Individual and area-based indicators of acculturation and the metabolic syndrome among low- income Mexican American women living in a border region. *American Journal of Public Health, 98*, 1979-1986.
- Dixon, L.B., Sunquist, J., & Winkleby, M. (2000). Differences in energy, nutrient, and food intakes in a U.S. sample of Mexican-American women and men: Findings from the Third National Health and Nutrition Examination Survey, 1988-1994. *American Journal of Epidemiology, 152*, 548-557.

- Dodoo, F.N. (1997). Assimilation differences in Africans in America. *Social Forces*, 76, 527-546.
- Espino, D.V. & Maldonado, D. (1990). Hypertension and acculturation in elderly Mexican Americans: Results from 1982-84 Hispanic HANES. *Journal of Gerontology*, 45, 209-213.
- Esquirol, Y., Bongard, V., Mabile, L., Soulat, J., & Perret, B. (2009). Shift work and metabolic syndrome: Respective impacts of job strain, physical activity, and dietary rhythms. *Chronobiology International*, 26, 544-559.
- Farley, T., Galves, A., Dickinson, M., & Perez, M.J.D (2005). Stress, coping, and health: A comparison of Mexican immigrants, Mexican-Americans, and non-Hispanic Whites. *Journal of Immigrant Health*, 7(3), 213-220.
- Finch, B.K., Hummer, R.A., Kolody, B., & Vega, W.A (2001). The role of discrimination and acculturative stress in the physical health of Mexican-origin adults. *Hispanic Journal of Behavioral Sciences*, 23(4), 399-429.
- Fisher-Hoch, S.P., Rentfro, A.R., Salinas, J.J., Perez, A., Brown, H.S., Reininger, B.M.,... McCormick, J.B. (2010). Socioeconomic status and prevalence of obesity and diabetes in a Mexican American community, Cameron County, Texas, 2004-2007. *Preventing Chronic Disease*, 7, A53.
- Ford, E.S. (2005). Prevalence of the metabolic syndrome defined by the International Diabetes Federation among adults in the U.S. *Diabetes Care*, 28, 2745-2749.
- Ford, E.S., Giles, W.H., & Dietz, W.H. (2002). Prevalence of the metabolic syndrome among U.S. adults: Findings from the third national health and nutrition examination survey. *Journal of the American Medical Association*, 287, 356-359.

- Fortmann, A.L., Gallo, L.C., & Philis-Tsimikas, T. (2011). Glycemic control among Latinos with type 2 diabetes: The role of social-environmental support resources. *Health Psychology, 30*, 251-258.
- Fritz, M.S., & MacKinnon, D.P. (2008). Mediation models for developmental data. In B. Laursen, T.D. Little, & N. Card (Eds.), *Handbook of developmental research methods* (pp. 291-310). New York, NY: Guilford Press.
- Gonzales, N.A., German, M., Kim, S.Y., George, P, Fabrett, F.C., Millsap, R., & Dumka, L.E. (2008). Mexican American adolescents' cultural orientation, externalizing behavior and academic engagement: The role of traditional cultural values. *American Journal of Community Psychology, 41*, 151-164.
- Gorman, B.K., Read, J.G., & Krueger, P.M. (2010). Gender, acculturation, and health among Mexican Americans. *Journal of Health and Social Behavior, 51*, 440-457.
- Gregory-Mercado, K.Y., Staten, L.K., Ranger-Moore, J., Thomson, C.A., Will, J.C., Ford, E.S.,...Marshall, J. (2006). Fruit and vegetable consumption of older Mexican-American women is associated with their acculturation level. *Ethnicity & Disease, 16*, 89-95.
- Grundy, S.M., Cleeman, J.I., Daniels, S.R., Donato, K.A., Eckel, R.H., Franklin, B.A.,...Costa, F. (2005). Diagnosis and management of the metabolic syndrome. An American Heart Association/National Heart, Lung, and Blood Institute scientific statement. *Circulation, 112*, e298.
- Gryzwacz, J.G., Quandt, S.A., Arcury, T.A., & Marin, A. (2005). The work-family challenge and mental health: Experiences of Mexican immigrants. *Community, Work, and Family, 8*, 271-279

