

THE CONCEPTUALIZATION OF DEPRESSION AND ACCULTURATIVE STRESS  
AMONG LATINO IMMIGRANTS: A COMPARISON OF SCORES FROM NON-  
HISPANIC WHITES AND PERSONS OF MEXICAN ORIGIN ON THE CENTER FOR  
EPIDEMIOLOGIC STUDIES DEPRESSION SCALE - REVISED (CESD-R)

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## **ABSTRACT**

Tasaneé Walsh: The Conceptualization of Depression and Acculturative Stress among Latino Immigrants: A Comparison of Scores from Non-Hispanic Whites and Persons of Mexican Origin on the Center for Epidemiologic Studies Depression Scale - Revised (CESD-R)  
(Under the direction of Kathleen Rounds)

This dissertation examines and compares the influence of acculturative stress on the experience of depressive symptoms among Non-Hispanic Whites and persons of Mexican origin. The objectives of this dissertation are threefold: First, to develop an expanded and integrated explanatory model of Latino acculturative stress that accounts for culture, stress and coping, cognitive appraisal, timing, and family and neighborhood factors; second, to evaluate the reliability and validity evidence of the English language version of the CESD-R; and third, to evaluate the reliability and validity evidence of the Spanish language version of the CESD-R.

The first manuscript posits an explanatory model that expands upon and integrates work by Berry (2006) and most notably adds the dimension of family and neighborhood. Recent research findings on Latino immigrant depression point toward the importance of understanding and leveraging the protective nature of neighborhood and family (Breslau, 2011; Shell, Peek, & Eschbach, 2013). The second manuscript evaluates the validity and reliability evidence of the English language version of the CESD-R. The results of an EFA, CFAs, and a multiple-group CFA of the English version of the CESD-R suggest that a 15-item version of the CESD-R best fit the study data. The final two-factor solution of *negative*

*mood and functional impairment and suicide*, fit the data well. The third manuscript evaluates the reliability and validity evidence of the Spanish language version of the CESD-R. The scores of the Spanish Language version of the CESD-R fit the same CESD-R factor structure of Manuscript II. The results support the use of the 15-item version of the CESD-R with a Spanish speaking sample. This suggests that despite cultural differences, there are common cross-cultural components of depression that relate to *negative mood and functional impairment and suicide*.

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## **LIST OF ABBREVIATIONS**

CAPHRs	Concern About Petrochemical Health Risk Scale
CES-D	Center for Epidemiologic Studies Depression Scale
CESD-R	Center for Epidemiologic Studies Depression Scale – Revised
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
DSM-5	The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
EFA	Exploratory Factor Analysis
RMSEA	Root Mean Square Error of Approximation
SF-36 Health Survey	The Short Form (36) Health Survey
TLI	Tucker Lewis Index
WLSMV	Weighted Least Squares Means and Variances Adjusted estimation

## **Introduction**

Latinos are currently the largest ethnic minority group in the United States with 50.5 million people, comprising an estimated 16.3 percent of the country's population of nearly 309 million people (U.S. Census Bureau, 2010). Latinos are a rapidly growing minority group in the US, increasing at a rate of 43 percent between 2000 and 2010 (U.S. Census Bureau). Of these Latinos, more than two thirds are foreign born (excluding Puerto Ricans) (U.S. Census Bureau). According to the U.S. Census Bureau, approximately 31.8 million immigrants residing in the US in 2010 were Mexico-born, accounting for the largest single immigrant group. This large proportion of Mexican immigrants illustrates the need to understand acculturation and its effects on mental health specific to this population. The process of acculturation presents numerous challenges to Mexican immigrant communities, potentially benefitting or adversely affecting the mental health of Mexican immigrants and their children (Breslau et al., 2011).

Approximately 20 percent of the Latino population will experience a significant symptom of depression (Breslau et al., 2011). Specifically for persons of Mexican origin, depression is the most common mental health disorder (Aguilar-Gaxiola & Thomas, 2009). Studies comparing the prevalence of depression amongst persons of Mexican origin and non-Hispanic Whites report mixed results. This is also the case for studies comparing rates of depression in U.S.-born and Mexico-born Mexican Americans. Some studies have shown that persons of Mexican origin have higher rates of depressive symptoms (Munet-Vilaro, Folkman, & Gregorich, 1999; Roberts, 1981) and higher rates of major depressive disorder

(Dunlop, Song, Lyons, Manheim, & Chang, 2003). Other studies indicate that non-Hispanic Whites have higher rates of depressive disorders than persons of Mexican origin (Riolo, Nguyen, Greden, & King, 2005). However, the general consensus is that persons of Mexican origin have similar rates of depression when compared to non-Hispanic Whites, and U.S.-born Mexican Americans have higher rates of depression when compared to Mexico-born Mexican Americans (Escobar, et al., 2000; Mendelson, et al., 2008; Breslau et al., 2011). According to Breslau et al. (2011), the longer a person of Mexican origin remains in Mexico before immigrating into the US, the lower the likelihood that he or she will develop anxiety and or a mood disorder.

Meeting the mental health needs of the fastest growing population in the US is a serious challenge to our society and specifically to the field of social work. Providing mental health clinicians with valid and culturally relevant mental health assessment tools is a key component to meeting the mental health needs of Latinos. Without the ability to correctly conceptualize symptoms of depression in Latino populations and how acculturation may affect this conceptualization, treatment of Latino depression may miss the mark.

The following three manuscripts center on the impact of acculturation on depression in persons of Mexican origin. Specifically, the three manuscripts aim to frame, from a multi-systems perspective, how Latinos experience depression, how it manifests, and how these experiences and manifestations differ for U.S.-born Mexican Americans, Mexico-born Mexican Americans, and non-Hispanic Whites.

The first manuscript provides a background of how frequently used theories of stress and coping and acculturation fall short in capturing all of the factors at play in fully understanding how culture and acculturation influence the manifestation of, and coping with,

depression in Latinos. A novel framework is presented to illustrate the importance of viewing how Latino's cope with depression from a multi-systems perspective including the key factors of family and neighborhood.

The second manuscript has two objectives. First, it is a study that examines if the English language version of the Center for Epidemiologic Studies Depression Scale - Revised (CESD-R) is a reliable and valid measure of depressive symptoms. Second, the study evaluates whether data from U.S.-born Mexican Americans, Mexico-born Mexican Americans, and non-Hispanic Whites factor differently from one another on the English language version of the CESD-R.

The third manuscript also has two objectives. First, it examines if the Spanish language version of the CESD-R is a reliable and valid measure of depressive symptoms. Second, it explores whether data from persons of Mexican origin in the US factor similarly to data from respondents included in a landmark Mexico City study that also employed the Spanish Language version of the CESD-R.

Together these three manuscripts can help further our understanding of how U.S.-born Mexican Americans, Mexico-born Mexican Americans, and non-Hispanic Whites experience and manifest depression similarly and differently. Further, this dissertation will contribute to the literature on the assessment of depression in persons of Mexican origin by determining how acculturation influences the scores on a commonly used assessment of depression.

## **Background**

To accurately design mental health research studies on persons of Mexican origin, it is important to understand how depression is conceptualized for this population. Further, it is critical to understand how well depression and other mental health outcomes among persons of Mexican origin are explained by foundational and widely used psychological and sociological theories. Critically evaluating and building upon “gold standard” theories of stress and coping provides a roadmap for future theory development and allows a common starting point to explain new research findings. This section describes how culture, acculturation and acculturative stress influence the development of mental health problems, and how traditional theories explain stress and depression.

To provide clarity to the following manuscripts, seminal concepts will be defined and described contextually.

### **Ethnicity**

To begin, it is important to understand the population of interest for the dissertation. The definitional terms for Hispanics and Latinos most often used in research are taken from the U.S. Census Bureau. The Census Bureau defines the term *Hispanic* or *Latino*, used interchangeably, as a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (U.S. Census Bureau, 2010). The external validity of studies involving Latino or Hispanic populations is threatened by the varying and consolidated terms that are used to refer to this population. Until recently, the prevailing approach to studying individuals who self-identify as being of Hispanic descent, is

to aggregate them into one group, either *Hispanic* or *Latino*. Specifically, studies often aggregated individuals who originated from Puerto Rico, Mexico, Cuba, Guatemala, El Salvador, Honduras, and Columbia into one category (Alegria et al., 2008). Clearly defining the specific ethnic group or specific ethnic sub-group of study can help minimize threats to external validity. Specifically, research studies that clearly define ethnic groups or ethnic sub-groups allow for generalizability and replication of findings, as well as theoretical, policy, and practice implications for specific ethnic groups (Shadish, Cook & Campbell, 2002). For this dissertation, the term *Latino* will be used when discussing extant literature and research, and when referring to the ethnic population in its entirety. In addition, the following three terms will be used to describe the three distinct data groups used for analyses: *U.S.-born Mexican Americans*, *Mexico-born Mexican Americans*, and *Non-Hispanic Whites*. *U.S.-born Mexican Americans* are defined as persons born in the US, of Mexican descent, residing in the US. *Mexico-born Mexican Americans* are defined as persons born in Mexico, of Mexican descent, residing in the US. *Non-Hispanic Whites* are White individuals who do not identify their origin as Hispanic, Latino, or Spanish, and are also residing in the US. Finally, *persons of Mexican origin* refer to both U.S.-born Mexican Americans and Mexico-born Mexican Americans.

### **Acculturation**

Acculturation has been defined as a process experienced by groups and individuals when they interact with another culture (Williams & Berry, 1991). Interest in studying the impact of acculturation is increasing along with the growing Latino population within the United States (Breslau et al., 2011). Acculturation is broadly defined as the process by which individuals adopt the values, customs, attitudes, beliefs, and behaviors of another culture.

Both linear and multidimensional theoretical frameworks have been developed by scholars to understand the process of acculturation. However, the research on acculturation has not kept pace with the development of acculturation theory (Abraido-Lanza, et al., 2005). Despite the more recent development of multi-dimensional models of acculturation, acculturation research has often employed older, linear assimilation models. Further, research on acculturative stress—the collective anxiety, loss of identity, and feelings of alienation that may result from the process of acculturation (Berry & Annis, 1974; Williams & Berry, 1991)—is just beginning to be explored by researchers investigating the effects of acculturation on Latino populations.

### **Acculturative Stress**

Acculturative stress has been defined as collective anxiety, loss of identity, and feelings of alienation that directly results from the acculturative process (Berry & Annis, 1974; Williams & Berry, 1991). Further, it refers to experiences during the process of acculturation that have served as catalysts for the development of a particular set of emotions and behaviors (i.e., depression, anxiety, feelings of marginality, psychosomatic symptoms, identity confusion) (Organista, 2007; Williams & Berry). In a more global sense, acculturative stress refers to the disparity in overall health and quality of life as experienced by minority cultural groups as compared to the majority cultural group (Organista).

### **The Hispanic Paradox**

Of particular interest are the effects of acculturation and acculturative stress on health outcomes. Some researchers suggest that the Latino immigrant community is protected from adverse health outcomes, and have coined the term the *Hispanic Paradox* to describe the phenomenon that Latinos tend to have better health than non-Hispanic Whites (Markides &



Coreil, 1986). The effect one's environment has on mental health outcomes, including depression, has been well documented (Rutter, 2005; Kessler et al., 2009). The assumption is that an environment with more opportunities, less poverty, and more resources, acts as a protective factor against the development of depression and other mental health issues. Conversely, the Hispanic Paradox asserts that staying in one's own country of origin despite political, economic, and social disadvantages is better for a Latino's overall mental health (Aguilar-Gaxiola & Thomas, 2009).

### **Stress and Coping**

Researchers are just beginning to understand the associations between stress, coping style, and health in Latinos living in the United States. Farley et al. (2005) found that coping styles differ among a rural population of U.S.-born Latinos, Mexico-born Mexican Americans, and non-Hispanic Whites. Their study supported findings from prior studies that suggested stress-coping styles relying on avoidance behaviors are associated with higher perceived stress and reduced quality of life. In addition, various studies point to Latino immigrants who experience high levels of acculturative stress, exhibit elevated levels of depression, suicidal ideation, anxiety, and overall have poor health outcomes (Hovey, 2000; Hovey & Magana, 2000; Borges et al., 2009). In regard to coping and health outcomes, it has been suggested that Mexico-born Mexican Americans utilize the coping styles of positive reframing, denial, and religion (Farley, et al., 2005), whereas U.S.-born Mexican Americans rely on positive reinterpretation, focusing on venting emotions, and religion (Vaughn & Roesch, 2003). Lastly, it has been shown that chronically ill Latinos who had greater optimism experienced fewer mental health problems (Njoku, Jason, & Torres-Harding, 2005; Borges et al., 2009).

## **Depression**

As defined by the World Health Organization (WHO), depression is a common mental health disorder, typified by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration (Mathers, Fat, & Boerma, 2008).

Depression is the third most burdensome disease worldwide, in terms of use of resources and lost income (Mathers, Fat, & Boerma, 2008). Studies of ethnic differences estimate lifetime percentages of depression of 6.52 among non-Hispanic Whites, 5.17 among Latinos and 4.57 among African-Americans (Kessler et al., 2009). According to Breslau et al. (2009), Mexican immigrants have been shown to have higher lifetime prevalence rates of depression compared to their family members who did not migrate (11.0% vs. 8.2%). Recent research findings suggest that emigrating from Mexico to the United States increases risk for the development of depression and suicide (Breslau et. al., 2011; Borges et al., 2009).

Manuscript I: Framework for Understanding Acculturative Stress and Depressive Outcomes  
in Persons of Mexican Origin

**Literature Review**

The *theory of stress and coping* describes the mechanisms of stress and the coping strategies that are available to help mediate the effects of stressful life events on health outcomes. For immigrants, the processes of migration and resultant acculturation are often stressful life events. Understanding acculturation and acculturative stress is central to becoming aware of the unique challenges faced by immigrants in the United States. The *theory of acculturation* describes the multidimensional process of leaving one's country of origin and adapting to a new culture. The *theory of acculturative stress* further explains the transformative effect of acculturation, through interpersonal and intercultural experience. It also describes how the stresses of acculturation can have an effect on one's emotional and physical well-being, and links the effects of acculturation with health outcomes. Lastly, the *Hispanic Paradox* describes morbidity and mortality specific to Latinos in the US, how their outcomes are different from other ethnic groups, and proffers explanations as to what may be serving as protective factors.

The role of culture is a central component to all the theoretical frameworks discussed in this manuscript regarding acculturative stress and coping. Figure 1 ("The Nature of Acculturation"), which depicts the relationship between two cultures, and how they might

influence one another within the context of acculturation, provides a basic building block for understanding how acculturative stress and coping affect Latino immigrants (Berry, 2003; Organista, 2007). Figure 1 shows that when two cultures interact, one culture assumes dominance over the other culture. While theoretically simplistic, it provides a foundation upon which to begin to understand the other theoretical frameworks of greater complexity.

### **Common Models of Stress and Coping**

For centuries the concept of stress has been used to describe the process of pressure and its resulting effect (Lazarus, 1993a). As early as the 1400s people were discussing how the concept of *stress* is central to understanding how to build and maintain a bridge (Lazarus, 1993b). The idea of stress has vastly evolved from the early bridge days, but the not easily understood complex process of how stress affects particular individuals' biopsychosocial reality remains constant. Stress and how it influences human behavior first became relevant when clinicians and researchers were tasked with choosing which enlisted men would hold up under the pressure of World War II (Lazarus, 1993b). Research examined the biological markers of stress during the fifties and sixties, focusing on brain and biochemical changes resulting from the introduction of stress (Tache & Selye, 1985). Lazarus then presented a model of stress that challenged the basic stimulus-response model, suggesting that motivation and cognition intercede between the stimulus and the response (Lazarus, 1993b). Lazarus also asserted that it is important to examine how each individual reacts to stress, questioning the idea that there is a standard human response to stress.

The transactional model of stress and coping initially built upon Lazarus' ideas regarding the importance of an individuals' reaction to an external stressor. Later, the model grew into a theory that emphasized the person-environment transaction (Lazarus & Cohen,

1977). According to the transactional model of stress and coping, a person first appraises the impact of the external stressor, conceptualizing it as either a threat or a challenge and then attempts to cope with the stressor by utilizing available social and cultural resources (Lazarus & Cohen). It is important to emphasize that the transactional model illustrates the importance of having social and cultural resources available to successfully cope with the stressor (Cohen, 1984).

Another model of stress and coping developed by Moos (1984) (Figure 2, “Stress and Coping: A Model of Interplay between Context, Coping, and Adaptation”) recognizes the importance of the person-environment interaction but posits that contextual factors should be considered equally as important. In addition, Moos’ model views culture as a macro-systems factor, separate from other environmental factors, which is unavoidable and encompasses the entire stress and coping process. The model illustrates the confluence of the *environmental system* (i.e., social climate and stressors) and the *personal system* (i.e., cognitive abilities and self-confidence) on ensuing *transitory conditions* (i.e., life events), *cognitive appraisal and coping skills* (i.e., approach and avoidance), which in turn affect the *health and well-being* (i.e., psychosocial functioning) of the person experiencing the stressor (Moos, 2002).

In recent years much of the focus of stress and coping has been on how individuals implement different coping mechanisms as a reaction to stress (Roesch, Weiner, & Vaughn, 2002). Mechanisms of coping are defined as purposeful ways of addressing or dealing with a stressful situation (Vogel & Romano, 1999). Emotional, cognitive, and behavioral processes can all be employed to combat the identified stressor (Vogel & Romano). Coping responses can target the problem that is causing the stress or attend to the emotions that go along with the stressful situation (Stephoe, 1991).

Stress and coping researchers usually separate coping strategies into four central categories: active coping; avoidance-based coping; emotion-focused coping; and social support (Farley, et al., 2005; Steptoe, 1991). *Active coping* or problem solving coping directly confronts the problem that is causing the stress, attempting to ameliorate the stressful situation and the associated stress reaction (Steptoe). Active coping can be accomplished through action, but it may also include cognitively restructuring the way one perceives the stressful event (Crockett, et al., 2007). Active coping is believed to mitigate the negative effects of stress, and has been found to be linked with better psychological well-being in Latina college students as well as with lower levels of psychological symptoms in Mexican-American inner-city adolescents (Crean, 2004; Crockett, et al., 2007; Gloria, Castellanos, & Orozco, 2005).

*Avoidance-based coping* is considered any behavior that implies escaping from the stressful situation (i.e. physically removing oneself from the stressful situation, or mentally daydreaming to escape the problem) (Crockett, et al., 2007; Steptoe, 1991). Avoidance-based coping is considered less effective than active coping, and may even worsen the negative effects of acculturative stress (Crockett, et al.).

*Emotion-focused coping* can involve the healthy expression of feelings in response to a stressful situation or it can involve bottling up, or denial of the emotions evoked by the stressful situation (Steptoe, 1991; Wenzel & Brown, 2009). Another common and effective type of coping is *Social support* or instrumental support which elicits assistance from an individuals' social network in dealing with a stressful situation (Steptoe). The four major approaches notwithstanding, most individuals take on their own individual style of coping,

incorporating parts of each of the aforementioned coping responses into their own coping style (Steptoe).

### **Theory of Acculturation**

The classic definition of acculturation was theorized in the mid-1930s by several anthropologists (Redfield, Linton, & Herskovits, 1936) who sought to understand the interaction between different, autonomous cultural groups when they come into contact with one another for a sustained period of time, and the resultant changes to their original cultural patterns and customs, such as language, values, attitudes, and identity (Organista, 2007). More recently, the process of acculturation has been examined by evaluating the experiences of indigenous peoples and ethnic groups in North America, both current and historical (Berry, 2003). Berry, who is considered one of the leading theorists and researchers on acculturation and acculturative stress (Ward, 2008), asserts that even though it is theoretically possible for two cultural groups to influence each other when they come into contact, in reality it is often the larger group that dominates the smaller, less powerful one. In this type of relationship, the larger culture may have greater control and influence over the smaller culture, and may even oppress it. The process of acculturation within this type of dynamic often is resistant, stressful, and conflictual for members of the smaller cultural group (Organista).

The process of acculturation has been defined as containing three steps: contact, conflict, and adaptation (Berry, 2003; Organista, 2007). *Contact* is the set of conditions under which two distinct, separate cultural groups meet. These conditions could be, for example, the result of one cultural group invading the lands of another, voluntary migration of one cultural group into the lands of another, or involuntary migration of one cultural group

seeking refuge in the lands of another cultural group. *Conflict* refers to the tensions that result when one group tries to assert dominance over the other. While it is theoretically possible for some individuals or groups to not experience this conflict, most groups experience some amount of tension regardless of how similar the two cultures are, because this is an inevitable by-product of power struggles where one group is striving for dominance. Finally, *adaptation* is the eventual relationship that develops between the two cultural groups in an attempt to reduce the tensions experienced in the previous stage. Accommodation at this stage can take different forms, from assimilation (for instance, when members of the smaller group marry into the larger group), to separation (for example, when the smaller group ends up existing as an autonomous group within the context of the larger group) (Organista).

Berry (2003) has theorized that the acculturative experiences of most societies can be categorized in one of four major forms of adaptation. They are: assimilation, integration, separation, and marginalization. These four forms of adaptation reflect a gradient in stress experienced by individuals undergoing acculturation. *Assimilation* strategy occurs when individuals do not wish to maintain their cultural identity and choose to interact with the dominant culture on a daily basis (Berry, 2006). In contrast, when individuals choose to hold onto their culture of origin, and avoid interactions with members of the dominant culture, this is called *separation*. When individuals choose to maintain their cultural integrity, while at the same time have daily interactions with members of the dominant culture, *integration* occurs. Finally, when there is little or no cultural maintenance (by choice or enforced) as well as little or no interest in interacting with members of the dominant culture, *marginalization* occurs.



Which form a particular minority ethnic group experiences when integrating with the majority culture depends on a number of factors, including the type of initial contact developed between the cultures, the amount of conflict present between them, as well as how tolerant the dominant culture is to diversification (Zambrana & Carter-Pokras, 2010). These factors work in tandem to influence the amount the non-dominant culture seeks to maintain its cultural identity and the degree to which positive relationships between cultures can be fostered (Organista). Berry (2003) proffers an evaluation tool to determine what type of adaptation is taking place for any given situation. His tool asks dichotomous questions on two issues: 1) Does the minority group attempt to retain its culture of origin? And, 2) are positive relations possible between the minority and majority groups? Responses to these two questions result in the minority group falling within one of the four quadrants (Figure 3, “Four Acculturation Strategies Based Upon Two Issues, in Ethnocultural Groups, and the Larger Society”) of integration, assimilation, separation, and marginalization (Berry, 2006). Similar questions can be asked of the dominant group, the answers to which can be used to identify the strategy most likely employed toward non-dominant groups.

Berry’s method of understanding acculturation strategies can be applied to the experience of persons of Mexican origin in the United States. Mexican-Americans, as a specific cultural group, have historically experienced segregation by the dominant culture as they attempt to adapt to culture within the US, as can be seen by the strained relationship between the minority and dominant groups (Organista). They have often chosen separation as an acculturation strategy, as can be seen by their relatively high retention of Mexican culture. However, Mexican-American adaptation is slowly moving from

segregation/separation to integration, which illustrates the dynamic nature of the acculturation process (Organista).

Researchers have made great strides in conceptualization and theoretical exploration of acculturation. Researchers are moving away from conceptualizing acculturation as a linear process where change is measured by assimilation into a dominant culture (Cuellar, Harris, & Jasso, 1980; Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987; Szapocznik, Scopetta, Kurtines, & Aranalde, 1978; Zea, et al., 2003). Now, researchers believe that acculturation is a bilinear, multidimensional process where change occurs in two places: 1) within the culture of origin, and 2) within the host culture (Birman, 1998; Birman & Trickett, 2001; Cortes, Rogler, & Malgady, 1994; Cuellar, Arnold, & Maldonado, 1995; Marin & Gamba, 1996; Mendoza, 1989).

With this new understanding, researchers are beginning to develop better ways of empirically operationalizing and measuring the process of acculturation. These new measures typically assess one or more of the five dimensions that may play a role in acculturation: cultural behavior, cultural identity, knowledge, language, and values (Zea, et al., 2003). *Cultural behavior* is often measured by an individual's choice in friends and media preferences. *Cultural identity* can be measured by how the individual self-identifies, how s/he chooses to affiliate, and cultural pride. *Cultural knowledge* can be measured by the amount of historical and political knowledge the individual possesses regarding his or her original or new culture, and which cultural celebrations s/he participates in. *Language proficiency* can be operationalized as use of an individual's new and original culture languages, preferences, and ability. Lastly, *cultural values* can be assessed by the degree an individual integrates beliefs about social norms, cultural customs, and traditions from a new

culture. Some researchers suggest that the first four dimensions reflect a superficial degree of immersion, while the fifth dimension reflects a deeper degree of immersion (Kim & Abreu, 2001; Marin, 1993; Stephenson, 2000).

### **Theory of Acculturative Stress**

Acculturative stress has been conceptualized as conflict, as experienced by the individual going through the process of acculturation, that is problematic, but controllable and surmountable (Berry, 2006). Individuals experience events that challenge their understanding about how to live. When these experiences are due to acculturation events, the stress of having to rethink one's way of living is considered to be *acculturative stress*. As part of these experiences, the individual begins to understand that he or she is going through the experiences because of intercultural contact, and that these experiences cannot be dealt with easily or quickly by adjusting or assimilating. Drawing from broader theories about stress and adaptation (e.g., Lazarus, 2000), the acculturative stress approach involves the study of how individuals deal with acculturative problems over time. That is, acculturative stress is a stress reaction to life events stemming from the experience of acculturation (Berry).

### **Berry's Acculturative Stress Approach to Conceptualizing Psychological Difficulties during Adaptation**

Berry's "Acculturative Stress Approach to Conceptualizing Psychological Difficulties during Adaptation" (Figure 4) begins to incorporate more of the factors involved and how they are inter-related, more specifically within the context of acculturative stress and psychological outcomes (Berry, 2006). It includes culture, and how intercultural contact is the defining life event that acts as the catalyst for the entire acculturative stress process. Of

particular note, this model incorporates the influence of time, how each component leads into the next, the decisions the individual makes regarding strategies used, and how coping impacts long-term outcomes. That is, this model captures whether, after intercultural contact an individual perceives that the stressors are controllable; what type of coping strategy he or she may employ to address the stressors, and how the resultant stress affects his or her long term outcomes.

Compared to Berry's first model that focuses on acculturative stress and adapting to psychological difficulties (Figure 4), his second model, "A General Framework for Understanding Acculturation and Acculturative Stress" (Figure 5) is more comprehensive and explains the key components of acculturation and acculturative stress (Berry, 2006). Berry's second model includes a cultural component, and the central role culture and cultural changes play in the acculturation and acculturative stress process. It also categorizes these components as ones that are affected at the cultural or group level, which in turn affect components at the individual and psychological level, such as behavioral shifts, acculturative stress, and psychological and socio-cultural adaptation. It also shows how these components are related temporally, with outcomes on the right hand side of the model. Further, the model takes into account the experiences of individuals in the dominant as well as minority group, indicating that the process of acculturation and acculturative stress can be experienced by members of both groups (though the level of intensity may differ).

To expand and articulate further the role acculturative stress plays in mediating mental health outcomes, one of the most prominent and well-studied theories of Latino acculturative stress the Hispanic Paradox, is discussed next.

### **Theory and Context of the Hispanic Paradox**

The relationship between low levels of socioeconomic status (SES) and poor health has been researched extensively and is well-documented (Abraido-Lanza, et al., 2005; Adler, et al., 1994). Latinos in the United States are disproportionately represented amongst those in lower SES groups and have an average income similar to that of African Americans rather than non-Hispanic Whites (Franzini, Ribble, & Keddie, 2002). As such, Latinos as a group would be expected to have higher levels of morbidity and mortality (Falcon, Aquirre-Molina, & Molina, 2001). However, many studies have shown that Latinos in the US have similar or better health, higher life expectancy, and relatively lower adult mortality compared to non-Hispanic Whites, despite lower levels of income and education (Abraido-Lanza, et al., 2005; Cho, Frisbie, Hummer, & Rogers, 2004; Crimmins, Kim, Alley, Karlamangla, & Seeman, 2007; Elo, Turra, Kestenbaum, & Ferguson, 2004; Franzini, Ribble, & Keddie, 2001; Morales, Mara, Kington, Valdez, & Escarce, 2002). This better than expected health and mortality (but not morbidity), despite higher rates of poverty, less education, and lower likelihood of possessing health insurance, has been coined the *Hispanic Paradox* (Abraido-Lanza, et al., 2005; Adler, et al., 1994; Markides & Coreil, 1986; Markides & Eschbach, 2005).

Not all empirical studies support the existence of a paradox, and differences exist depending on the domain of health examined and the population under investigation (Crimmins, et al., 2007). For instance, some studies have shown that total mortality from cardiovascular disease is not lower for Latinos than non-Hispanic Whites, but results across studies are not consistent, especially for men (Markides & Coreil, 1998; Hunt et al., 2003; However, studies have shown that age-adjusted cerebrovascular disease (i.e., stroke) mortality rates are lower for Latinos than non-Hispanic Whites, but results varied by age and

gender, with older ages and men showing significantly larger differences (Franzini, et al., 2002). Further, Latinos have lower age-adjusted mortality rates from cancers that are more prevalent in the United States, but have higher mortality rates for forms of cancer that are less prevalent, as well as higher rates of diabetes (particularly non-insulin-dependent diabetes mellitus) (Franzini, et al., 2002; Arias, 2010).

Markides and Eschbach (2005) suggest that the Hispanic health advantage is strongest for men, older adults, and Mexico-born Latinos. On the contrary, some studies have not shown the existence of a mortality advantage for Latinos compared to non-Hispanic Whites (Hunt, et al., 2002; Hunt, et al., 2003). For instance, Latino males between the ages of 15 and 44 have higher mortality rates than non-Hispanic Whites; but the reverse is true for females of this age group (Franzini, et al., 2002). Further, Latino mortality rates are lower for females from the age of fifteen, but for males from the age of fifty-five (Franzini, et al., 2002). These lower mortality rates for middle-aged to older Latinos likely reflect lower mortality from chronic diseases that are generally seen in these older age groups. Other studies question the data quality of studies that have shown a mortality advantage (Smith & Bradshaw, 2005). Various researchers concur that the Hispanic Paradox is limited to the foreign-born, and more specifically to those who are Mexico-born, rather than Latinos who are U.S.-born (Crimmins, et al., 2007; Palloni & Arias, 2004).

A number of researchers have hypothesized that the Hispanic Paradox may in fact be the result of selection bias, given the high number of immigrants within the population (Jasso, Massey, Rosenzweig, & Smith, 2004; Palloni & Arias, 2004). One hypothesis posits that only healthy migrants tend to immigrate into the United States, which may explain why some studies show better health outcomes for Latinos (Abraido-Lanza, Dohrenwend, Ng-

Mak, & Turner, 1999; Sorlie, Backlund, Johnson, & Rogot, 1993). The *healthy migrant effect* suggests that Latinos who are healthier and stronger are more successful in making the sometimes difficult migration into the United States, bringing healthy people into the US and leaving behind less healthy members of the population. Several studies have compared Latino mortality for the U.S.-born and foreign-born by country of origin. One study found that Latinos born in Central America, South America, and the Caribbean have better mortality than Puerto Rican-born and U.S.-born Latinos (Fang, Madhavan, & Alderman, 1997). Another study found that age- and sex-adjusted all-cause mortality rates for U.S.-born Mexican Americans to be higher than that of non-Hispanic Whites, but Mexico-born Mexican Americans to have lower mortality rates than non-Hispanic Whites (Wei, et al., 1996).

The *salmon bias* is another migratory hypothesis which suggests that Latinos eventually migrate back to their country of origin when they get sick or old (Tura & Elo, 2008; Abraido-Lanza, et al., 1999; Pablos-Mendez, 1994; Palloni & Arias, 2004). When Latinos migrate back to their birth countries to die, their deaths are not recorded in the United States, thus resulting in artificially lower mortality rates. However, this hypothesis has not been substantiated, though studies of return migration confirm that a large percentage of foreign-born Latinos return to their home country (though it is unclear how permanent this return migration is) (Franzini, et al., 2002). One study found that U.S.-born Latinos (who would likely stay in the US to be with their families later in life), Cubans (who cannot return to their country of origin), and Puerto Ricans (whose deaths are recorded in US vital statistics) also have lower mortality rates than non-Hispanic Whites, which provides evidence against the salmon bias hypothesis (Abraido-Lanza, et al., 1999).

Other researchers are unconvinced that the healthy migrant effect and salmon bias account for the Latino health advantage. Rather, they hypothesize that other factors, such as health behaviors, account for the phenomenon (Abraido-Lanza, et al., 1999). Some researchers believe that Latinos may employ different coping mechanisms than non-Hispanic Whites to deal with stressful situations, and that this may account for some of the Latino health paradox (Farley, et al., 2005). Other studies have shown that Latinos are less likely to consume alcohol and smoke tobacco products than non-Hispanic Whites (Haynes, Harvey, Montes, Nickens, & Cohen, 1990; Markides, Ray, Stroup-Benham, & Trevino, 1990; Perez-Stable, Marin, & Marin, 1994; Singh & Siahpush, 2002), and have better diets than the general population (Ramirez, McAlister, Gallion, & Villarreal, 1995). However, studies indicate that with increased acculturation, financial stability, and education, Latinos are increasingly adopting negative health practices (Markides, et al., 1990; Ramirez, 1992). Further, adoption of more mainstream behaviors has been shown to increase risks for cancer and other diseases (Ruiz, Steffen & Smith, 2013; Lowenstein, 1981; Ramirez, et al., 1995).

### **An Integrated Explanatory Model of Acculturation**

#### **Limitations of Previous Models**

While each of the previously presented theoretical frameworks provides a useful lens through which to view a perspective of acculturative stress and coping, none provide a comprehensive model that captures all the key factors that may influence mental health outcomes among persons of Mexican origin. The following section highlights the gaps and areas that need further explanation regarding the previously reviewed theories.

In Moos' Stress and Coping Model (Figure 2) the actual underlying mechanisms of approach and avoidance coping styles, and how they influence psychosocial functioning are



unclear. Further, the model does not include how the social systems of family and neighborhood influence stress and coping. This is a critical omission, as other theories (Bronfenbrenner, 1979; Bowen, 1993) and research (Peek & Cutchin, 2010; Breslau et al., 2011) indicate that both neighborhood and family factors significantly influence stress and coping.

Berry's Acculturative Stress Model (Figure 4) solely focuses on the individual aspects of acculturation and acculturative stress, and fails to show what components might operate at a group or cultural level. Further, it suggests that long term outcomes might result from adaptive or non-adaptive changes in the individual, due to a unidirectional relationship. However, it does not account for any changes an individual might later make to coping strategies that result in more adaptive outcomes and does not account for neighborhood and family affects.

Berry's General Framework for Understanding Acculturation and Acculturative Stress Model (Figure 5) does not introduce coping as a component in the acculturative stress and health outcome process. Also, it does not take into account that the acculturative stress process is temporal and continually occurring. Further, it does not depict any cognitive re-evaluation an individual might engage in after experiencing a negative outcome. Finally, it does not discuss how neighborhood and family influences may attenuate or worsen acculturative stress.

### **The Development of a New Expanded and Integrated Model**

In the next section Berry and Moos models are integrated and expanded to create a new expanded and integrated model. The integrated model is presented in Figure 6.

Building upon the works of Berry (2006), “An Integrated Explanatory Model of Acculturation” (Figure 6) incorporates parts of the stress and coping model (Moos, 1984). Additionally, the integrated model includes how two critical social systems—neighborhood and family—influence acculturation. Further, the model proposes conceptualizing the acculturation process like a stream of water, where changes at one point in the flow of the river affect changes further downstream from the point of intervention.

### **Nested Influence: From Culture to Individual**

**Macro level: Influence of culture.** To begin, the top third of the model shows changes that occur at the macro level, or those that take place at the cultural level, to the ethnic group or family involved in the process of acculturating. This cultural component focuses on the intercultural contact that occurs between the dominant society and the culture of the group entering into the dominant society. Each culture possesses characteristics specific to itself, and after contact occurs, there is negotiation between which characteristics remain the same and which characteristics must change in order for members of each culture to interact with one another. This process takes place over time, and continues to inform the process of acculturation and resultant acculturative stress that occurs within the individual. While some existing models have demonstrated the centrality of culture, none have illustrated the continuous interaction between the two cultures over time, as well as the continuous influence this interaction has at the individual level.

**Meso level: Influence of family and neighborhood.** The middle section of the model depicts how family and neighborhood influence macro and micro levels of acculturative stress. Specifically, the model shows how family and neighborhood play a role in how acculturative stress manifests in biopsychosocial outcomes (e.g. depression).

However, it is important to point out that the model does not infer mediation, only that family and neighborhood influence outcomes. The direction and the nature of this influence on biopsychosocial outcomes are dependent upon many other factors that are shown in the model.

Research findings are mixed on how neighborhood composition influences the mental health outcomes of immigrant Mexico-born Mexican Americans. One study of Mexico-born parents found that those who settle in neighborhoods where racial discrimination is present experience more depressive symptoms than those who settle in neighborhoods bereft of racial discrimination (Ornelas & Perriera, 2011). Further, results from studies on the impact of co-ethnic neighborhoods have found that co-ethnic neighborhoods provide social support, access to important scarce resources, and protection against perceived stress and discrimination (Brown et al., 2009; Shell, Peek & Eschbach, 2013). In contrast, other studies have yielded results that suggest co-ethnic neighborhoods lead to poor mental health outcomes (Alegria et al., 2007). Specifically, some Latinos living in co-ethnic neighborhoods perceive a strong burden to provide initial stabilization and guidance to newly immigrated neighbors. This perceived burden can lead to increased stress, anxiety and depression (Kao & Tienda, 2005). In addition, co-ethnic Latino neighborhoods are commonly impoverished. In turn, neighborhoods that are impoverished are likely to have more crime. Impoverished and high crime neighborhoods can, in some cases, lead to increases in the prevalence of mental health problems (Feldmeyer, 2009). Moreover, what is clear is that neighborhood influences do play a significant role in how acculturative stress manifests in mental health outcomes. However, further research is needed to flesh out if neighborhood influence is primarily positive or negative.

Along with neighborhood influences, it has been shown that family influences, or *familism*, affect the way Latinos experience acculturative stress, and specifically, how familism modifies the effects of acculturative stress on mental health outcomes. Findings from studies on how familism influences the effects of acculturative stress on mental health outcomes distinguish superficial or casual support from instrumental and emotional family support (Orneleas, 2011). Study results show that instrumental and consistent emotional support buffers the negative effects acculturative stress has on mental health outcomes, whereas superficial, tenuous, or conflictual family relations worsen mental health outcomes (Orneleas, 2011). Specifically, study results indicate that Latinos who have familism that is characterized by family members listening to feelings, being there when they are needed, and spending quality time together, have fewer depressive symptoms (Hovey, 2000). In sum, it appears that being surrounded by familism that is actively supportive and emotional in nature is critical for counteracting negative effects acculturative stress may have on Latino mental health.

**Micro level: Influence of the individual.** The bottom third of the model shows changes that occur over time at the micro (or individual) level. They are broken down into three main points suitable for intervention: *upstream*, *midstream*, and *downstream*. *Upstream* processes in the acculturative stress, coping, and health outcomes system focus on the acculturative stressors experienced by the individual. These stressors can include changes in language use, involvement in cultural activities of their ethnic origin, changes in health behaviors, perceived racism, and perceived discrimination.

*Midstream* processes focus on the coping strategies the individual uses to attempt to address acculturation stressors. These coping strategies can be adaptive or maladaptive in nature, which can affect the amount and severity of acculturative stress experienced.

Finally, *downstream* processes focus on the mental and physical health outcomes that result from effective or maladaptive psychological acculturation and adaptation.