- Hammarstedt, M. (2001). Disposable income differences between immigrants and natives in Sweden. *International Journal of Social Welfare*, 10, 117-126.
- Hao, Z., Wu, B., Wang, D., & Liu, M. (2011). Association between metabolic syndrome and cognitive decline: A systematic review of prospective population- based studies. *Acta Neuropsychiatrica* 23, 69-74.
- Hazuda, H.P., Haffner, S.M., Stern, M.P., & Eifler, C.W. (1988). Effects of acculturation and socioeconomic status on obesity and diabetes in Mexican Americans. *American Journal of Epidemiology*, 128, 1289-1301.
- Hovey, J.D. & King, C.A. (1996). Acculturative stress, depression, and suicidal ideation among immigrant and second-generation Latino adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, 35, 1183-1192.
- Hsin, O., La Greca, A., Valenzuela, J., Moine, C., & Delamater, A. (2010). Adherence and glycemic control among Hispanic youth with type 1 diabetes: Role of family involvement and acculturation. *Journal of Pediatric Psychology*, 35, 156-166.
- Huang, X., Song, L., Li, T., Li, J., Wu, S., & Li, N. (2001). The effect of social support on type II diabetes with depression. *Chinese Journal of Clinical Psychology*, 9, 187-189.
- Hutley, L. & Prins, J.B. (2005). Fat as an endocrine organ: Relationship to the metabolic syndrome. *American Journal of Medical Sciences*, 330, 290-294.
- Kanat, M., Winnier, D., Norton, L., Arar, N., Jenkinson, C., Defronzo, R., & Abdul-Ghani, M. (2011). The relationship between  $\beta$ -cell function and glycosylated hemoglobin: Results from the veterans administration genetic epidemiology study. *Diabetes Care*, 34, 1006-1010.

- Kanji, J.N., Anglin, R.E.S., Hunt, D.L., & Panju, A. (2010). Does this patient with diabetes have large-fiber peripheral neuropathy? *Journal of the American Medical Association*, *303*, 1526-1532.
- Karasek, R.A., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., & Amick, B. (1998). The Job Content Questionnaire (JCQ): An instrument for internationally comparative assessment of psychosocial job characteristics. *Journal of Occupational Health Psychology*, *3*, 322-355.
- Keefe, S. & Padilla, A. (1987). *Chicano ethnicity*. University of New Mexico Press, Albuquerque.
- Koponen, H., Jokelainen, J., Keinanen-Kiukaanniemi, S., Kumpusalo, E., & Vanhala, M. (2008). Metabolic syndrome predisposes to depressive symptoms: A population-based 7-year follow-up study. *Journal of Clinical Psychiatry*, *69*, 178-182.
- Laakso, M. (1999). Hyperglycemia and cardiovascular disease in type 2 diabetes. *Diabetes*, *48*, 937-942.
- Laudisio, A., Marzetti, E., Pagano, F., Pozzi, G., Bernabei, R., & Zuccala, G. (2009). Depressive symptoms and metabolic syndrome: Selective association in older women. *Journal of Geriatric Psychiatry and Neurology*, *22*, 215-222.
- Lee, S. & Song, X. (2010). Evaluation of the Bayesian and maximum likelihood approaches in analyzing structural equation models with small sample sizes. *Multivariate Behavioral Research*, *39*(4), 653-686.
- Lin, N. & Enzel, W.M. (1989). Life stress and health: Stressors and resources. *American Sociological Review*, *54*, 382-399.