Interventions that target downstream processes would try to help individuals manage their health outcomes and possibly encourage psychological or behavioral changes to help minimize the further development of negative health outcomes. In this model, adaptation can occur after the acculturative stress has occurred, and allows for any psychological and socio-cultural changes, as well as physiological changes, an individual makes (either consciously or unconsciously) in response to the stress experienced (i.e., sense of well-being, self-esteem, increasing social support linkages, changes in the cardiovascular or nervous systems).

One major new element that this integrated model takes into account is the opportunity for individuals to realize how the acculturative stress is affecting them and to make changes based on their experiences. Possible adaptations include changing coping strategies to reduce (or increase) the amount of acculturative stress experienced in the future. This feedback loop is not present in existing models, but may be a critical piece highlights individual agency in the psychological acculturation system.

In summary, the integrated explanatory model of acculturation shows how changes over time at the macro level (to two cultures through intercultural contact) and meso level (to family and neighborhood) influence changes in the individual at the micro level (to psychological acculturation, adaptation, and health outcomes).

### **Implications**

This expanded framework provides opportunities for exploration, investigation and development of new ideas that have the potential of refining social work practices and research approaches with Latino immigrants.

### **Social Work Practice**

Social workers are frequently the professionals who are tasked with assisting Latino immigrants as they navigate the challenges of acculturating to US culture (Furman et al., 2009). One of challenges that some Latinos face is depression. Contrary to other theoretical models and approaches (i.e., stress and coping, learning, theory and social cognitive theory) that are more myopic in conceptualizing depression, the new model allows social workers to view Latino immigrant depression from multiple angles and levels. The model also factors in how family and neighborhood relations can either exacerbate or buffer the stress of acculturation, which in turn, can either mediate or increase vulnerability for depression. Further, the new model introduces how cultural context and acculturation influence how an individual appraises a situation. Social workers could use this new model to assess for environmental and individual problem areas and strengths. Following the assessment, this model could also be used for treatment planning. For example, when working with a Latino immigrant, a social worker could use this model to assess for level of acculturation, specifically, screening for any dissonance with his/her culture of origin or problems with acculturating to the US. The social worker could also use the model to look for culture of origin strength's such as traditions or rituals that could be leveraged to help mitigate symptoms of depression.

The new integrated and expanded model accounts for the collectivist and communal orientation that many Latinos, especially Mexican Americans, possess (Holleran Waller,

2003). The addition of the family and neighborhood components into an integrated model of acculturation guides social workers in planning mental health intervention that may be critical in protecting Latinos against mental health problems. In particular, the embedding of specific Latino sub-group (i.e., Mexican, Puerto Rican, Salvadorian) community centers that offer a variety of services and resources including family counseling will serve to increase sense of belongingness for Latino immigrants. A sense of belongingness has been shown to be a critical factor in the prevention mental health problems, especially depression (Furman et al., 2009; Joiner, 2005). For example, social workers who are working in communities where there is a preponderance of persons of Mexican origin could use the new expanded and integrated model to inform the development of Mexican community centers. In addition to other services and resources, the centers could offer counseling services and meeting spaces for cultural activities and festivities.

Further, unique to social work practice are the values that inform social worker case conceptualization and clinical decision making. The new expanded and integrated model is informed by social work values. Social work values center on client empowerment, right to self-determinism, identification of strengths, and acceptance of all types of client diversity. For example, in the new model importance is placed on cultural competence, systems thinking, meeting a person where he or she is, and identifying and capitalizing on client strengths. The new model provides a scaffold upon which social work values can be laid and systems thinking supported.

In sum, the new, integrated model presents a framework consistent with multi-systems thinking and social work values. It also acknowledges the importance of culture and acculturation. It reveals many areas and levels where social workers can tap client strengths

and use social work interventions at a variety of levels: community, family, culture, and individual.

### **Future Research**

Understanding how two distinct components of the Latino community, U.S.-born or recently immigrated, cope with stressors and how such coping styles affect health outcomes is important to affecting positive changes in the Latino and other at-risk communities. Due to the complexity of this phenomenon, further research employing multi-dimensional statistical methods is needed to understand the relationships among nativity, acculturative stress and its interaction with other stress, and coping mechanisms on health outcomes. Structural equation modeling (SEM) would be particularly useful in exploring the relationships between the various components, because it allows for the testing of mediational and theoretical models. In addition, SEM affords the researcher flexibility in representing relationships among theoretical constructs. It also allows for latent variable modeling. Finally, it offers the capability to evaluate the general compatibility of a proposed model for the data being examined and the strength of relationships between constructs (Quintana & Maxwell, 1999).

Specifically, SEM could be used to test the new integrated and expanded model by examining whether neighborhood and family factors mediate the process of acculturative stress on measures of depression and other mental health outcomes. In addition, SEM could be employed to compare whether appraisal of acculturative stress mediates mental health outcomes more than adaptive coping strategies, or if the interaction between appraisal and adaptive coping has the strongest mediational effect on mental health outcomes.



In summary, it is important that future studies tease out the effect acculturation—by itself or in combination with other factors—has on health and mental health outcomes. This will help sensitize social workers to the importance of assessing the level of acculturation in Latino immigrant clients.

## **Conclusions**

Acculturative stress and its effect on the health and mental health of Latinos, and influence on development of depression, is a complex process that includes macro, meso and micro processes. The theories and explanatory frameworks of stress and coping, acculturation, acculturative stress and the Hispanic Paradox, all offer ways of interpreting how individuals deal with stress, especially immigrants. Berry's General Framework for Understanding Acculturation and Acculturative Stress (Figure 5) provides an excellent starting point for understanding how cultural changes, specifically how acculturation influences changes at the individual and psychological levels.

The new integrated and expanded model aims to further the understanding of Latino acculturative stress by incorporating the essential components of Berry's General Framework model, but adds the following key components to optimally address the complex and interactive psychological, social and environmental processes at play in Latino immigration: The new expanded and integrated model illustrates how all three micro, meso and macro processes are involved in the experience of acculturative stress for Latino immigrants. Most notably, the addition of neighborhood and familism is critical in fully conceptualizing how acculturation affects Latino immigrants. 2) The new model includes foundational processes of stress and coping mechanisms that transcend culture. And 3), the new model provides a framework that demonstrates the temporal relationship between acculturative stress

components, and how interventions can target *upstream*, *midstream* and *downstream* opportunities to improve mental health outcomes.

Figure 1. The Nature of Acculturation (adapted from Berry, 2003; Organista, 2007)

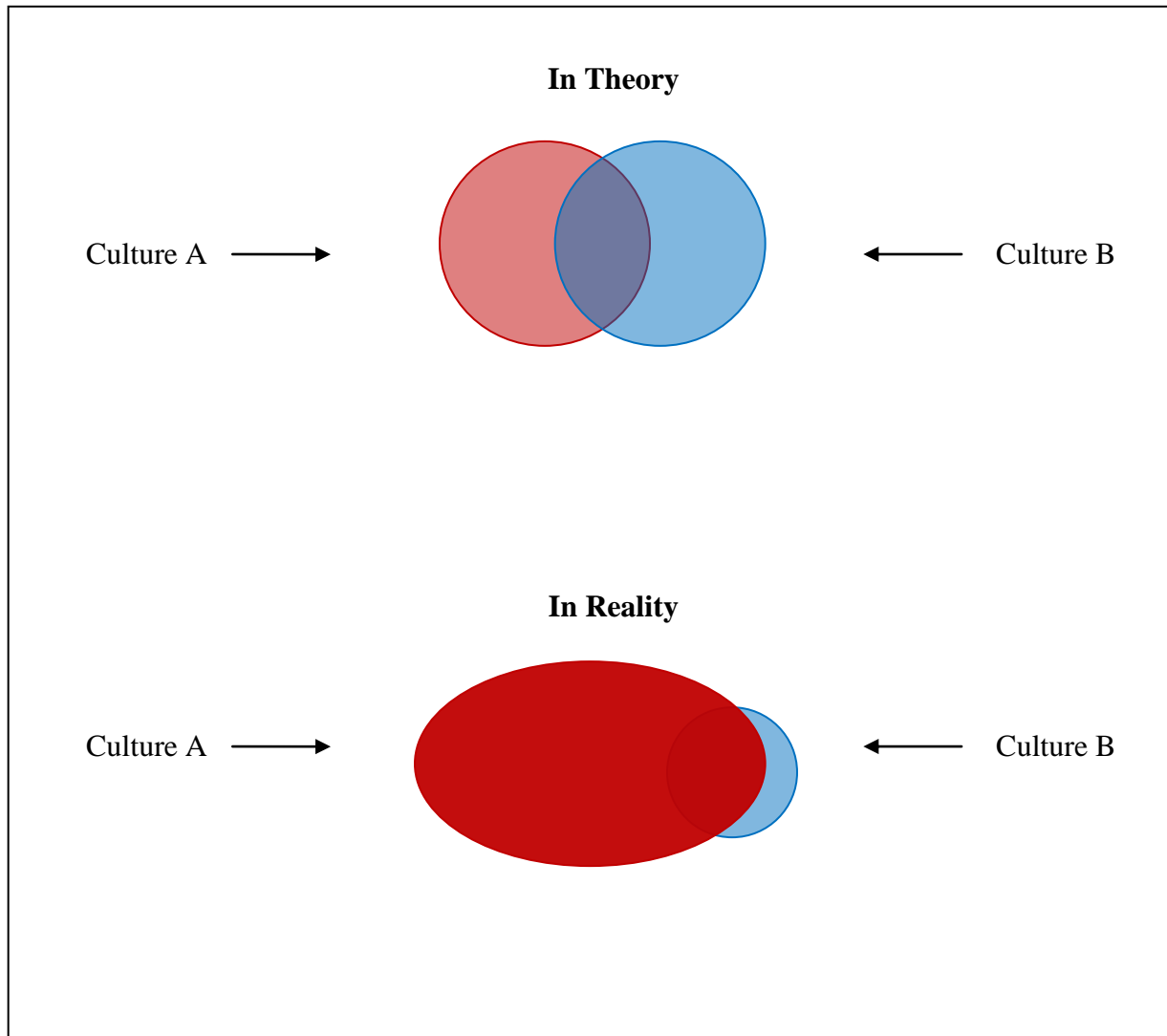


Figure 2. Stress and Coping: A Model of Interplay between Context, Coping, and Adaptation (Moos, 1984)

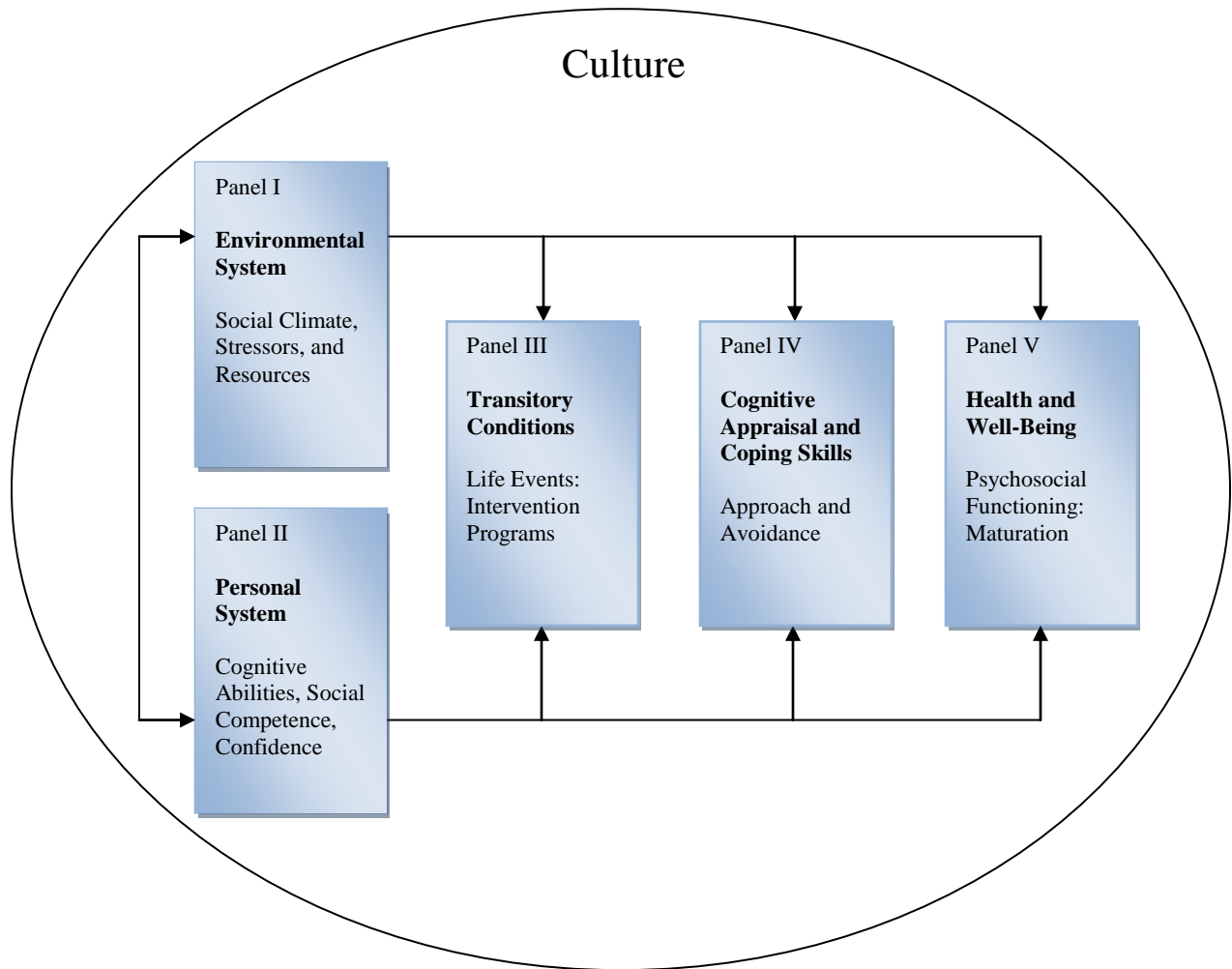
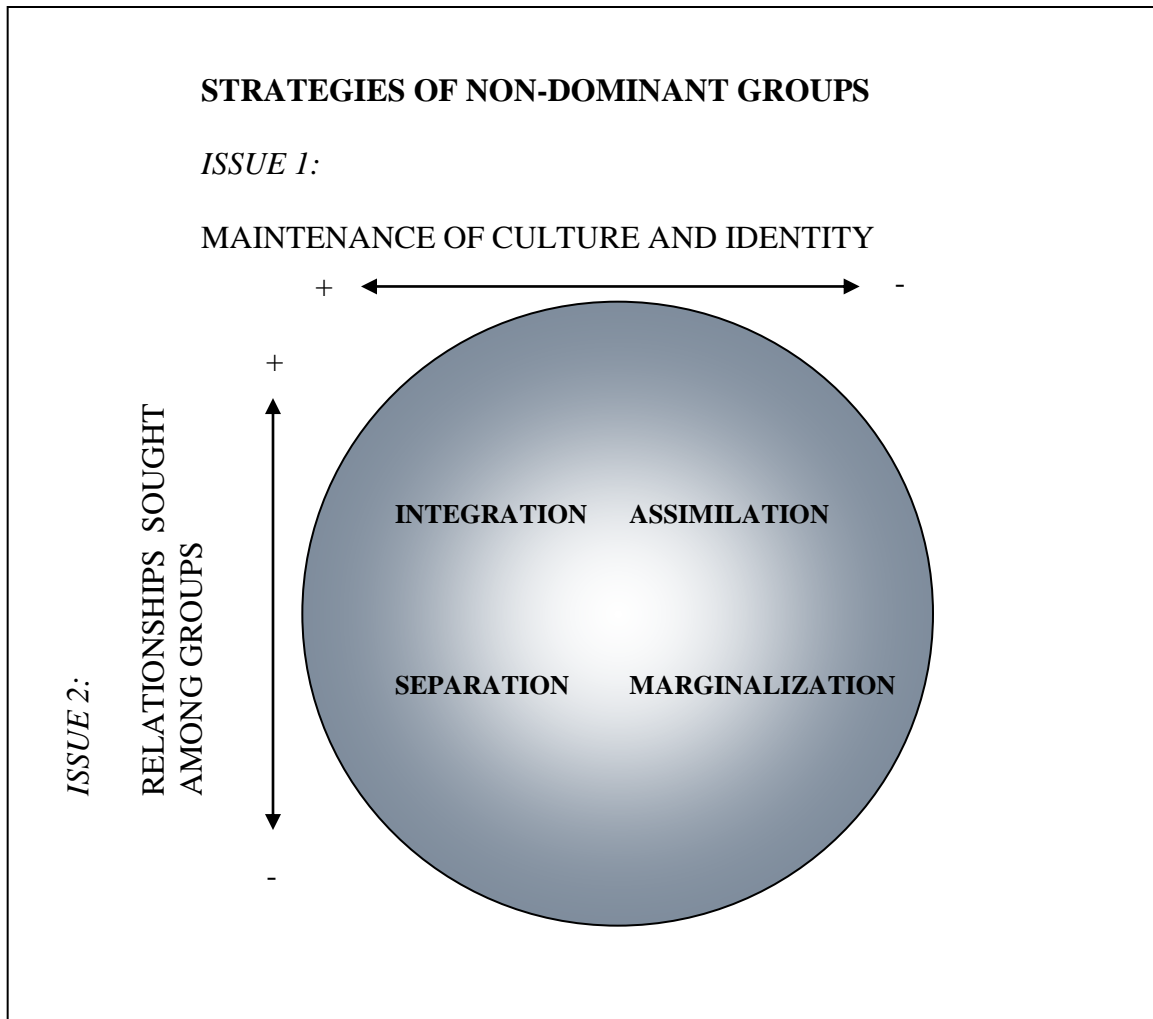


Figure 3. Four Acculturation Strategies Based Upon Two Issues, in Ethnocultural Groups, and the Larger Society (Berry, 2006)



## STRATEGIES OF DOMINANT GROUPS

*ISSUE 1:*

MAINTENANCE OF CULTURE AND IDENTITY

+ ← → -

*ISSUE 2:*

RELATIONSHIPS SOUGHT  
AMONG GROUPS

+

↑

↓

-

MULTICULTURALISM

MELTING POT

SEGREGATION

EXCLUSION

Figure 4. Acculturative Stress Approach to Conceptualizing Psychological Difficulties during Adaptation (Berry, 2006)

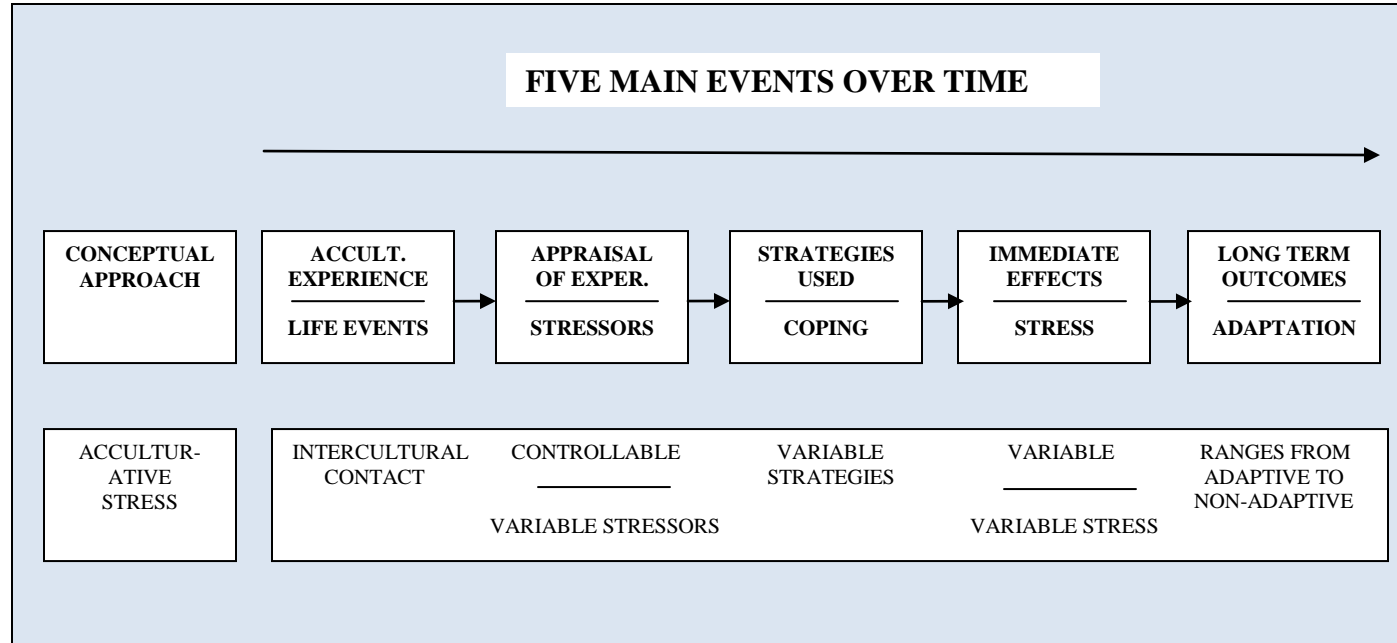


Figure 5. A General Framework for Understanding Acculturation and Acculturative Stress  
(Berry, 2006)

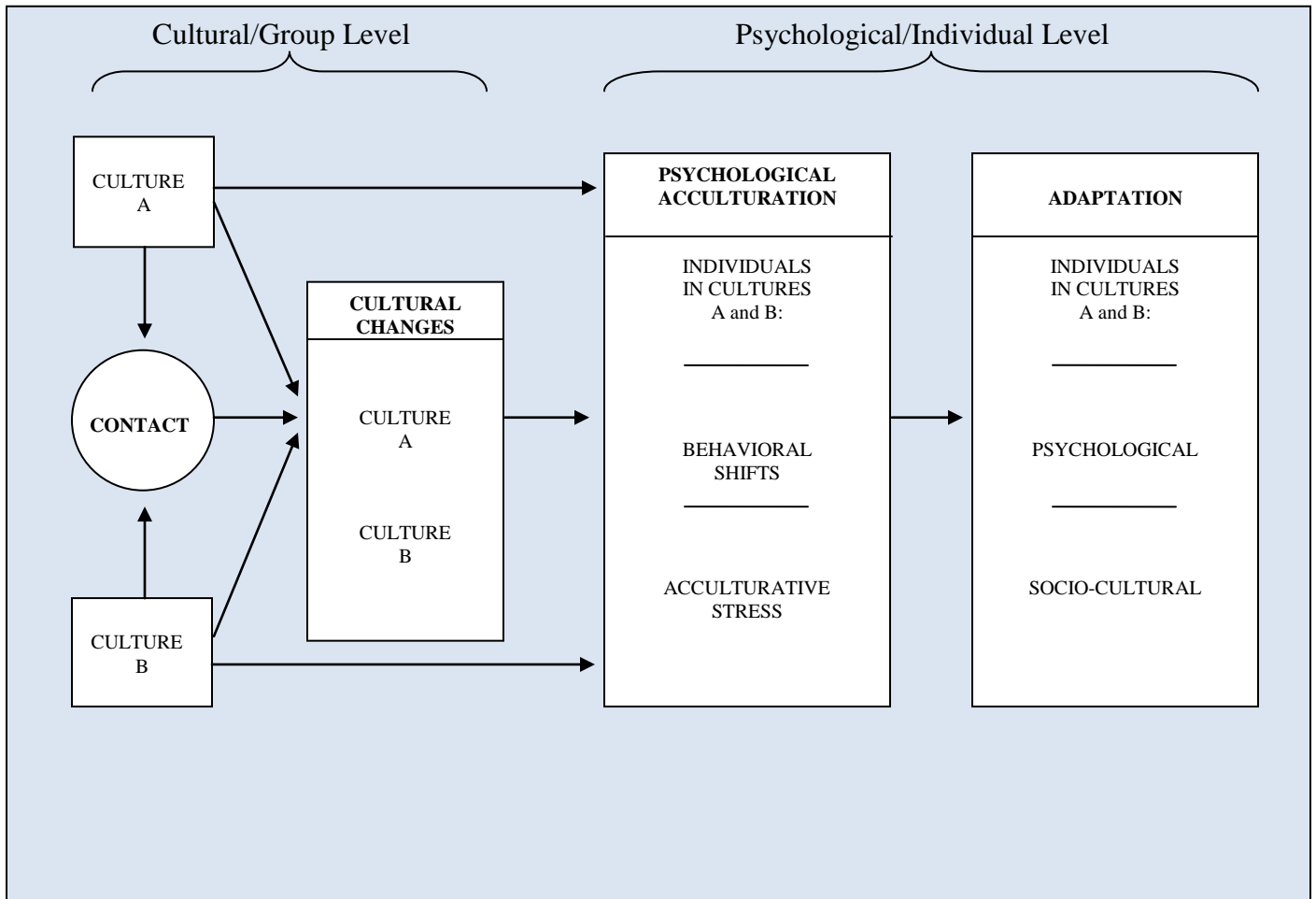
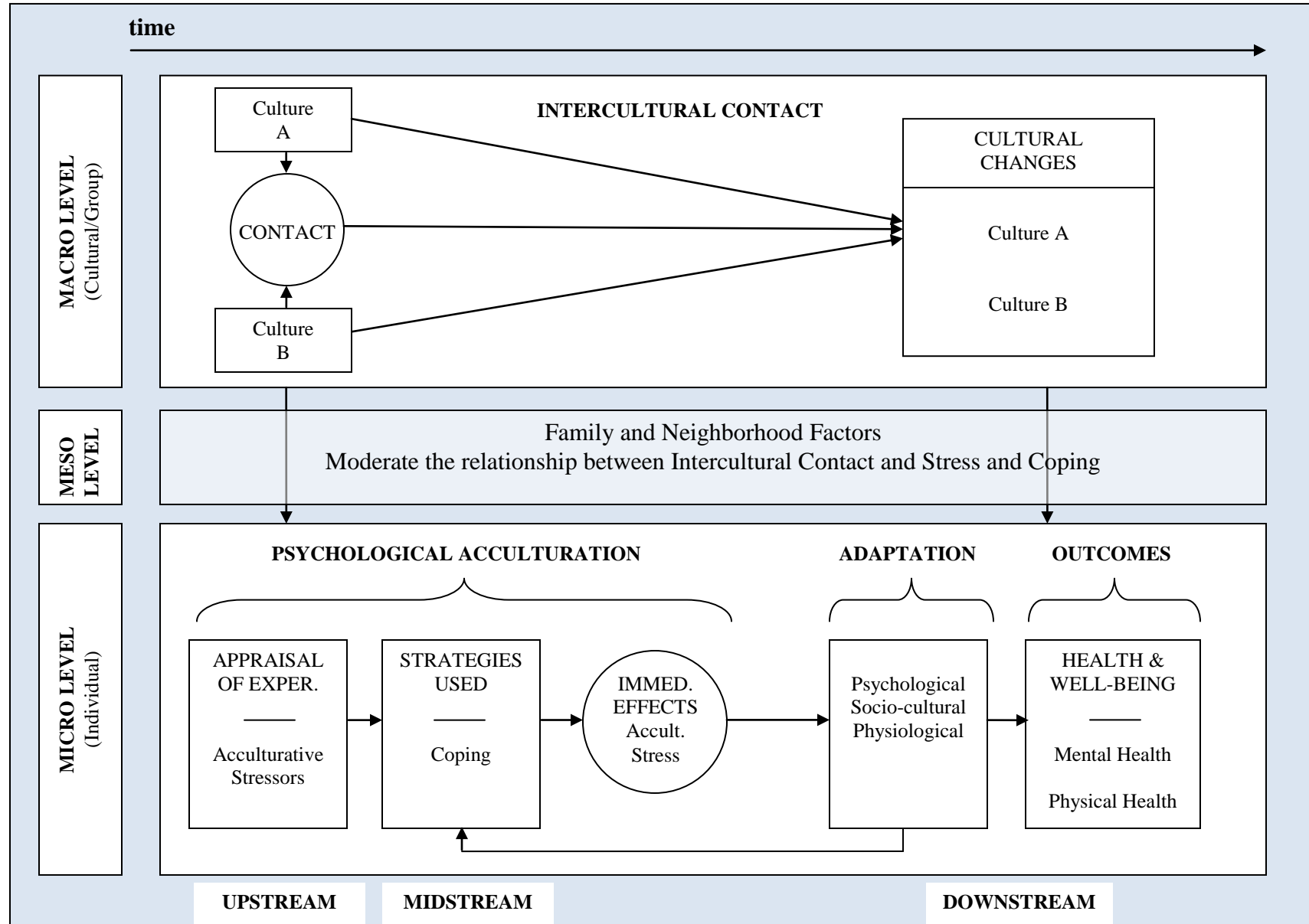




Figure 6. An Integrated Explanatory Model of Acculturation



## Manuscript II: Reliability and Validity Evidence of the English Language Center for Epidemiologic Studies Depression Scale - Revised (CESD-R)

Accurately assessing depression among Latinos and making proper referrals and treatment decisions is paramount for safeguarding this rapidly growing population, especially because it is a population that already severely underutilizes mental health resources (Breslau et al., 2011). Inaccuracies in the assessment of depression can lead to faulty treatment planning, including the failure to refer to mental health providers when appropriate. As the Center for Epidemiologic Studies Depression Scale - Revised (CESD-R) gains acceptance as a screening device for depression (<http://cesd-r.com>), it is critical to test if the measure is a valid measure of depression in Latinos. The study described in Manuscript II aimed to determine if the CESD-R is a valid measure of depression for persons of Mexican origin, and whether persons of Mexican origin (both U.S.-born and Mexico-born) manifest symptoms of depression differently than non-Hispanic Whites on the CESD-R. This study has important implications for the measurement of depression in persons of Mexican origin and understanding the role acculturation plays in the development of depressive symptoms.

### **Literature Review**

A major depressive episode is the key component of the diagnosis of major depressive disorder. To have a major depressive episode, one must have five or more depressive symptoms all within, and lasting for, a two-week period. For adults, one of the symptoms must either be depressed or irritable mood or loss of interest or pleasure. The

other symptoms of a major depressive episode according to the DSM-5 are: significant weight loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue, feelings of worthlessness, decreased concentration, and suicidal ideation or suicide attempt. The symptoms must cause significant distress or impairment (American Psychiatric Association, 2013).

It is estimated that in their lifetime, approximately 16-20 percent of the Hispanic population will experience a major depressive episode (Algeria, 2008). Approximately 10 percent of persons of Mexican origin report high levels of depressive symptoms (Breslau et al., 2011). Until recently, studies comparing the prevalence of depression among persons of Mexican origin and non-Hispanic Whites, and between U.S.-born and Mexico-born Mexican Americans, were mixed. Some studies have shown that persons of Mexican origin have higher rates of depressive symptoms (Roberts, 1981; Munet-Vilaro, Folkman et al., 1999) and higher rates of major depressive disorder (Dunlop et al., 2003). Other studies indicate that non-Hispanic Whites have higher rates of depressive disorders than persons of Mexican origin (Riolo et al., 2005). More current research strongly suggests that the longer a person stays in Mexico the less likely he or she will become depressed, anxious, or suicidal (Breslau et al.; Borges et al., 2009). The most recent research on depression and Mexico-born Mexican Americans is especially credible due to its rigorous longitudinal methods and utilization of Spanish-speaking clinicians administering diagnostic interviews (Breslau et al.; Borges et al.). In contrast, previous research was mostly correlational and dependent upon self-report measures typically designed for Whites (Tyson, 2011).

Findings from research on Latinos and depression suggest that depression manifests more somatically in Latinos than in non-Latino populations (Issac, 1996; Tyson, 2011;

Minsky, 2003). Further, Latinos manifest mood and affective symptoms of depression dissimilarly to non-Latinos (Issac, 1996; Tyson, 2011; Minsky, 2003). Latinos appear to merge symptoms such as appetite and low energy with symptoms such as sad mood and low self-esteem into one component of depression, whereas non-Latinos commonly manifest a defined mood and affective component of depression separate from somatic symptoms (Algeria, 2008; Tyson, 2011; Minsky, 2003). Also, research suggests that Latinos do not commonly associate issues related to sleep with depression (Tyson, 2011; Grzywacz, et al., 2011). Specifically, studies suggest that sleepiness and fatigue among Mexican immigrants is a product of poor work conditions and physical stress and not depressed mood. (Grzywacz, et al., 2011; Winkleman, et al., 2013). In Non-Hispanic Whites, sleep disturbance has been shown to be a result of sad mood, specifically, negative and depressed thoughts prevent sleeping (Franzen & Buysse, 2008; Nyer et al., 2013).

In addition, study findings suggest that non-Hispanic Whites and U.S.-born Mexican Americans have much higher rates of depressive disorders and thoughts and behaviors related to suicide compared to Mexico-born Mexican Americans (Borges, et al., 2009). According to ethnographic research on how Latinos experience depression and a large scale epidemiological study of Mexico-born Mexican Americans and suicide, Mexican Americans conceptualize suicide as a problem separate from depression, whereas many non-Latinos view suicide as an extreme form of depression (Tyson, 2011; Borges, et al., 2009).

Additionally, persons of Mexican origin, Puerto Ricans and individuals from El Salvador categorize feeling stressed as depression (Tyson, 2011). This finding is similar to data on Whites where there is a significant overlap of anxiety and depressive symptoms (Kessler et al., 2009). This overlap has been so common that terms such as anxious

depression have been developed for research to refer to depression that is marked by significant symptoms of anxiety (Fava et al., 2008).

Lastly, compared to non-Hispanic Whites and U.S.-born Mexican Americans, among Mexico-born Mexican Americans depression manifestation is more prominent in interpersonal and community interactions. Though social isolation and withdrawal are common symptoms of depression for many, regardless of ethnicity, Mexico-born Mexican Americans' lack of involvement in community activities and withdrawal from family may be more indicative of depression than the "classic" sad mood (Furman et al., 2009; Breslau et al., 2011).

Researchers and sociologists studying Mexico-born Mexican depression have used the term "sociosomatic" to describe how Mexico-born Mexican Americans exhibit signs of depression through restricted and withdrawn social interactions within the Mexican community (Pincay & Guarnaccia, 2007; Rao, Poland & Lin, 2012). Similar to psychosomatic disorders that involve expressing emotional distress via physical symptoms, sociosomatic symptoms of depression involve expressing emotional distress through social symptoms such as withdrawal and isolation (Rao, Polan & Lin, 2012). Sociosomatism is believed to be more common among Latinos because Latinos are typically more community and group focused and more likely to see life as a collective experience compared to non-Hispanic Whites. Further, it makes sense that the area of life that is viewed as most important for Latinos, that is, the community/social arena, would be an area that depressive symptoms manifest (Tyson, 2011).

The above section underscores the importance of understanding and ultimately measuring the similar and dissimilar manifestations of depression for Latinos and specifically persons of Mexican origin.

### **Center for Epidemiologic Studies Depression Scale - Revised (CESD-R)**

Developed in 2004 by a team of researchers at Johns Hopkins University (Eaton et al., 2004), the Center for Epidemiologic Studies Depression Scale - Revised (CESD-R) sought to bring the original Center for Epidemiologic Studies Depression (CES-D) instrument in line with the current understanding of major depression and depressive symptomatology, as delineated by the fourth revision (1994) of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association 2000). The original CES-D has been shown to be useful when assessing depression epidemiology in large-scale, national surveys (Comstock & Helsing, 1976; Eaton & Kessler, 1981; Radloff & Locke, 1986); can be implemented via telephone or self-administration; has been translated into other languages; and is accessible to the elderly, under-served, and poor (Eaton, et al.). The new CESD-R seeks to maintain the characteristics of the original instrument, which allow it to have wide and far-reaching use, while updating its content to align with current knowledge of depression.

To date, very few studies have evaluated the reliability and validity of the CESD-R (Eaton et al. 2004; Van Dam & Earleywine, 2011). This study proposes to evaluate reliability and validity evidence of the CESD-R using a community sample, including cross-validation of the measure on persons of Mexican origin, compared to non-Hispanic Whites.

### **Research Questions**

The study seeks to answer the following research questions:

1. Is the English language version of the CESD-R a reliable measure of depressive symptoms?
2. Is the English language version of the CESD-R a valid measure of depressive symptoms?
3. Do data from persons of Mexican origin (U.S.-born and Mexico-born) factor differently than data from non-Hispanic Whites on the English language version of the CESD-R?

## **Research Methods**

### **Study Design**

The data for this manuscript came from the Texas City Stress and Health Study. The purpose of the original study was to examine the sociobiological stresses associated with living close to technological and environmental health hazards (i.e., oil refineries). Special attention was paid to capturing the experiences of people of Mexican origin. One major advantage of the original study is that it sampled every Hispanic household within Texas City, Texas. Texas City is located 40 miles southeast of Houston, TX, and 14 miles northwest of Galveston, TX. Since Houston is a port of entry for many immigrants from Mexico, Texas City has a sizable population of people of Mexican origin (both Mexico-born and U.S.-born). Another advantage of this dataset is that it is one of the few that contains the CESD-R measure in a relatively large sample of persons of Mexican origin (Peek, Cutchin et al., 2010).

Sampling for the Texas City Stress and Health Study took place over three stages (Peek, Cutchin et al. 2010). During the first stage, all homes in the delimited area of Texas City, TX, were contacted to determine the age and ethnicity of all occupants. Households

with at least one adult who self-identified as Hispanic were classified as “Hispanic.” All homes were categorized into one of three ethnic groupings: 1) adult Hispanics aged 25-64; 2) older Hispanics aged 65 and over; and 3) non-Hispanics. During the second stage, Housing Units (HUs) were selected for inclusion. All Hispanic HUs and 1-in-8 non-Hispanic HUs were selected to be a part of the study. During the third stage, individuals were selected for inclusion from the subset of HUs created in the second stage. One adult per Hispanic HU aged 25-64 was selected at random and considered eligible for inclusion in the study. One adult per non-Hispanic HU (regardless of age), and all older Hispanics aged 65 and over were selected at random and were also considered eligible.

Selected adults were approached for their participation in the study. The institutional review board at the University of Texas Medical Branch (UTMB) approved the study protocol. Informed consent was obtained from all participants, after which residents were interviewed in their homes. The survey instrument contained a number of demographic, behavioral, social, and health measures. Interview rates for this study were 80%, resulting in a sample size of 2,706.

### **Removal of Multi-Level Component**

Given the study design and recruitment strategy described above, it was possible for some HUs to have more than one respondent. With sufficient numbers, such structure would lend itself to a multi-level analysis of the data, with clustering occurring at the HU level. Preliminary exploration of the data indicated that of the original 2706 respondents, 308 respondents (11.38% of the total) shared an HU with at least one other respondent. Thus, there was an insufficient number of clustered respondents to justify conducting a multi-level analysis. Therefore, HUs with multiple respondents were reduced to one respondent each.



Cases were randomly selected and deleted from each HU with multiple respondents. A total of 163 cases were deleted from the dataset, leaving a sample size of 2543.

### **Reduction of Dataset by Ethnicity**

After the multi-level component was removed from the dataset, respondents who did not self-identify as being non-Hispanic White or of Mexican origin (n=494), and who would not be included in the analysis, were removed from the dataset. The resultant sample size was 2049.

### **Missing Values**

Preliminary analysis of the CESD-R, SF-36 Mental Health Subscale, and CAPHRS items indicated that cases had less than 5 percent missing, with most variables missing only 0 to 3 cases, with one variable missing 5 cases (0.2%) and another variable missing 4 cases (0.2%). Data analysis conducted using Mplus Version 7.11 (Muthén & Muthén, 2013) employed full information maximum likelihood (FIML) to address cases with missing data (Muthén, 1984; Muthén & Muthén, 1998-2007).

### **Sampling**

The Texas City Stress and Health sample was further reduced to only include respondents who completed the English language version of the CESD-R and self-identified as non-Hispanic White or as a person of Mexican origin (either U.S.-born or Mexico-born). After removing cases to address the multi-level component and reduction of the dataset by ethnicity, there were a total of 1825 respondents who completed the English CESD-R. Of these, 916 were non-Hispanic White respondents, 766 were U.S.-born persons of Mexican origin, and 143 were Mexico-born persons of Mexican origin.