- Lippi, G. & Targher, G. (2010). Glycated hemoglobin (HbA1c): Old dogmas, a new perspective? *Clinical Chemistry and Laboratory Medicine*, 48, 609-614.
- Lipsikas, C.B. & Makinen, I.H. (2010). Immigration and suicidality in the young. *The Canadian Journal of Psychiatry*, 55, 274-281.
- MacDonald, G. & Leary, M.R. (2005). Why does social exclusion hurt? The relationship between social and physical pain. *Psychological Bulletin*, 131, 202-240.
- MacKinnon, D.P. (2008). *Introduction to statistical mediation analysis*. New York: Erlbaum.
- Marin, G. & Marin, B.V. (1991). *Research with Hispanic Populations*. Newbury Park, CA: Sage.
- Marmot, M.G. & Syme, S.L. (1976). Acculturation and coronary heart disease in Japanese-Americans. *American Journal of Epidemiology*, 104, 225-247.
- Masten, W.G., Caldwell-Colbert, A. T. Alcala, S.J. & Mijares, B E., (1986). Reliability and validity of the Center for Epidemiological Studies Depression Scale. *Hispanic Journal of Behavioral Sciences*, 8, 77-84.
- Merkin, S., Basurto-Dávila, R., Karlamangla, A., Bird, C., Lurie, N., Escarce, J., & Seeman, T. (2009). Neighborhoods and cumulative biological risk profiles by race/ethnicity in a national sample of U.S. adults: NHANES III. *Annals Of Epidemiology*, 19, 194-201.
- Mokdad, A.H., Ford, E.S., Bowman, B.A., Dietz, W.H., Vinicor, F., Bales, V.S., & Marks, J.S. (2003). Prevalence of obesity, diabetes, and obesity-related health factors, 2001. *Journal of the American Medical Association*, 289, 76-79.
- Morrison, J.A., Friedman, L.A., Wang, P., & Glueck, C.J. (2008). Metabolic syndrome in childhood predicts adult metabolic syndrome and type 2 diabetes mellitus 25-30 years later. *The Journal of Pediatrics*, 152, 201-206.

- Mulvaney-Day, N.E., Alegria, M., & Sribney, W. (2006). Social cohesion, social support, and health among Latinos in the United States. *Social Science & Medicine*, *64*, 477-495.
- Muthén, B. & Asparouhov, T. (2012). Bayesian SEM: A more flexible representation of substantive theory. *Psychological Methods*, *17*, 313-335.
- Myers, H.F. & Rodriguez, N. (2003). Acculturation and physical health in racial and ethnic minorities. In K.M. Chun, P.B. Organista, & G. Marin (Eds.), *Acculturation: Advances in theory, measurement, and applied research* (pp. 163-185). Washington DC: American Psychological Association.
- National Diabetes Education Program (2005). The diabetes epidemic among Hispanic and Latino Americans. National Diabetes Statistics fact sheet: General information and national estimates on diabetes in the United States, 2005. Bethesda, MD: U.S. Department of Health and Human Services, National Institute of Health. Retrieved May 6, 2011 from [http://www.ndep.nih.gov.eri.lib.byu.edu/diabetes/pubs/FS\\_HispLatino\\_Eng.pdf](http://www.ndep.nih.gov.eri.lib.byu.edu/diabetes/pubs/FS_HispLatino_Eng.pdf)
- Neuhouser, M.L., Thompson, B., Coronado, G.D., & Solomon, C.C. (2004). Diet and food insufficiency among Hispanic youths: Acculturation and socioeconomic factors in the third National Health and Nutrition Examination Survey. *Journal of the American Dietetics Association*, *104*, 51-57.
- Peek, M.K., Cutchin, M.P., Salinas, J.J., Sheffield, K.M., Eschbach, K., Stowe, R.P., & Goodwin, J.S. (2010). Allostatic load among non-Hispanic Whites, non-Hispanic Blacks, and people of Mexican origin: Effects of ethnicity, nativity, and acculturation. *American Journal of Public Health*, *100*, 940-946.