### **Measures**

*Center for Epidemiologic Studies Depression Scale - Revised (CESD-R): English  
Language Version*

**Original CES-D.** The CES-D (also known as CESD) was developed at the Center for Epidemiologic Studies (CES), National Institute of Mental Health (NIMH), National Institutes of Health (NIH), in 1971 (Radloff, 1977). The CES-D is a compilation of a number of other depression measures, including Zung's depression scale (Zung, 1965), the Beck Depression Inventory (Beck, Ward et al. 1961), and the Minnesota Multiphasic Personality Inventory (MMPI) (Eaton et al., 2004). The CES-D is a self-report measure that contains 20 items that evaluate mood, somatic complaints, interactions with others, and motor functioning. Respondents choose from a 4-point Likert scale (coded value from 0 to 3), with anchors from "Rarely or none of the time (less than one day)" to "Most or all of the time (5-7 days)." Responses are summed (based on their coded value) to create a composite score, ranging from 0 to 60, with people whose final score is 16 or higher being identified as a depressive "case" (Eaton et al., 2004). Generally, those who score 16 or higher have reported 6 of the 20 items to be frequently present over the course of the previous week, or most of the 20 items to be present for a shorter amount of time (Eaton et al., 2004).

Four factors of depressive symptomatology were generally (but not always) found for the original CES-D measure: depressed affect, positive affect, somatic and retarded activity, and interpersonal functioning (Eaton et al., 2004).

**Problems with CES-D.** The CES-D was developed before the third revision of the DSM (Eaton et al., 2004). As such, symptom questions are not directly drawn from the DSM criteria, and contain content that is different from that of the DSM-III (1980), DSM-III-R (1987), DSM-IV (1994), DSM-IV-TR (2000) (Eaton et al.) and DSM-5. Because CES-D

items reflect a different domain than DSM-IV criteria, the two documents are, in effect, evaluating different constructs. For example, the original CES-D does not include symptoms related to anhedonia, psychomotor retardation/agitation, and suicidal ideation, all of which are captured by current DSM criteria (Eaton et al.). In addition, weight changes, sleep problems, feelings of worthlessness, and concentration difficulties are separately measured by a single item each. On the other hand, symptoms related to dysphoria are measured by six items on the CES-D and eight items no longer relate to the current DSM definition of major depression (Eaton et al.). Given these limitations, researchers from Johns Hopkins University sought to revise the original CES-D to bring it in line with the current DSM specifications of depression and depressive symptomatology. The criteria for major depression did not change from DSM-IV to DSM-5.

**Revised CES-D (CESD-R): English Language Version.** The 20-item revised version of the CES-D was primarily developed to better align with the Major Depressive Disorder (MDD) diagnosis in the DSM-IV (Eaton et al., 2004) (Appendix A). The CESD-R was developed to incorporate the following previously omitted symptoms: anhedonia, psychomotor retardation/agitation, suicide ideation. Further, eight items in the original CES-D were removed because they no longer conformed to the DSM-IV diagnostic criteria of MDD. The CESD-R was also changed to include a 5-point response scale, as opposed to the 4-point scale in the CES-D, because it more accurately reflects the time period and symptom severity of MDD. Lastly, the positively worded items regarding mood in the CES-D were deemed confusing and unnecessary and were therefore removed.

According to the developers of the CESD-R, the scale has maintained the strong reliability and validity of the CES-D (Eaton et al., 2004; Van Dam & Earleywine, 2011).

Further, the scores from the CES-D and CESD-R are highly correlated with one another; Pearson's correlations range from 0.88 to 0.93 (Eaton et al. 2004).

The CESD-R has been shown to load on a one-dimensional factor of depression, and break into two main symptom categories, negative mood and functional impairment (Eaton et al., 2004; Van Dam & Earleywine, 2011). These studies included predominately White and African American participants and did not include a significant number of Latinos or individuals of Mexican origin. Further, a search for studies of measurement invariance on the CESD-R by nativity found no studies.

### ***SF-36 Health Survey, Mental Health Subscale***

The SF-36 Health Survey is a brief inventory with 36 questions measuring general health and well-being (Ware, 2004). Data from this measure were used to examine score performance validation of the CESD-R. Specifically, the mental health subscale of the SF-36 was used to assess a mood construct that is expected to have scores correlated with CESD-R scores. The mental health subscale of the SF-36 has been used in previous studies to assess for score performance validation of depression measures (Cruz et al., 2009). The survey is divided into two main components: Physical Health and Mental Health. The Mental Health component is further divided into 4 subscales: Vitality, Social Functioning, Role-Emotional, and Mental Health. The Mental Health subscale is comprised of five items, such as, "Have you been very nervous?" to "Have you been happy?" (Appendix B). Response options for each of the questions are: 1) "all of the time," 2) "most of the time," 3) "some of the time," 4) "a little of the time," and 5) "none of the time." It should be noted that these response options are in reverse order, from greatest frequency to least frequency. Studies have shown

that scores from the SF-36 Health Survey have reliability statistics above .70, with the physical and mental health summary scores yielding reliability estimates above .90 (Ware).

### ***Concern about Petrochemical Health Risk Scale (CAPHRS)***

The Concern about Petrochemical Health Risk Scale (CAPHRS) administered by the Texas City Stress and Health Study was also used in this study. Data from this measure were used to provide score performance validation related to discriminant validity. Specifically, the CAPHRS assesses a construct (concern about petrochemical health risk) that is clearly different than the construct of depression. The CAPHRS has good reliability ( $\alpha = 0.96$ ), and a high degree of internal consistency and discriminant validity (Cutchin, Martin et al. 2008). Four questions about perceived risks associated with living close to oil and chemical plants were developed in-house by the Texas City Stress and Health team (Appendix C). The questions included are: 1) “How concerned are you that pollution from the oil and chemical plants might harm your health or your family’s health?” 2) “How concerned are you that accidents, such as explosions or spills, from the oil and chemical plants might harm your health or your family’s health?” 3) “How concerned are you that stored waste from the oil and chemical plants might harm your health or your family’s health?” And 4) “How concerned are you that the oil and chemical plants might cause health problems or disease in you or your family?” Response options for each of the questions are: 1) “not at all concerned,” 2) “a little concerned,” 3) “moderately concerned,” 4) “very concerned,” 5) “extremely concerned,” 6) “don’t know,” and 7) “refused.”

### **Statistical Analysis**

#### ***Conceptualizing Validity***

Over the last two and half decades the field of social science measurement and instrument testing has experienced a paradigm shift. The traditional view of validation assumes that measurements can be proven to be valid and that the process of validation is static, either a measurement is valid or not valid (Bollen, 1989). This traditional view of validation uses content, criterion, and construct validity to demonstrate whether a measure accurately and fully assesses the construct of study (Bowen, 2005).

The new and broader view of validation evidence asserts that validation is an ongoing process and that measures are not simply deemed valid or not valid (Addock & Collier, 2001). Validity is multifaceted and comprised of multiple pieces that exist on a continuum and includes content validation, score performance validation, respondent-related validation and practice-related validation (Bowen, 2008). The broader view of validation places importance on the interpretation and understanding of the context and application of measurement scores (Bowen, 2008).

This manuscript adopts the broader view of validation evidence and will address the areas of content validation, score performance validation, respondent-related validation and practice-related validation.

### ***Content Validation***

Content validation refers to the ability of a measure to fully address the complete dimensionality of a construct. Principal Axis Factoring (PAF) results were used to evaluate the structure and relationship of the dimensions of depression as measured by the CESD-R. EFA and CFA were conducted on the CESD-R to analyze whether the scores support the multiple dimensions of the CESD-R and to evaluate the statistical associations among the CESD-R items.

PAF, also known as principal factor analysis (PFA) or common factor analysis, is a data reduction method used to determine the least number of factors in a set of data which can account for the common variance (correlation), after removing the unique and error variance (Costello & Osborne, 2005; Owen, 2009). Much debate exists over the merits of PAF as compared to principal components analysis (PCA) (Ford et al., 1986; Bentler & Kano, 1990; MacCallum & Tucker, 1991; Floyd & Widaman, 1995; Costello & Osborne). However, many methodologists agree that PAF is the preferred method of exploratory factor analysis over PCA, because PCA seeks to explain all the variance contained within factored variables, without considering the effects of unique and error variance (Costello & Osborne; Owen). Further, the aim of PAF is to reveal any latent structure that causes the variables to co-vary (Costello & Osborne; Owen).

PAF is also the preferred factor extraction method for evaluating non-normal, multivariate data, whereas a maximum likelihood (ML) approach is preferred when the data are normally distributed (Costello & Osborne, 2000). Initial evaluation of frequency distribution histograms of the CESD-R variables indicates that items are positively skewed, and thus are non-normal. Therefore, the multivariate normality assumption required for ML is violated, and a PAF approach is warranted.

The goal of rotation is to simplify the data structure for interpretation (DeVellis, 2003; Costello & Osborne, 2005; Owen, 2008). Rotation can be either orthogonal or oblique. Varimax, quartimax, and equimax are commonly available orthogonal methods, and direct oblimin, quartimin, and promax are commonly available oblique methods of rotation (Costello and Osborne). Varimax rotation is the most common method used. Orthogonal rotations produce uncorrelated factors, whereas oblique rotations allow factors to correlate

with each other (Costello & Osborne). However, if the factors are truly uncorrelated, then the results from an orthogonal rotation and an oblique rotation should be identical (Costello & Osborne). Given that the variables within the CESD-R are likely to be correlated (i.e., sleep disturbances are likely to be correlated with lack of energy), an oblique rotation is theoretically more likely to result in a more accurate solution. Therefore, the initial factor solution was rotated using the direct oblimin option in PASW Statistics for Windows, Version 18.0 (SPSS Inc., 2009). Because an oblique rotation was used, the *pattern matrix* was examined for factor loadings for each item (Costello & Osborne).

Factor loadings are considered “high” if they are .8 or greater (Velicer & Fava, 1998), but this is rarely achieved. Rather, studies in the social sciences generally report magnitudes between .40 and .70, though a factor loading cutoff as low as .32 has been cited as a minimum rule of thumb (Tabachnick & Fidell, 2001; Costello & Osborne, 2005). For this study, the factor loading cut-off employed for interpretation of items in scales was .32, which is considered to be a “fair” loading (Tabachnick & Fidell, 1996). The factor solution was evaluated for simple structure. When simple structure is achieved each variable loads well on one factor, but not on the other factors (Costello & Osborne, 2005).

Two main methods researchers employ to determine the number of factors to retain in factor analysis are: 1) the *eigenvalue* greater than or equal to 1 criterion (Kaiser, 1960; DeVellis, 2003; Owen, 2008); and 2) the scree test (Costello & Osborne, 2005). *Eigenvalues* are measures of general variance, indicating how much of the variation in the original group of variables is accounted for by a particular factor (Vogt, 2005). A conventional rule for deciding how many factors to retain (or extract) is the *eigenvalue* greater than or equal to 1 criterion (also called the Kaiser-Harris criterion) (Kaiser; DeVellis; Owen). Application of



this rule results in components with an *eigenvalue* less than 1 being removed before the solution is rotated. Despite its conventional usage, methodologists disagree on the accuracy of the *eigenvalue* technique, and many believe the scree test to be the best choice for determining factor retention (Costello & Osborne; Owen). The scree test involves examining the scree plot (as produced by PASW Statistics, or another statistical software package) and identifying the bend or elbow of the curve (Costello & Osborne). The scree plot is a two dimensional graph with item factors on the x axis and eigenvalues on the y axis (Kline, 2005). The data points above the break determines the number of factors to retain. For this study, both *eigenvalues* and the scree test were used to determine the best number of factors to retain..

***Score Performance Validation: Comparison with SF-36 Mental Health Subscale and Concern About Petrochemical Health Risk Scale (CAPHRS)***

Evidence of score performance validity includes evidence that scores from an instrument measuring a construct relate as expected with existing measures of the same construct or other constructs (Trochim & Donnelly, 2006). For this manuscript, the English language CESD-R items were compared to items from a measure designed to measure a related construct, the SF-36 Mental Health Subscale (Ware, 2004) (Appendix B) and a measure designed to measure an unrelated construct, the Concern About Petrochemical Health Risk Scale (CAPHRS) items (Appendix C). Analysis of scores from the CESD-R were compared and contrasted with scores from the SF-36 Mental Health Subscale and the CAPHRS to evaluate convergent and discriminant score performance validity respectively.

***Respondent-Related Validation: Multiple-Group Confirmatory Factor Analysis (CFA)***

Respondent related validation refers to how appropriate and relevant the content and format of the measure is to its target population (Standards for Educational and Psychological Testing, 1999). Multiple-group confirmatory factor analysis (CFA) can provide evidence of a measure's appropriateness across groups. To begin, CFA aims to determine if the dimensionality and factor-loading pattern of an established factor model fits a new sample (either from a similar population as previously examined or from a different population). For this manuscript, the results of the confirmatory factor analysis (CFA) were compared to the results of the EFA to determine if they both supported the same factor structure for the English language CESD-R. In addition, factor models for non-Hispanic Whites, U.S.-born Mexican Americans, and Mexico-born Mexican Americans were compared to determine if factor invariance existed among ethnic groups.

### ***Practice Related Validation***

Practice related validation is an area of validation that addresses the value, functionality, contextual relevance and ethics of using and interpreting measure scores (Cronbach, 1988; Bowen & Powers, 2005). To build the case for practice-related validity of the CESD-R, the social work implications section and the strengths and limitations and future research sections will reflect the importance of assessing the value, functionality, contextual relevance and ethics of using and interpreting CESD-R scores when making policy and clinical decisions regarding persons of Mexican origin.

### ***Reliability Evidence***

**Cronbach's Coefficient alpha ( $\alpha$ ).** The gold standard estimate of reliability is Cronbach's (1951) coefficient alpha,  $\alpha$  ( DeVellis, 2003; Kline, 2005). Cronbach's alpha measures internal consistency reliability (Kline, 2005). It looks at how correlated scores on

items measuring the same construct, i.e., scale items, are to each other (Kline, 2005).

Variability in a set of item scores is due to either actual differences across individuals in the phenomenon being measured (i.e., true variation in the latent construct) or error (DeVellis, 2003). Another way of conceptualizing the difference between the two types is *signal* and *noise* (DeVellis, 2003). Cronbach's alpha partitions the total variance into its two components. The *signal* component equals alpha. That is, alpha equals 1 – error variance (DeVellis, 2003). If the Cronbach's alpha of a measure is low, then the items in the measure may be so dissimilar combining them into a total score may not be appropriate (Kline, 2005). In contrast to creating an observed composite from scale items, latent variable modeling uses scale items as measures of a theoretical latent construct. Using multiple indicators of a construct, such as depression, in the latent variable framework allows for shared variance among the indicators to be defined as variance related to the construct, and unshared item variance to be defined as error. In addition, multiple-group CFA can be utilized to test if the same measure behaves the same way when comparing multiple groups.

## **Statistical Procedures**

### ***Analysis of Categorical Data***

Mplus Version 7.11 (Muthén & Muthén, 2013) was used to test the psychometric properties of the English language CESD-R. In addition, the maximum likelihood estimation approaches used in other statistical software packages rely on the assumption of multivariate normality. In practice, many social science variables are non-normal. Further, survey responses are often coded as yes/no or as scores on an ordered scale (e.g., strongly disagree, disagree, neutral, agree, strongly agree). Values on categorical/ordinal response scales are not meaningful quantities (e.g., the numbers could be reversed from 1 to 5 to 5 to 1). The use of a

polychoric correlation matrix based on the assumption of an underlying normal distribution with thresholds corresponding to observed ordinal values is required to properly analyze such variables. The English language CESD-R dataset contained categorical, non-normal data, which in turn required statistical software that can accurately estimate a polychoric correlation matrix (Muthén & Muthén, 1998-2007).

Mplus employs a multi-step method for ordinal outcome variables that analyzes a matrix of polychoric correlations rather than covariances. This approach works as follows: 1) thresholds are estimated by maximum likelihood, 2) these estimates are used to estimate a polychoric correlation matrix, which in turn is used to, 3) estimate parameters through weighted least squares using the inverse of the “asymptotic covariance matrix” as the weight matrix (Muthén, 1984; Jöreskog, 1990). In Mplus these steps take place automatically when the syntax includes a line identifying outcomes (i.e., indicators) as categorical.

### ***Categorical CFA***

As indicated earlier, Mplus CFA models are capable of analyzing polychoric correlation matrices. When at least one factor indicator is ordered categorical, Mplus offers seven estimator choices: weighted least squares (WLS), robust weighted least squares (WLSM, WLSMV), maximum likelihood (ML), maximum likelihood with robust standard errors and chi-square (MLR, MLF), and unweighted least squares (ULS). The best approach to analyze categorical variables with few categories is the continuous/categorical variable methodology (CVM) estimator (Muthén, 1984; West, Finch et al., 1995). The CVM estimator allows for the analysis of ordered polytomous variables, such as the Likert-like scale employed by the English language CESD-R, and yields unbiased parameter estimates unlike those produced by methods based on normality theory (West, Finch et al.). The CVM

approach is also referred to as a robust weighted least squares approach, and the estimators are WLSMV and MLSM in Mplus. An optimal choice for categorical outcomes is weighted least-squares with mean and variance adjustment (WLSMV) if the sample size is 200 or greater (Muthén et al., 1997; Flora & Curran, 2004).

The sample with data from the English language CESD-R was originally randomly split into half so the EFA and CFA could be conducted on different subsamples. The first half was used to conduct the EFA. However, problems encountered with the second half at the CFA stage made it necessary to use the full sample. Exploration of the data revealed that a number of items exhibited non-normal distributions, floor effects, and small cell sizes for some responses. For example, few respondents indicated that “I wanted to hurt myself” nearly every day for 2 weeks. Because of this limitation, the entire dataset was used to run the CFA, to maximize the number of cases and variance available for analysis.

The fit of CFA models was evaluated using:  $\chi^2$  (chi-square), RMSEA, CFI, and TLI. The WLSMV  $\chi^2$  has been shown to perform well in Mplus (Flora & Curran, 2004). The model chi-square ( $\chi^2$ ) is an absolute fit index. A  $\chi^2$  that is non-significant ( $p \geq .05$ ) suggests that the model fits the data well. However, commonly in social science research the  $\chi^2$  remains significant in larger samples (Kenny & McCoach, 2003). The root mean square error of approximation (RMSEA) is a parsimony correction index which means more complex models will be considered as having poorer fit (Harrington, 2008). The RMSEA evaluates whether the model fits reasonably well in the population, with  $RMSEA \leq .05$  indicating close approximate fit, between .05 and .08 indicating reasonable error of approximation, and  $RMSEA \geq .10$  suggesting poor fit (Kline, 2005). Comparative fit indices evaluate the fit of the model compared to a more restricted, nested baseline model

(Harrington), and include the CFI and TLI. There are multiple guidelines for “acceptable” model fit, but in general, a Comparative Fit Index (CFI) greater than .90 (Kline) or .95 (Brown, 2006) (with a range from 0 to 1) and a Tucker-Lewis Index (TLI) greater than .95 (Brown) suggests reasonably good fit (Harrington).

### ***Multiple-Group CFA***

Multiple group confirmatory factor analysis was used to evaluate how well CFA models fit across different groups and populations. Of particular interest for this study was the question of whether or not the factor structure of the English language CESD-R was similar across three different ethnic groups: 1) non-Hispanic Whites, 2) U.S.-born persons of Mexican origin, and 3) Mexico-born persons of Mexican origin. Just as in the CFA, the entire dataset was used for the Multiple-Group CFA, to maximize the number of cases and variance within items to evaluate differences in factor structure between ethnic groups.

Mplus’s default full information procedure for missing data was used in all analyses. The dataset contained 1821 cases, of which 917 cases were non-Hispanic Whites, 763 cases were U.S.-born Mexican Americans, and 141 cases were Mexico-born Mexican Americans. Covariance coverage ranged from .979 to 1.000, indicating a high percentage of data available for analysis.

Additionally, the dataset was evaluated to ensure that for each item of the CESD-R, there was the same number of response categories with at least one case for each of the three ethnic groups. In situations where this was not the case (usually due to floor effects), response categories were collapsed. Response categories were collapsed for six of the 16 items.