- Perez, P. (2008). Role of spirituality and acculturation in the health of Mexican women in the United States. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 68, 7675.
- Picot, G. & Hou, F. (2003). The rise in low-income rates among immigrants in Canada. *Statistics Canada*, 198, 1-54.
- Popkin, B.M. & Udry, J.R. (1998). Adolescent obesity increases significantly in second- and third-generation U.S. immigrants: The National Longitudinal Study of Adolescent Health. *Journal of Nutrition*, 128, 701-706.
- Quintana, S.M., Vogel, M.C., & Ybarra, V.C. (1991). Meta-analysis of Latino students' adjustment in higher education. *Hispanic Journal of Behavioral Sciences*, 13, 155-168.
- Radloff, L.S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.
- Rees, C.A., Karter, A.J., & Young, B.A. (2010). Race/ethnicity, social support, and associations with diabetes self-care and clinical outcomes in NHANES. *The Diabetes Educator*, 36, 435-445.
- Ritsner, M., Modai, I., & Ponizovsky, A. (2000). The stress-support patterns and psychological distress of immigrants. *Stress Medicine*, 16, 139-147.
- Rodriguez, N., Myers, H.F., Morris, J.K., & Cardoza, D. (2000). Latino college student adjustment: Does an increased presence offset minority-status and acculturative stresses? *Journal of Applied Psychology*, 30, 1523-1550.
- Romero, A.J. & Roberts, R.E. (2003). Stress within a bicultural context for adolescents of Mexican descent. *Cultural Diversity and Ethnic Minority Psychology*, 9, 171-184.

- Ross, S., Franks, S., Hall, J., Young, R., & Cardarelli, R. (2011). Levels of acculturation and effect on glycemic control in Mexicans and Mexican Americans with type 2 diabetes. *Postgraduate Medicine, 123*(1), 66-72.
- Ruiz, J.M., Steffen, P., & Smith, T.B. (2013). Hispanic mortality paradox: A systematic review and meta-analysis of the longitudinal literature. *American Journal of Public Health, 103*(3), e52-e60.
- Santos, S.J., Bohon, L.M., & Sanchez-Sosa, J.J. (1998). Childhood family relationships, marital and work conflict, and mental health distress in Mexican immigrants. *Journal of Community Psychology, 26*, 491-508.
- Santos-Rey, K., Fernandez-Riejos, P., Mateo, J., Sanchez-Margalet, V., & Goberna, R. (2010). Glycated hemoglobin vs. the oral glucose tolerance test for the exclusion of the impaired glucose-tolerance in high-risk individuals. *Clinical Chemistry and Laboratory Medicine, 48*, 1719-1722.
- Sarnoff, R., Adams, E., Shauffler, H. & Abrams, B. (2001). Disparities in reported prenatal care advice from health care providers among women of Mexican origin in California. *Journal of Immigrant Health, 3*(2), 77-84.
- Satia-Abouta, J., Patterson, R.E., Neuhouser, M.L., & Elder, J. (2002). Dietary acculturation: Applications to nutrition research and dietetics. *Journal of the American Dietetics Association, 102*, 1105-1118.
- Schnall, P.L., Schwartz, J.E., Landsbergis, P.A., Warren, K., & Pickering, T.G. (1992). Relation between job strain, alcohol, and ambulatory blood pressure. *Hypertension, 19*, 488-494.

- Schneider, M.E., & Ward, D.J. (2003). The role of ethnic identification and perceived social support in Latinos' adjustment to college. *Hispanic Journal of Behavioral Sciences*, 25, 539-554.
- Selvin, E., Steffes, M.W., Zhu, H., Matsushita, K., Wagenknecht, L., Pankow, J.,...Brancati, F.L. (2010). Glycated hemoglobin, diabetes, and cardiovascular risk in nondiabetic adults. *The New England Journal of Medicine*, 362, 800-811.
- Singhammer, J. & Bancila, D. (2011). Associations between stressful events and self-reported mental health problems among non-western immigrants in Denmark. *Journal of Immigrant and Minority Health*, 13, 371-378.
- Slavik, S. & Croake, J. (2006). The individual psychology conception of depression as a stress-diathesis model. *American Journal of Individual Psychology*, 62, 417-428.
- Smart, J.F. & Smart, D.W. (1995). Acculturative stress and Hispanics: Loss and challenge. *Journal of Counseling and Development*, 73, 390-396.
- Spence, J.T. (1985). Achievement American style: The rewards and costs of individualism. *American Psychologist*, 40, 1285-1295.
- Steffen, P.R. (2006) The cultural gradient: Culture moderates the relationship between socioeconomic status (SES) and ambulatory blood pressure (2006). *Journal of Behavioral Medicine*, 29, 501-510.
- Steffen, P.R., Smith, T.B., Larson, M., & Butler, L. (2006). Acculturation to Western society as a risk factor for high blood pressure: A meta-analytic review. *Psychosomatic Medicine*, 68, 386-397.
- Stern, M.P., Knapp, J.A., Hazuda, H.P., Haffner, S.M., Patterson, J.K., & Mitchell, B.D. (1991). Genetic and environmental determinants of type II diabetes in Mexican Americans: Is