Given the ordered, categorical nature of the outcome variables, Mplus Version 2.1 or higher was required. Version 7.11 (Muthén & Muthén, 2013) was used to run the multiple-group CFA, and measurement invariance of structural parameters across groups were evaluated. Muthén and Muthén (Mplus Short Courses: Topic 2, 2009, p.168) suggest the following steps to conduct multiple-group analysis with categorical outcomes:

- 1) Fit the model separately in each group. For this study, the two-factor model developed in the EFA and evaluated in the CFA was fit separately for the three ethnic groups (U.S.-born Mexican Americans, Mexico-born Mexican Americans, and non-Hispanic Whites).
- 2) Fit the model in all groups allowing all parameters to be free except factor means which are fixed to zero in all groups and scale factors which are fixed to one in all groups. For this study, data from all ethnic groups were evaluated together in this step to test the model without measurement constraints.
- 3) Fit the model in all groups holding the factor loadings and thresholds equal across groups with factor means fixed to zero in the first group and free in the other groups and scale factors fixed to one in the first group and free in the other groups. For this study, loadings and thresholds for all three ethnic groups were constrained to be equal to evaluate measurement invariance.
- 4) Modify the model. For this study, chi-square difference testing (using the DIFFTEST syntax) was employed to determine whether fit deteriorated between Step 2 and Step 3, and if so, to pinpoint the parameters which are non-invariant.

## **Results**

### **Sample Characteristics**

The current sample was on average middle-aged, represented more by women than men, and predominately comprised of Non-Hispanic Whites and U.S.-born Mexican Americans (Table 1).

Table 2 shows descriptive statistics for the scores on the CESD-R. The CESD-R 80 is the standard version of the CESD-R and uses the maximum score of 80. The CESD-R 60 was calculated to allow for comparison to the original CESD. The CESD-R60 was created by taking the highest category (“nearly every day for two weeks”) and collapsing its scores with the second highest category (“5 - 7 days”). Per the original CESD instrument, a cut-off score of 16 and above indicates potential concern for depression (Radloff, 1977).

Table 2 shows the distribution of scores on the CESD-R for the three ethnic groups. In particular, it highlights the differences by nativity of sub-threshold ( $\leq 16$ ) and threshold ( $> 16$ ) depressive scores. Non-Hispanic Whites had the highest percentage of threshold depressive scores, followed by U.S.-born Mexican Americans and Mexico-born Mexican Americans.

### **Research Question 1: Is the English language version of the CESD-R a reliable measure of depressive symptoms?**

This section presents findings with respect to Research Question 1. The result presented here addresses reliability.

The Cronbach’s coefficient alpha ( $\alpha$ ) of the measure was evaluated to determine the reliability of the CESD-R. The internal consistency of the CESD-R English version was high ( $\alpha = .93$ ). The high alpha score indicates that, at least for these data, the CESD-R items are inter-related and are measuring the same construct. The high Cronbach’s alpha score



indicates that the measure being used to generally define the latent construct of depression has items that are inter-related.

**Research Question 2: Is the English language version of the CESD-R a valid measure of depressive symptoms?**

This section presents findings with respect to Research Question 2. Results presented here address score performance validation and content validation.

***Score Performance Validation***

The CESD-R was compared to the SF-36 Mental Health subscale to evaluate score performance validity. The Pearson's R value was relatively high ( $r = -.74, p < .001$ ). Because the response categories of the SF-36 Mental Health Subscale are in reverse order, with the greatest frequency category coded as 1 ("All of the time") and the least frequency category coded as 5 ("None of the time"), the negative R value indicates a positive correlation between items on the CESD-R and the SF-36 Mental Health Subscale. This suggests that the two instruments are measuring a similar construct.

The CESD-R was compared to the Concern about Petrochemical Health Risk Scale (CAPHRS) to also evaluate score performance validity. The Pearson's R value was low ( $r = .20, p < .001$ ) indicating a small correlation between items on the CESD-R and the Concern about Petrochemical Health Risk Scale (CAPHRS). This suggests that the two instruments are not well-correlated and are measuring different constructs.

***Content Validation: Exploratory Factor Analysis***

An Exploratory Factor Analysis (EFA) was conducted to evaluate the content validity of the CESD-R. As discussed earlier, a number of techniques were employed to determine the most parsimonious factor structure of the CESD-R.

**Eigenvalues criterion.** Using the eigenvalues greater than 1 criterion, PASW Statistics returned a three factor solution (Table 3). While this was a useful starting point, results suggest a two factor solution, as the third factor falls on the borderline of the eigenvalue greater than 1 criterion.

**Scree plot.** The “elbow” or “bend” in the scree plot suggested that a one factor solution was the most simple and parsimonious structure for the data (Figure 7). This also suggested that a second order factor may be the best solution.

**Factor loadings.** Maximum likelihood estimation using oblique rotation (direct oblimin) limited to one-, two-, and three-factor solutions was used to explore factor loadings. None of the solutions revealed factor loadings that were theoretically and psychometrically parsimonious. While the two-factor solution provided the closest approximation to a parsimonious model, it highlighted the challenge that Item 18 did not load well on either factor.

**Removal of items.** First, Item 2 (“I could not shake off the blues”) was removed because of the outdated manner in which it described feelings of sadness (DSM-5, 2013) and because of its lack of cross-cultural relevance (Lehti et al., 2010). The pattern matrix suggested a two-factor solution, and contained one item (Item 18 “I lost a lot of weight without trying to”) which did not load onto either factor, and contained five items which contained a factor loading of .32 or higher on both factors (also referred to as double-loading items).

Next, Item 18 (“I lost a lot of weight without trying to”) was removed from the model, as it had been shown to not load well on either factor in a two-factor solution. The resultant two-factor solution contained five double-loading items.

Double-loading items were then removed from the model, in a step-wise manner (the item with the highest secondary factor loading first), and the two-factor solution pattern matrix was evaluated after each removal. A number of item combinations were explored to determine the most parsimonious model.

**Final EFA model.** After all the factor structures were evaluated, a 16-item, two-factor model solution was the most theoretically and psychometrically supported (Table 4). The following four items were removed: Item 2 (“I could not shake off the blues”), Item 8 (“Nothing made me happy”), Item 9 (“I felt like a bad person”), and Item 18 (“I lost a lot of weight without trying to”). The model suggested one large factor which formed the latent construct of *negative mood and functional impairment*. A smaller set of items formed a second factor related to *suicide*. One item, Item 6 (“I felt sad”), from the first factor also presented a marginal loading (.321) on the second factor.

#### ***Content Validation: Confirmatory Factor Analysis***

A Confirmatory Factor Analysis (CFA) was conducted to evaluate the content validity of the CESD-R. As discussed earlier, a number of techniques were employed to determine the most parsimonious factor structure of the CESD-R.

**Initial two-factor model from EFA.** A two-factor CFA was conducted using Mplus. As determined by the exploratory factor analysis, the two-factor model with one double-loading item, had the most theoretical and statistical parsimony. Overall, the fit of the two-factor model was acceptable. While the chi-square test of model fit was significant  $\chi^2$  (102) = 1519.98,  $p < .001$ , and the RMSEA (.09 [90% CI = .08, .09]) was above .08, the CFI (.96) and TLI (.95) were greater than .95 indicating good model fit (Table 5).

**Modifications to improve model fit.** Mplus standardized model results indicated that Item 6 (“I felt sad”) only had a factor loading of .21 on the *suicide* factor. Because of this low loading, Item 6 was removed from the *suicide* factor. Modification indices were also evaluated to improve model fit. Modifications were added one at a time, and resultant model fit indices and modification indices were evaluated. A number of model structures were explored, including one-factor and second-order factor model solutions, to determine the model with the best fit.

**Final CFA model.** After all the model structures were explored, a 16-item, two-factor model solution was the most theoretically and psychometrically supported. The initial double-loading item (Item 6 “I felt sad”) was removed from the *suicide* factor, but remained in the *negative mood and functional impairment* factor. The following correlated errors were also included to improve model fit: Item 19 (“I had a lot of trouble getting to sleep”) with Item 5 (“My sleep was restless”); Item 6 (“I felt sad”) with Item 4 (“I felt depressed”); and Item 3 (“I had trouble keeping my mind on what I was doing”) with Item 20 (“I could not focus on the important things”). The correlation of these three pairs of errors made theoretical sense in terms of how depressive symptoms are classified in the DSM-5 and is consistent with the research on clustering of depressive symptoms (Uehara et al., 2011). Items 5 and 19 are both somatic symptoms of depression and indicate sleep disturbances commonly seen in depression. Items 4 and 6 are core indicators of depressed mood and are used interchangeably in diagnostic interviews (Sherrill & Kovacs, 2000). Item 3 and 20 are items commonly used to assess for the impairment depression has on concentration. The fit of the final two-factor model was good, and had improved over the initial EFA model. While the chi-square test of model fit was significant  $\chi^2(100) = 583.66, p < .001$ , the RMSEA (.05

[90% CI = .05, .06]) was between .05 and .08 indicating reasonable error of approximation, and the CFI (.99) and TLI (.98) were greater than .95 indicating good model fit (Table 5).

**Research Question 3: Do data from persons of Mexican origin (U.S.-born and Mexico-born) factor differently than data from non-Hispanic Whites on the English language version of the CESD-R?**

This section presents findings with respect to Research Question 3. Results presented here address respondent-related validation.

***Respondent-related Validation***

A Multiple-Group Confirmatory Factor Analysis was conducted to evaluate the content validity of the CESD-R. As discussed earlier, a number of techniques were employed to determine the most parsimonious factor structure of the CESD-R.

**Adjustments to dataset and model.** First, the dataset was evaluated to ensure that for each item of the CESD-R, there was the same number of response categories with at least one case for each of the three ethnic groups. In situations where this was not the case (usually due to floor effects), response categories were collapsed. Response categories were collapsed for six of the 16 items. Despite being collapsed into two response categories, initial runs using the final CFA two-factor model indicated that Item 15 (“I wanted to hurt myself”) still had too few cases for Mexico-born Mexican Americans in response category 2. Thus, Item 15 was removed from the model. The resultant 15-item model contained a two-item *suicide* latent variable.

**Model fit without measurement invariance.** Following recommended steps (Muthén & Muthén, Mplus Short Courses: Topic 2, 2009, p.168), the new model was fit separately for the three ethnic groups (non-Hispanic Whites, U.S.-born Mexican Americans,

and Mexico-born Mexican Americans). Although the chi-square tests of model fit for non-Hispanic Whites,  $\chi^2 (86) = 333.85, p < .001$ , and U.S.-born Mexican Americans,  $\chi^2 (86) = 293.94, p < .001$ , were significant indicating poor fit, the RMSEA fit indices supported good fit (Table 6). Also, the chi-square test of model fit for Mexico-born Mexican Americans was not significant,  $\chi^2 (86) = 108.09, p = .054$ , indicating good fit. The RMSEA was .06 [90% CI = .05, .06] for non-Hispanic Whites, .06 [90% CI = .05, .06] for U.S.-born Mexican Americans, and .04 [90% CI = .00, .07] for Mexico-born Mexican Americans. CFI and TLI model fit results were also in the high range (CFI = .98-.99, TLI = .98-.99). The fit statistics suggest that the model fit well for all three groups.

Next, the two-factor model was fit for all ethnic groups together allowing all parameters to be free except factor means which were fixed to zero in all groups and scale factors which were fixed to one in all groups. The chi-square test of model fit result was significant,  $\chi^2 (258) = 642.33, p < .001$ , but the other model fit indices (RMSEA = .05 [90% CI = .05, .05]; CFI = .99, TLI = .99) indicated that the model fit well (Table 6).

**Model fit with measurement invariance.** To evaluate measurement invariance, the model was fit in all groups with factor loadings and thresholds held equal across groups with factor means fixed to zero in the first group (non-Hispanic Whites) and free in the other groups (U.S.-born Mexican Americans and Mexico-born Mexican Americans), and scale factors fixed to one in the first group and free in the other groups. The chi-square test of model fit was significant,  $\chi^2 (358) = 647.46, p < .001$ , but the other model fit indices (RMSEA = .04 [90% CI = .03, .04]; CFI = .99, TLI = .99) suggest that the model fit well (Table 6).

**Determining partial measurement invariance.** A chi-square difference test between the configural model and the scalar model was conducted. This invariance test returned a significant p-value (.01), which suggested that the restriction imposed by the scalar model worsened the fit of the model, and thus the non-invariant (configural) model had better fit. To pinpoint the parameters with invariance, each parameter was constrained individually and compared to the configural model using the DIFFTEST syntax. This evaluation of individual parameters found that only one item, Item 14 (“I wished I were dead”), was non-invariant. Given that only one item was found to be non-invariant, the measure as a whole can be considered invariant, and the scalar model can be considered the better model.

### **Discussion and Conclusion**

The discussion section will cover key theoretical issues that influenced decisions of statistical modeling, how the results answered the research questions, how study findings compare to previous research, study strengths and limitations, and implications for social work.

Researchers recommend incorporating valid and relevant theoretical and methodological perspectives to sufficiently and accurately explain social science data (Bowen & Guo, 2012; Joiner, 2005; Klein, 2005; Rubin & Babbie, 2007; Muthén, 1989). In addition, it is considered best practice to use relevant psychosocial theories in determining factor structure and re-specifying structural models (Bryne, 2013, Bowen & Guo, 2012; Muthén & Muthén, 2007). The current study used statistical theory (discussed in analysis section) and psychosocial theories to guide modeling decisions.

Previous confirmatory factor analysis studies conducted on the CESD-R yielded a one-dimensional factor structure, *depression*, with two prominent sub-factors emerging, *negative mood* and *functional impairment* (Eaton, 2004; Van Dam & Earleywine, 2011). However, it is important to note that previous research on the CESD-R primarily used non-Hispanic White samples and did not include Mexico-born Mexican respondents. For the current study, both the one-factor *depression* solution and the two-factor solution of *negative mood* and *functional impairment* did not fit the data well. Hence, an exploratory factor analysis approach informed by theories explaining depression and suicide among Latinos, factor loading values, and results of the scree plot were used to develop the final two-factor solution. The final two-factor solution of *negative mood and functional impairment* and *suicide*, fits the data well. The following discussion centers on answering the research questions for this study and compares and contrasts this study's finding with other relevant findings.

The findings from the current study have addressed the research questions by confirming that the CESD-R is a reliable measure of depression. The internal consistency of the CESD-R English version, as applied to the current data, was very good. The Cronbach's alpha value is comparable to previous studies of the CESD-R (Eaton, 2004; Van Dam & Earleywine, 2011).

Findings from this study partially support the CESD-R as a valid measure of depression. The original 20 item CESD-R (Eaton, 2004) did not fit the data well. A 16 item, two-factor model version of the CESD-R that excluded the items "I could not shake off the blues," "Nothing made me happy," "I felt like a bad person," and "I lost a lot of weight without trying to" fit the data best and made the most theoretical sense. Other researchers



studying the validity of the CESD-R found that the 20 item scale fit their data well (Eaton, 2004; Van Damm, 2011). Perhaps the reason why this study's data did not fit the CESD-R as well as the data from other studies is because the other studies used predominantly non-Hispanic White participants and much larger sample sizes. More research is needed to explore the merit of these explanations.

Results of the multiple-group CFA yielded measurement invariance for the 15 item English language version of the CESD-R. During the multiple-group CFA evaluation process, Item 15 ("I want to harm myself") was removed from the *suicide* factor. The item had to be removed as there were too few Mexico-born Mexican Americans who indicated that they wanted to harm themselves. The need to remove this item supports other research findings that suggest Mexico-born Mexican Americans do not associate suicide with "feeling depressed" and have significantly lower rates of suicidal thoughts and behaviors compared to non-Hispanic Whites and U.S.-born Mexican Americans (Tyson, 2011; Borges et al., 2009; Breslau et al., 2001).

The results of the Multiple-Group CFA also indicate that the CESD-R may have problems with floor effects on several items, especially items related to suicide. Evidence is emerging that the preferred approach to assess for suicide is to use dichotomous scales that are specifically designed to measure suicide, and to measure suicide separate from depression (Posner et al., 2011; Brown, 2011).

### **Strengths**

The current study has several strengths that increase its applicability and contribution to the field of depression and Latinos. First, it included a moderate sample of Mexico-born Mexican Americans. Few studies of depression among Latinos have included an ample size

of Mexico-born Mexican Americans (Breslau et al., 2011). Second, a Multiple-Group CFA was conducted on three separate groups: non-Hispanic Whites, U.S.-born Mexican Americans, and Mexico-born Mexican Americans. To this author's knowledge, this is the first study that has tested invariance of the CESD-R. Third, Mplus and its WLSMV estimator were used instead of the ML estimator to estimate the difference between the Likert-like scale items of the CESD-R. Fourth, the study is one of only a few that has examined the psychometric properties of the revised version of the CES-D. Despite the evolution of depression diagnoses, very little research has been conducted to evaluate measures that are current with the most updated DSM diagnostic criteria for depression.

### **Limitations**

The current study also has several limitations that need to be considered when interpreting the results. First, the three groups included in the study, non-Hispanic Whites, U.S.-born Mexican Americans, Mexico-born Mexican Americans were disproportionate in size. In particular, the effect that disproportionate group size has on the results of Multiple-Group CFA is not entirely known, but it may limit the ability for the WLSMV estimator to account for the differences in the factor structure of the group that is underrepresented (Byrne, 2013). Second, the total responses across all three groups on many of the CESD-R items demonstrated floor effects. Floor effects resulted in collapsing a number of the items into fewer groups. Of note, the items related to suicide showed very little range in responses, with most of the responses on or near the floor. Third, it is important to mention that the study sample was very healthy in terms of depressive symptoms.

### **Implications**

Additional studies that use this study's truncated version (15-item) of the CESD-R on other sample populations are needed to determine if the results are valid. Research on the CESD-R should include clinical samples to determine the suitability for the five-point Likert-like scale and utility of the suicide items. Also, data were collected by going door-to-door and soliciting participation in the study. This approach may have precluded individuals who were not home during the day. In addition, the study was not anonymous and therefore some individuals, especially those who were undocumented, may have been reluctant to respond to an invitation to participate in the study.

In the present study, Multiple-Group CFA was used as the source of evidence for respondent related validation. It is recommended that future studies on the CESD-R include cognitive interviewing conducted by persons of Mexican origin. Analysis of the cognitive interviews should emphasize how respondents viewed the terms, phrases and assumptions the CESD-R makes about depression.

### ***Practice Related Validity***

The study results indicate that scores on the CESD-R for Mexico-born Mexican Americans may be different than US born Mexican Americans and non-Hispanic Whites. Specifically, it appears that Mexico-born Mexican Americans experience and conceptualize suicide separately from depressed mood. This finding underscores the importance of using caution when using the CESD-R as a stand-alone method of determining depression among Mexico-born Mexican Americans. As other studies have indicated, semi-structured diagnostic interviews including open-ended questions about emotions and feelings, interviews with family members, a separate measure for suicide, and utilization of interviewers from similar cultural groups should augment self-report measures (Tyson, 2011;

Breslau et al., 2011; Rao, Poland & Lin, 2012; Pincay & Guarnaccia, 2007; Borges et al., 2009). Using a multidimensional assessment approach is vital in capturing the culturally specific manifestations of depression among Mexico-born Mexican Americans and Latinos. Relying solely on CESD-R scores to determine if depressive symptoms exist and are functionally impairing could result in misdiagnosing depression. The misdiagnosing of depression in Latino populations is one of the reasons why Latinos do not receive the mental health care they need (Breslau et al., 2011; Aguilar-Gaxiola & Thomas, 2009). Further studies on the CESD-R should test whether scores on the CESD-R converge with semi-structured interviews designed to assess depression among Latinos, whether CESD-R scores lead to appropriate referral to mental health referral, and whether CESD-R scores respond as expected in measuring the effectiveness of evidence based treatments of depression.

Table 1

English Language CESD-R: Sociodemographic Characteristics (N = 1,825)

Sociodemographic Characteristic	Descriptive Statistics
Age	mean = 49.7 (SD = 15.9) min = 25, max = 91 median = 49
Gender	
Male	790 (43%)
Female	1,035 (57%)
Ethnicity	
Non-Hispanic White	916 (50%)
U.S.-born Mexican American	766 (42%)
Mexico-born Mexican American	143 (8%)

Table 2

English Language CESD-R: Scores by scale version (N = 1,824)

Descriptive Statistics	Potential Concern for Depression by Ethnicity (>16 cut off score)		
		≤ 16	>16
CESD-R 80			
mean = 9.4 (SD = 12.6)	Non-Hispanic White	723 (78.9%)	193 (21.1%)
median = 4	U.S.-born Mexican American	614 (80.2%)	152 (19.8%)
min = 0, max = 77	Mexico-born Mexican American	125 (88.0%)	17 (12.0%)
	TOTAL	1,462 (80.2%)	362 (19.8%)
CESD-R 60			
		≤ 16	>16
mean = 8.6 (SD = 10.9)	Non-Hispanic White	742 (81.0%)	174 (19.0%)
median = 4	U.S.-born Mexican American	623 (81.3%)	143 (18.7%)
min = 0, max = 60	Mexico-born Mexican American	126 (88.7%)	16 (11.3%)
	TOTAL	1,491 (81.7%)	333 (18.3%)

Table 3

English Language CESD-R: Exploratory Factor Analysis – Eigenvalues criterion

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.089	45.447	45.447	8.643	43.213	43.213	8.077
2	1.582	7.912	53.358	1.131	5.653	48.866	2.809
3	1.061	5.306	58.664	.618	3.092	51.958	6.345
4	.991	4.953	63.617				
5	.854	4.268	67.885				
6	.691	3.457	71.342				
7	.654	3.271	74.613				
8	.617	3.086	77.699				
9	.561	2.804	80.503				
10	.505	2.523	83.026				
11	.469	2.344	85.370				
12	.456	2.282	87.652				
13	.394	1.971	89.623				
14	.373	1.864	91.486				
15	.345	1.726	93.212				
16	.333	1.665	94.877				
17	.303	1.516	96.394				
18	.290	1.448	97.841				
19	.258	1.291	99.133				
20	.173	.867	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Figure 7

English Language CESD-R: Exploratory Factor Analysis – Scree Plot

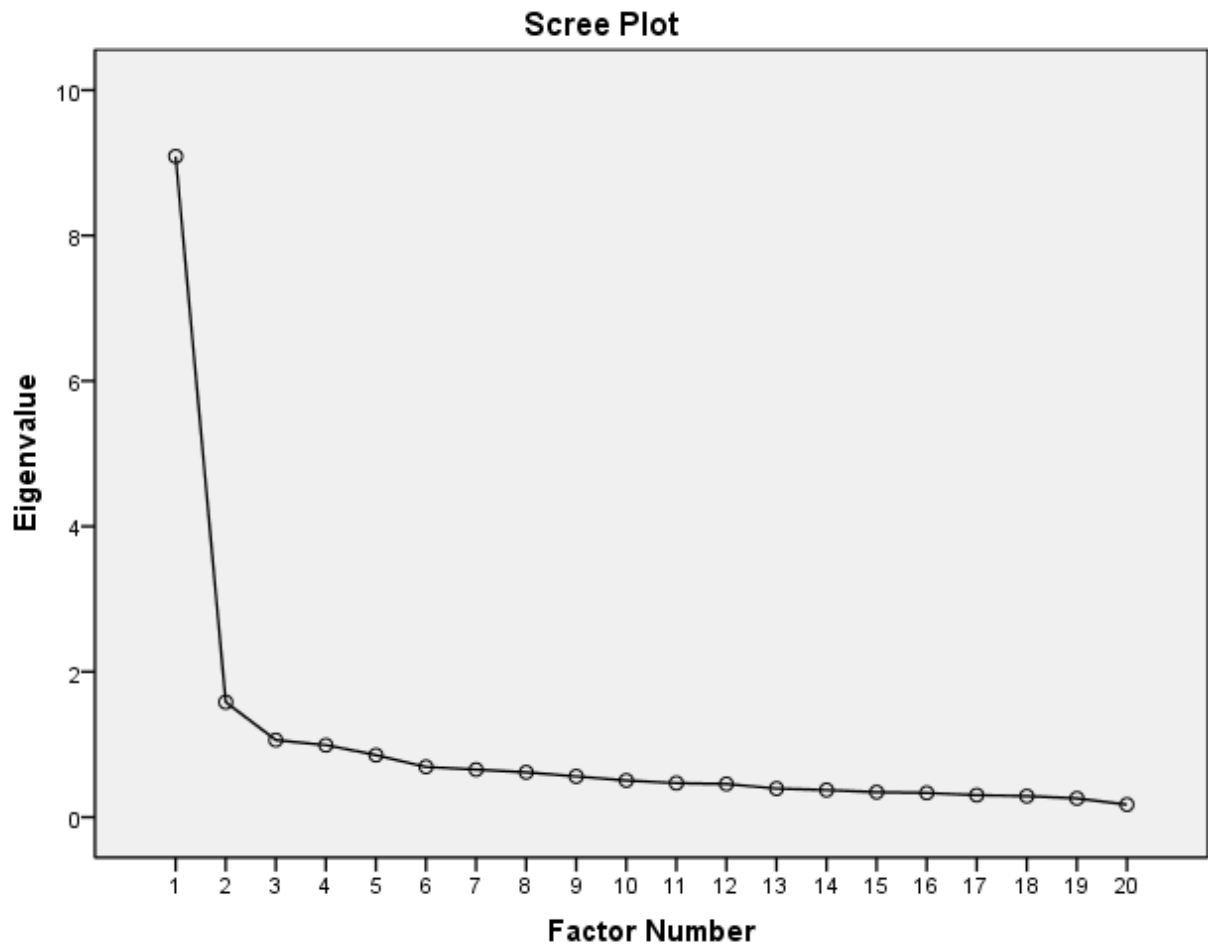




Table 4

English Language CESD-R: Exploratory Factor Analysis – 2 Factor Structure

Pattern Matrix <sup>a</sup>		
	Factor	
	1	2
1. My appetite was poor	.535	
3. I had trouble keeping my mind on what I was doing	.633	
4. I felt depressed	.605	
5. My sleep was restless	.740	
6. I felt sad	.573	.321
7. I could not get going	.769	
10. I lost interest in my usual activities	.592	
11. I slept much more than usual	.495	
12. I felt like I was moving too slowly	.801	
13. I felt fidgety	.660	
14. I wished I was dead		.795
15. I wanted to hurt myself		.617
16. I was tired all the time	.777	
17. I did not like myself		.461
19. I had a lot of trouble getting to sleep	.701	
20. I could not focus on the important things	.671	

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Factor 1: negative mood and functional impairment

Factor 2: suicide

Table 5

English Language CESD-R: Confirmatory Factor Analysis - Fit Indices

Model	$\chi^2$ (df) <i>p</i>	RMSEA [90% CI]	CFI	TLI
Initial 2-factor EFA Model	1519.98 (102) .000	.09 [.08, .09]	.96	.95
Final 2-factor CFA Model	583.66 (100) .000	.05 [.05, .06]	.99	.98

$\chi^2$  = chi-square statistic, df = degrees of freedom, RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index

Table 6

English Language CESD-R: Summary of Results for Single and Multiple-Group Analyses

	Chi-square $\chi^2$ (df) <i>p</i>	RMSEA [90% CI]	CFI	TLI
Without Measurement Invariance				
Non-Hispanic White (n=917)	333.85 (86) .000	.06 [.05, .06]	.98	.98
U.S.-born Mexican American (n=763)	293.94 (86) .000	.06 [.05, .06]	.99	.99
Mexico-born Mexican American (n=141)	108.09 (86) .054	.04 [.00, .07]	.99	.99
Together (least constrained model) (n=1821)	642.33 (258) .000	.05 [.05, .05]	.99	.99
With Measurement Invariance				
All ethnic groups together with measurement invariance (n=1823)	647.46 (358) .000	.04 [.03, .04]	.99	.99

Manuscript III: Reliability and Validity Evidence of the Spanish Language  
Center for Epidemiologic Studies Depression Scale - Revised (CESD-R)

As the Latino population grows in the U.S., so does the need for quality mental health services. Good mental health treatment starts with a thorough and accurate assessment. Language is a considerable barrier in providing mental health treatment to Latinos, especially when one takes into account that the majority of mental health clinicians working in the U.S. are not bilingual. Valid and reliable mental health assessment instruments that are translated into Spanish are vital in collecting information about Latino mental health problems. Research has found that using a combination of self-report and semi-structured interviews is the best approach to assess depression in Latino populations (Breslau et al., 2011; Aguilar-Gaxiola & Thomas, 2009). Some individuals will feel more comfortable and be more candid in filling out a self-report questionnaire, whereas others feel more comfortable answering questions face-to-face (Aguilar-Gaxiola & Thomas, 2009).

Further, as technology advances and a reliance on the internet continues to trend up, the practice of filling out self-assessments of mental health problems, including depression, increases (<http://cesd-r.com/>). This has implications for self-referral to mental health services. If on-line self-report measures are not reliable and valid, individuals who fill out on-line self-assessments may not receive accurate information about the scope or severity of their mental health symptoms.

This manuscript aims to test the validity and reliability evidence of the Spanish translated version of a commonly used measurement of depression, the CESD-R.

### **Literature Review**

It is paramount that mental health research conducted on Latinos incorporates reliable and valid assessments that have been translated into Spanish (Ponce, Hays, & Cunningham, 2006; Grzywacz et al., 2006; Guarnaccia, Angel, & Worobey, 1989). Valid assessments of depression translated into Spanish can assist in accounting for some of the cultural differences in the conceptualization and assessment of depression (Aguilar-Gaxiola & Thomas, 2009; Guarnaccia et al., 1989; Trimble, 2007; Kenny & McCoach, 2003). Consideration of the unique cultural perceptions about depression in the Latino culture is needed to best assess Latinos who are depressed (Grzywacz, et al., 2006). Spanish translation will not address all of the cultural differences that exist in perceptions of depression, but will, at a minimum, ensure semantic equivalence (Harkness, 2003).

There are many challenges to ensuring that constructs within assessment measurements are properly represented in the respondent's own cultural context (Aguilar-Gaxiola & Thomas, 2009). One of the main challenges is language translation. The steps and overall process of how an assessment instrument is translated from one language to another have implications for validity. There are three main components to a well-translated assessment instrument: semantic equivalence across languages, conceptual equivalence across cultures, and normative equivalence to the source survey (Hunt & Bhopal, 2004). *Semantic equivalence* refers to the words and sentence structure in the translated text expressing the same meaning as the source language. *Conceptual equivalence* is when the concept being measured is the same across groups, although wording to describe it may be

different. *Normative equivalence* describes the ability of the translated text to address social norms that may differ across cultures.

Back translation can improve the reliability and validity of research in different languages by requiring that the quality of a translation is verified by an independent translator translating back into the original language (Smith, 2004). The original and back-translated documents can then be compared. If the two documents are similar, then it can be surmised that the instrument in both languages is semantically equivalent. Another technique to assess for semantic equivalence is to conduct cognitive interviewing (Hunt and Bhopal, 2004). Cognitive interviewing could be used to assess for cross-cultural semantic equivalence by determining if the translated question retains the intended meaning.

Conceptual equivalence can be evaluated by multiple group confirmatory factor analysis. Multiple group confirmatory factor analysis is able to assess whether different ethnic groups respond similarly to an assessment instrument (Byrne, 2013). In addition, how a construct such as depression is conceptualized across cultural groups can be explored using ethnographic research that delves into the cultural context of a construct (Tyson, 2011).

Normative equivalence can be addressed by using ethnographic research. Ethnographic research, specifically the observations and questions used in this approach can assist in determining if a construct conforms to the social norms of a particular culture. For example, Tyson and colleagues (2011) used ethnographic research to determine if cultural specific norms influenced the conceptualization of depression across multiple Latino subgroups.

**Center for Epidemiologic Studies Depression Scale - Revised (CESD-R)**

The Center for Epidemiologic Studies Depression Scale - Revised (CESD-R) was developed in 2004 by a team of researchers at Johns Hopkins University (Eaton et al., 2004). Their goal was to update the original Center for Epidemiologic Studies Depression (CES-D) instrument so that it captured the current understanding of major depression and depressive symptomatology, as per the fourth revision (1994) of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association 2000). The original CES-D has been used extensively to assess depression epidemiology in national surveys (Comstock & Helsing, 1976; Eaton & Kessler, 1981; Radloff & Locke, 1986); can be self-administered, administered over the telephone, or in-person by a researcher; has been translated into other languages; and is accessible to many at-risk segments of the population, including the elderly and the poor (Eaton, et al.). The new CESD-R seeks to maintain the accessibility strengths of the original instrument, while updating its content to reflect current knowledge of depression.

There are few published studies that evaluate the reliability and validity of a Spanish language version of the CESD-R (Eaton et al. 2004; Van Dam & Earleywine, 2011). This dissertation evaluates the reliability and validity evidence of a Spanish language version of the CESD-R using a community sample of Spanish-speaking Mexico-born Mexican Americans living in Texas City, Texas.

### **Research Questions**

- 1) Is the Spanish language version of the CESD-R a reliable measure of depressive symptoms?
- 2) Is the Spanish language version of the CESD-R a valid measure of depressive symptoms?

- 3) Do data from persons of Mexican origin from the Texas City study factor similarly to data from a Mexico City study (Gonzalez-Forteza, et al., 2008) on the Spanish language version of the CESD-R?

## **Research Methods**

### **Study Design**

This study uses data from the Texas City Stress and Health Study (Peek et al., 2008). The purpose of the original study was to explore the sociobiological stresses experienced by Texas City residents living close to technological and environmental health hazards (i.e., oil refineries). Texas City, Texas, is located approximately 40 miles southeast of Houston, Texas is close to Galveston, Texas, and contains a sizable population of persons of Mexican origin (both Mexico-born and U.S.-born). The Texas City Stress and Health Study paid special attention to capturing the experiences of persons of Mexican origin, and sampled every Latino household in Texas City. As a result, this dataset is one of the few that has administered the CESD-R to a relatively large sample of persons of Mexican origin (Peek, Cutchin et al., 2010).

Sampling for the Texas City Stress and Health Study occurred over three stages (Peek, Cutchin et al., 2009). First, all households in the catchment area of Texas City, Texas were contacted to determine the age and ethnicity of its occupants. Households with at least one adult who self-identified as Latino were classified as “Hispanic.” Then, all homes were categorized into three groups based on ethnicity and age: 1) adult Hispanics aged 25-64; 2) older Hispanics aged 65 and over; and 3) non-Hispanics. Second, specific Housing Units (HUs) were selected for inclusion in the study. One-in-8 non-Hispanic HUs and all Hispanic HUs were selected for inclusion. Third, individuals from each HU were selected for



inclusion. One adult per Hispanic HU aged 25-64 was selected at random and considered eligible for inclusion. One adult per non-Hispanic HU (regardless of age) was selected at random and considered for inclusion. All older Hispanics aged 65 and over were selected and considered eligible for inclusion.

Those adults selected for inclusion were approached for their participation in the study. The study protocol was approved by the University of Texas Medical Branch (UTMB) institutional review board. Informed consent was obtained from all participants who agreed to participate, and researchers interviewed residents in their homes. The survey instrument contained demographic, behavioral, social, and health measures. Eighty percent of those who agreed to participate were interviewed for the study, resulting in a sample size of 2,706.

### **Removal of Multi-Level Component**

Given the recruitment strategy employed by the Texas City Stress and Health Study, it was possible for some HUs to have more than one respondent. Preliminary exploration indicated that only 308 out of the original 2,706 respondents (11.38% of the total) shared an HU with at least one other respondent. Thus, there was an insufficient number of clustered respondents to justify conducting a multi-level analysis. As a result, HUs with multiple respondents were reduced to one respondent each by randomly selecting a case for each HU. A total of 163 cases were deleted from the dataset, reducing the sample to 2,543 cases.

### **Reduction of Dataset by Ethnicity**

Next, respondents who did not self-identify as being non-Hispanic White or of Mexican origin ( $n = 494$ ) were removed from the dataset. This reduced the sample size to 2,049 cases.

## **Missing Values**

Preliminary analysis of the CESD-R, SF-36 Mental Health Subscale, and CAPHRS items indicated that there was less than 5 percent missing data. The majority of variables were only missing 0 to 3 cases. One item was missing 5 cases (0.2%) and one other item was missing 4 cases (0.2%). Mplus Version 7.11 (Muthén & Muthén, 2013) were used for data analysis, and full information maximum likelihood (FIML) was employed to handle items with missing data (Muthén, 1984; Muthén & Muthén, 1998-2007).

## **Sampling**

The Texas City Stress and Health sample was further reduced to only include respondents who completed the Spanish language version of the CESD-R as well as self-identified as being a Mexico-born Mexican. Initial analysis suggested there were 9 U.S.-born Mexican Americans and 215 Mexico-born Mexican Americans. Because of the small number of U.S.-born Mexican respondents, the U.S.-born Mexican Americans were excluded from the analysis. The resultant sample size for analysis was 215 Mexico-born Mexican Americans.

## **Measures**

### ***Center for Epidemiologic Studies Depression Scale - Revised (CESD-R): Spanish***

#### ***Language Version***

**Original CES-D.** The Center for Epidemiologic Studies Depression Scale (CES-D, also known as CESD) was developed in 1971 by the Center for Epidemiologic Studies (CES), National Institute of Mental Health (NIMH), National Institutes of Health (NIH) (Radloff, 1977). The CES-D is a compilation of depression measures, which include the Beck Depression Inventory (Beck, Ward et al., 1961), Zung's depression scale (Zung, 1965),

and the Minnesota Multiphasic Personality Inventory (MMPI) (Eaton et al., 2004). The CES-D is a self-report measure. It contains 20 items that measure mood, somatic issues, interpersonal interactions, and motor functioning. Respondents choose from a 4-point Likert scale (coded from 0 to 3), with anchors from “Rarely or none of the time (less than one day)” to “Most or all of the time (5-7 days).” Responses are summed to create a composite score, which ranges from 0 to 60. An individual whose final score is 16 or higher is identified as a depressive “case” (Eaton et al., 2004). Generally, those who score 16 or higher have reported 6 of the 20 items to be frequently present during the past week, or most of the 20 items during a shorter amount of time (Eaton et al., 2004).

Four factors of depressive symptoms were typically found for the original CES-D measure: depressed affect, positive affect, interpersonal functioning, and somatic and retarded activity (Eaton et al., 2004).

**Problems with CES-D.** The CES-D was developed before the release of the DSM-III (Eaton et al., 2004). Because it did not draw from the DSM criteria, it contained content that was different from that of the DSM-III (1980) and its subsequent revisions DSM-III-R (1987), DSM-IV (1994), DSM-IV-TR (2000) and DSM-5 (2013) (Eaton et al.). Because the CES-D reflected a different domain from that of the DSM-IV, the two instruments may in fact be evaluating different constructs. For example, the original CES-D did not include symptoms related to psychomotor retardation/agitation, anhedonia, and suicidal ideation, which were included in DSM criteria (Eaton et al.). Further, sleep problems, weight changes, feelings of worthlessness, and concentration difficulties were measured by a single item (Eaton et al.). Conversely, symptoms related to dysphoria were measured by six items. Finally, eight items included in the CES-D no longer related to the DSM-IV definition of

major depression I (Eaton et al.). Given these limitations, researchers from Johns Hopkins University sought to revise the original CES-D.

**Revised CES-D (CESD-R): Spanish Language Version.** The 20-item revised version of the CES-D (CESD-R; Appendix A) was developed to better align with the Major Depressive Disorder (MDD) diagnosis in the DSM-IV (Eaton et al., 2004). The CESD-R was developed to incorporate the following previously omitted symptoms: anhedonia, psychomotor retardation/agitation, suicide ideation, which had not been included in the original CES-D. Further, eight items in the original CES-D were removed because they no longer conformed to the DSM-IV diagnostic criteria. The CESD-R was developed to include a 5-point response scale, because it more accurately reflected the time period and symptom severity of MDD, as opposed to the original 4-point response scale. Lastly, positively-worded items were removed from the new CESD-R because respondents found them to be confusing in the original CES-D and were therefore removed.