- there a descending limb to the modernization diabetes relationship? *Diabetes Care*, 14, 649-654.
- Tang, T.S., Brown, M.B., Funnell, M.M., & Anderson, R.M. (2008). Social support, quality of life, and self-care behaviors among African Americans with type 2 diabetes. *The Diabetes Educator*, 34, 266-276.
- Taylor, R. & Zimmet, P. (1983). Migrant studies in diabetes epidemiology. In J.I. Mann, K. Pyorala, & A. Teuscher (Eds.), *Diabetes in epidemiological perspective* (pp. 58-77). New York: Churchill Livingstone.
- Triandis, H.C. (1994). *Culture and social behavior*. St. Louis, MO: McGraw-Hill, Inc.
- Triandis, H.C. (1995). *Individualism and collectivism*. Boulder, CO: Westview Press.
- Vanhala, M., Jokelainen, J., Keinanen-Kiukaanniemi, S., Kumpulaso, E., & Koponen, H. (2009). Depressive symptoms predispose females to metabolic syndrome: A 7-year follow-up study. *Acta Psychiatrica Scandinavica*, 119, 137-142.
- Vega, W.A., Kolody, B., Aguilar-Gaxiola, S., Alderete, E., Catalano, R., & Caraveo-Anduaga, J. (1998). Lifetime prevalence of DSM-III-R psychiatric disorders among urban and rural Mexican Americans in California. *Archives of General Psychiatry*, 55, 771-778.
- Vega, W.A., Kolody, B., Valle, R., & Weir, J. (1991). Social networks, social support, and their relationship to depression among immigrant Mexican women. *Human Organization*, 50, 154-162.
- Vega, W.A., Sribney, W.M., Aguilar-Gaxiola, S., & Kolody, B. (2004). 12-month prevalence of DSM-III-R psychiatric disorders among Mexican Americans: Nativity, social assimilation, and age determinants. *The Journal of Nervous and Mental Disease*, 192, 532-541.

- Vella, C. A., Ontiveros, D., Zubia, R. Y., & Bader, J. O. (2011). Acculturation and metabolic syndrome risk factors in young Mexican and Mexican–American women. *Journal of Immigrant and Minority Health, 13*, 119-126.
- Viinamaki, H., Heiskanen, T., Lehto, S.M., Niskanen, L., Koivumaa-Honkanen, H., Tolmunen, T.,...Hintikka, J. (2009). Association of depressive symptoms and metabolic syndrome in men. *Acta Psychiatrica Scandinavica, 120*, 23-29.
- Vrijkotte, T.G.M., Van Doornen, L.J.P., & De Geus, E.J.C. (1999). Work stress and metabolic and hemostatic risk factors. *Psychosomatic Medicine, 61*, 796-805.
- Williams, C.L. & Berry, J.W. (1991). Primary prevention of acculturative stress among refugees: Application of psychological theory and practice. *American Psychologist, 46*, 632-641.
- Wodarski, J.S. (1992). Social work with Hispanic Americans. In D.F. Harrison, J.S. Wodarski, & B.A. Thyer (Eds.). *Cultural Diversity and Social Work Practice* (pp. 71-105). Springfield, IL: Thomas.
- Zhang, X., Norris, S.L., Gregg, E.W., & Beckles, G. (2007). Social support and mortality among older persons with diabetes. *The Diabetes Educator, 33*, 273-281.
- Zunzunegui, M.V., Forster, M., Gauvin, L., Raynault, M.F., & Douglas, W.J. (2006). Community unemployment and immigrants' health in Montreal. *Social Science and Medicine, 63*, 485-500.