***Initial development of the Spanish language CESD-R.*** During the development of the 20-item Spanish language CESD-R, a 35-item Spanish language CESD-R was initially considered (Eaton et al., 2004). To evaluate the 35-item version of the instrument, it was administered to a population of elderly patients (ages 60 to 92 years;  $N = 300$ ) at a primary healthcare clinic in Mexico City (Eaton, et al., 2004; Reyes-Ortega, et al., 2002). Prior to administration, the items were translated into Spanish and revised for cultural context. Psychometric analysis indicated good reliability of the scale ( $\alpha = 0.90$ ), with item-total correlations ranging between 0.11 and 0.74 ( $M = 0.50$ ) (Eaton, et al., 2004; Reyes-Ortega, et al., 2002). These findings suggest the instrument is a reliable measure of depression for Spanish speaking populations.

Another study aimed to assess the psychometric properties of the Spanish language version of the CESD-R (Gonzalez-Forteza, et al., 2008). Using a sample of adolescent students in Mexico City (N = 1,549), the study found the CESD-R showed a six-factor structure, with high internal consistency ( $\alpha = 0.93$ ) (Gonzalez-Forteza, et al., 2008). It employed a 35-item version of the instrument.

In an effort to reduce redundancy within the instrument, the final 20-item CESD-R was developed (Eaton et al., 2004). This scale has maintained the strong reliability and validity of the CES-D (Eaton et al., 2004; Van Dam & Earleywine, 2011). Further, the scores from the CES-D and CESD-R are highly correlated to one another, with Pearson's correlations ranging from 0.88 to 0.93 (Eaton et al., 2004).

Studies have shown that the CESD-R has loaded well onto a one-dimensional factor model of depression, as well as a model with two main symptom categories: negative mood and functional impairment (Eaton et al., 2004; Van Dam & Earleywine, 2011). It should be noted, however, that these studies included predominately White and African American respondents and did not include a significant number of Latinos or individuals of Mexican origin.

***Development of the Spanish language CESD-R for use in the Texas City Stress and Health Study.*** For use in the Texas City Stress and Health Study (Peek, Cutchin et al., 2010), a Spanish language version was not readily available. Therefore, it was necessary to develop a Spanish language version. The following steps were taken to create one. Two educated Spanish speakers who were fluent in Mexican Spanish translated the instrument, one to create the forward translation version (English to Spanish) and one to create the backward translation version (Spanish to English). First, the original (in English) was

translated, and the two versions were compared to each other. Any discrepancies were rectified through discussion. Next, the Spanish version was back-translated (Spanish back to English) to ensure the questions were semantically equivalent. Again, any discrepancies were addressed by the team. Finally, the translated version was reviewed by a third Spanish speaker, also fluent in Mexican Spanish.

### ***SF-36 Health Survey, Mental Health Subscale***

The SF-36 Health Survey instrument includes 36 items which measure general health and well-being (Ware, 2004). The survey contains two main components: Physical Health and Mental Health. The Mental Health component is further divided into 4 subscales: Vitality, Social Functioning, Role-Emotional, and Mental Health. The Mental Health subscale includes 5 items, asking questions such as “Have you felt calm and peaceful?” and “Have you been happy?” (Appendix B). Response options for each of the questions are: 1) “all of the time,” 2) “most of the time,” 3) “some of the time,” 4) “a little of the time,” and 5) “none of the time.” Response options are in reverse order, from greatest frequency to least frequency. Studies have shown that scores from the SF-36 Health Survey have reliability statistics above .70, with physical and mental health summary scores yielding reliability above .90 (Ware).

### ***Concern about Petrochemical Health Risk Scale (CAPHRS)***

The Concern about Petrochemical Health Risk Scale (CAPHRS) contains four questions about perceived risks associated with living close to oil and chemical plants (Appendix C). Items were developed by the Texas City Stress and Health Study, and were translated into Spanish and then back-translated to ensure fidelity between the English language and the Spanish language versions of the instrument (Peek, et al., 2009). The

instrument includes 4 items, asking questions such as “How concerned are you that pollution from the oil and chemical plants might harm your health or your family’s health?” and “How concerned are you that accidents, such as explosions or spills, from the oil and chemical plants might harm your health or your family’s health?” Response options for each of the questions were: 1) not at all concerned, 2) a little concerned, 3) moderately concerned, 4) very concerned, 5) extremely concerned, 6) don’t know, and 7) refused. The CAPHRS has been shown to have good reliability ( $\alpha = 0.96$ ), and a high degree of internal consistency and discriminant validity (Cutchin, et al., 2008).

## **Statistical Analysis**

### ***Conceptualizing Validity***

The field of social science measurement and instrument testing has experienced a paradigm shift in recent years. The traditional view of validation assumes that validation is static, and that measures can be proven to be either valid or not valid (Bollen, 1989). This view of validation uses content, criterion, and construct validity to examine whether a measure accurately and fully assesses the construct in question (Bowen, 2005).

The new and broader view of validation evidence asserts that validation is an ongoing process rather than static (Addock & Collier, 2001). Validity is multifaceted, comprised of multiple pieces, and includes content validation, score performance validation, respondent-related validation and practice-related validation (Bowen, 2005). The broader view of validation places importance on the interpretation and understanding of the context and application of measurement scores (Bowen & Powers, 2005).

This manuscript adopts the broader view of validation evidence and will address the areas of content validation, score performance validation, respondent-related validation and practice-related validation.

### ***Content Validation***

Content validation refers to the ability of a measure to fully address the complete dimensionality of a construct. Because of the small sample size ( $n = 215$ ) of the study dataset, the dataset could not be randomly divided into half and yield meaningful Exploratory Factor Analysis (EFA) results. Instead, the entire dataset was retained and a Confirmatory Factor Analysis (CFA) was conducted on the Spanish language CESD-R. The two-factor model derived from the multiple-group CFA in Manuscript II served as the established model to inform, evaluate, and confirm the factor structure of the Spanish language CESD-R.

### ***Score Performance Validation: Comparison with SF-36 Mental Health Subscale and Concern about Petrochemical Health Risk Scale (CAPHRS)***

Score performance validity demonstrates that an instrument intended to evaluate one construct is, in fact, measuring that construct (Trochim & Donnelly, 2006). For this manuscript, the Spanish language CESD-R items were compared to items from an instrument designed to measure a related construct, the SF-36 Mental Health Subscale (Ware, 2004) (Appendix B) and items from an instrument designed to measure an unrelated construct, the Concern about Petrochemical Health Risk Scale (CAPHRS) (Appendix C). Analysis of scores from the CESD-R were compared and contrasted with scores from the SF-36 Mental Health Subscale and the CAPHRS to evaluate convergent and discriminant score performance validity respectively.

### ***Respondent-Related Validation: Confirmatory Factor Analysis (CFA)***



Respondent-related validation refers to how appropriate and relevant the content and format of the measure is for the intended group (Standards for Educational and Psychological Testing, 1999). The final CFA model from Manuscript II was applied to the Spanish language data, which allowed for comparisons between model fit of Spanish language CESD-R respondents in this manuscript, to the non-Hispanic White, U.S.-born Mexican, and Mexico-born Mexican respondents of the English language CESD-R in Manuscript II.

### ***Practice Related Validation***

Practice related validation is an area of validation that addresses the value, functionality, contextual relevance and ethics of using and interpreting measure scores (Cronbach, 1988; Bowen & Powers, 2005). To assess practice-related validation for this manuscript, the social work implications, strengths, limitations, and future research sections reflect the importance of assessing the value, functionality, contextual relevance and ethics of using and interpreting CESD-R scores when making policy and clinical decisions regarding persons of Mexican origin.

### ***Reliability Evidence***

**Cronbach's Coefficient alpha ( $\alpha$ ).** Reliability is most often evaluated by examining Cronbach's (1951) coefficient alpha,  $\alpha$  (DeVellis 2003; Kline 2005). Cronbach's alpha measures internal consistency reliability (Kline 2005). It looks at how correlated scores on items measuring the same construct, i.e., scale items are to each other (Kline 2005). Variability in a set of item scores is due to either: actual differences across individuals in the phenomenon being measured (i.e., true variation in the latent construct), or to error (DeVellis 2003). Another way of differentiating between the two types is by using the concepts of *signal* and *noise* (DeVellis 2003). Cronbach's alpha partitions the total variance into its two

components. The *signal* component equals alpha ( DeVellis 2003). If the Cronbach's alpha of a measure is low, then the items in the measure may be so dissimilar, combining them into a total score may not be appropriate (Kline 2005).

## **Statistical Procedures**

### ***Analysis of Categorical Data***

Mplus Version 7.11 (Muthén & Muthén, 2013) was used to test the psychometric properties of the Spanish language CESD-R. The Spanish language CESD-R dataset contained categorical, non-normal data, which required statistical software that could accurately estimate a polychoric correlation matrix (Muthén & Muthén, 1998-2007). Mplus was the best statistical software package to use for data analysis, as it is capable of estimating the polychoric correlation matrix in the presence of categorical data.

Mplus employs a multi-step method for ordinal outcome variables that analyzes a matrix of polychoric correlations. In Mplus these steps take place automatically when the syntax includes a line identifying outcomes as categorical, and works as follows. First, thresholds are estimated by maximum likelihood. Then, these estimates are used to estimate a polychoric correlation matrix, which in turn is used to estimate parameters through weighted least squares using the inverse of the "asymptotic covariance matrix" as the weight matrix (Muthén, 1984; Jöreskog, 1990).

### ***Categorical CFA***

Mplus CFA models can handle the ordered, categorical (ordinal) nature of the Spanish language CESD-R factor indicators. The best approach to analyze categorical variables with few categories is the continuous/categorical variable methodology (CVM) estimator (Muthén, 1984; West, Finch et al., 1995). The CVM approach is also referred to as

a robust weighted least squares approach, and the estimators are weighted least-squares with mean and variance adjustment (WLSMV) and weighted-least squares with mean adjustment (MLSM) in Mplus. An optimal choice for categorical outcomes is WLSMV if the sample size is 200 or greater (Muthén et al., 1997; Flora & Curran, 2004).

Because of the small sample size of the Spanish language CESD-R, the entire dataset was used to run the CFA, to maximize the number of cases and variance available for analysis. Once the final CFA model from Manuscript II was applied to the Spanish language data, Mplus returned various tests of model fit. Fit indices that were evaluated were:  $\chi^2$  (chi-square), RMSEA, CFI, and TLI. The model chi-square ( $\chi^2$ ) is an absolute fit index. The WLSMV  $\chi^2$  has been shown to perform well in Mplus (Flora & Curran, 2004). A  $\chi^2$  that is non-significant ( $p \geq .05$ ) suggests that the model fits the data well. However,  $\chi^2$  often remains significant in larger samples in social science research (Kenny & McCoach, 2003). The root mean square error of approximation (RMSEA) is a parsimony correction index. This means that more complex models are considered to have poorer fit (Harrington, 2008). The RMSEA evaluates whether the model fits reasonably well in the population, with  $RMSEA \leq .05$  indicating close approximate fit, between .05 and .08 indicating reasonable error of approximation, and  $RMSEA \geq .10$  indicating poor fit (Kline, 2005). Comparative fit indices evaluate the fit of the model compared to a more restricted, nested baseline model (Harrington), and include the CFI and TLI. A Comparative Fit Index (CFI) greater than .90 (Kline) or .95 (Brown, 2006) (with a range from 0 to 1) and a Tucker-Lewis Index (TLI) greater than .95 (Brown) suggests reasonably good fit (Harrington).

## **Results**

### **Sample Characteristics**

The sample was on average middle-aged, represented by more women than men, and predominately comprised of Mexico-born Mexican Americans (Table 7).

Table 8 shows descriptive statistics for the scores on the CESD-R. The CESD-R 80 is the standard version of the CESD-R, reflecting the maximum score of 80. The CESD-R 60 was calculated to allow for comparison to the original CES-D. The CESD-R 60 was created by taking the highest category ('nearly every day for two weeks') and collapsing its scores with the second highest category ('5 - 7 days'). Per the original CES-D instrument, a cut-off score of 16 and above indicates potential concern for depression (Radloff, 1977).

Table 8 shows the distribution of scores on the CESD-R. It highlights the difference between sub-threshold ( $\leq 16$ ) and threshold ( $> 16$ ) depressive scores, by nativity. Mexico-born Mexican Americans have the highest percentage of threshold depressive scores, followed by U.S.-born Mexican Americans.

### **Research Question 1: Is the Spanish language version of the CESD-R a reliable measure of depressive symptoms?**

To assess the reliability of the Spanish language CESD-R, the Cronbach's coefficient alpha ( $\alpha$ ) was evaluated. The internal consistency of the CESD-R Spanish version was high ( $\alpha = .92$ ). The high alpha score indicates that the Spanish CESD-R items are inter-related and are measuring the same construct. The high Cronbach's alpha score indicates that the measure being used to generally define the latent construct of depression has items that are inter-related.

## **Research Question 2: Is the Spanish language version of the CESD-R a valid measure of depressive symptoms?**

This section provides evidence for score performance validation and content validation.

### ***Score Performance Validation***

The Spanish language CESD-R and the SF-36 Mental Health subscale were compared to evaluate score performance validity. The Pearson's R value was somewhat high ( $r = -.66, p < .001$ ). Because the response categories of the SF-36 Mental Health Subscale are in reverse order, with the most greatest frequency category coded as 1 ("All of the time") and the least frequency category coded as 5 ("None of the time"), the negative R value indicates a positive correlation between items on the CESD-R and the SF-36 Mental Health Subscale. This suggests that the two instruments are measuring a similar construct.

The Spanish language CESD-R and the Concern about Petrochemical Health Risk Scale (CAPHRS) were also compared to each other. The Pearson's R value was low ( $r = .17, p < .05$ ) indicating a small correlation between CESD-R items and Concern about Petrochemical Health Risk Scale (CAPHRS) items. This suggests that the two instruments are not well-correlated and are measuring different constructs.

### ***Content Validation: Confirmatory Factor Analysis***

A Confirmatory Factor Analysis (CFA) was conducted to evaluate the content validity of the Spanish language CESD-R. The final two-factor model from the Multiple-Group CFA from Manuscript II was employed. This model contained 15 items, and 3 correlated errors (Figure 8). The results of applying this model to the Spanish language CESD-R data suggest that the fit of the model was good. While the chi-square test of model

fit was significant ( $p < .01$ ), the RMSEA (.05) did not exceed .05 indicating close approximate fit, and the CFI (.99) and TLI (.99) were greater than .95 indicating good model fit (Table 9).

**Research Question 3: Do data from persons of Mexican origin from the Texas City study factor similarly to data from a Mexico City study (Gonzalez-Forteza, et al., 2008) on the Spanish language version of the CESD-R?**

Findings from this study support previous research on the Spanish version of the CESD-R, confirming the CESD-R as a reliable measure of depression. The Cronbach's alpha for this manuscript ( $\alpha = .92$ ) is very similar to the two other studies (.90 and .93) that tested the reliability of a Spanish version of the CESD-R (Gonzalez-Forteza, et al., 2008; Eaton et al., 2004). The Mexico City study (Gonzalez-Forteza, et al., 2008) evaluated the factor structure and validity of a Spanish language version of the CESD-R. That study sampled adolescents and used a 35 item, instead of a 20 item, version of the CESD-R. Thus, the comparability to this manuscript is limited. Nonetheless, the previous study arrived at a six-factor solution for depression, but model fit indices were not reported. The factor structure included a large number of items loading on a *somatization* factor, many items loading on several separate affect variables, and the items related to suicide loading on a *depressed affect* factor. However, the factor loadings for the suicide items were relatively low (3.3 and 3.6). Among non-Hispanic White adolescents it is common to have more affective symptoms of depression as compared to adults (Tarrier, Taylor, & Gooding, 2008). Perhaps this trend holds true for Mexico-born Mexican Americans adolescents as well, and explains why the previous study had many items loading on multiple affect factors, whereas the model employed in this manuscript (mean age = 42) did not have any affect factors.

## **Discussion and Conclusion**

The discussion section will cover issues that influenced decisions of statistical modeling, how the results answered the research questions, how study findings compare to previous research, and study strengths and limitations.

To increase theoretical parsimony and consistency regarding modeling decisions, the final two-factor (negative mood and functional impairment, suicide) multiple-group CFA model for the English language version of the CESD-R from Manuscript II was used as the configural model for the Spanish language version of the CESD-R. The model fit the data well.

Future research should be conducted to see if this factor structure holds for Mexico-born Mexican clinical samples, where it is likely that respondents may report more severe symptoms of depression and thus perhaps more thoughts of suicide. However, it's not always the case that depression severity portends suicide (Kessler et al., 2005).

Findings from this manuscript answered the research questions. According to Cronbach's alpha ( $\alpha = .92$ ), the Spanish language version of the CESD-R showed good internal consistency on measuring depression among the current sample. The Spanish CESD-R demonstrated good score performance validity and content validity, with the model fitting the data well. The results of the CFA conducted on the Spanish version CESD-R support the factor structure that was shown to fit the data well for the English version of the CESD-R. Specifically, somatization symptoms loaded on the same factor as mood; and suicide-related items had to be loaded onto a factor separate from mood and functional impairment. As mentioned in Manuscript II, it appears that items associated with suicide do not fit well with

other items associated with depression. In addition, items associated with suicide showed considerable floor effects.

This study has several strengths. First, the study offered a Spanish language version of a depression instrument. Not all population surveys offer non-English versions of study instruments, which thereby excludes non-English speakers from participating in studies, or prevents the measure from being culturally equivalent (Trimble, 2003). Second, it is the only study to evaluate the psychometric properties of the CESD-R among an adult population. Third, the CFA was conducted using Mplus and its WLSMV estimator for categorical data. This allowed analysis to utilize the most current modeling techniques to evaluate the validity of the factor structure.

This study also had several limitations that temper the applicability and generalizability of the findings. First, the sample size was fairly small. Ideally, for a CFA using categorical data and employing the WLSMV estimator a sample size larger than 400 is desired (Byrne, 2013). Second, the current sample did not allow for a test of measurement invariance. Future research on the Spanish language version of the CESD-R should include an adequate number of participants who speak and read Spanish and are U.S.-born Mexican and Mexico-born Mexican. Third, this study sampled a community sample. Future research should test the Spanish version of the CESD-R on a clinical sample. In theory, a clinical sample would eliminate some of the problems with floor effects and would further evaluate if suicide is an element of the construct of depression for persons of Mexican origin.

Finally, Future research should also employ linguistic cognitive interviewing. Including linguistic cognitive interviewing will provide insight into how the questions on the



CESD-R are seen through a Latino cultural lens and how the meaning of the questions are similar and different (Roberts et al., 2012).

Findings from Manuscript III appear to suggest that the Spanish language version of the 15-item CESD-R has reasonable semantic equivalence, conceptual equivalence, and normative equivalence. Thus, at least for this study population, the 15-item CESD-R - translated well from English to Spanish. Specifically, translating the CESD-R from English to Spanish did not alter the model fit of the 15-item CESD-R.

Table 7

Spanish Language CESD-R: Sociodemographic Characteristics (N = 224)

Sociodemographic Characteristic	Descriptive Statistics
<b>Age</b>	mean = 42.5 (SD = 14.6) min = 25, max = 88 median = 38
<b>Gender</b>	
Male	80 (36%)
Female	144 (64%)
<b>Ethnicity</b>	
U.S.-born Mexican American	9 (4%)
Mexico-born Mexican American	215 (96%)

Table 8

Spanish Language CESD-R: Scores by scale version (N = 224)

Descriptive Statistics	Potential Concern for Depression by Ethnicity (>16 cut off score)		
	CESD-R 80		
		≤ 16	>16
mean = 7.5 (SD = 10.8)	U.S.-born Mexican American	8 (88.9%)	1 (11.1%)
median = 3	Mexico-born Mexican American	178 (82.8%)	37 (17.2%)
min = 0, max = 56	TOTAL	186 (83.0%)	38 (17.0%)
CESD-R 60			
		≤ 16	>16
mean = 7.0 (SD = 9.7)	U.S.-born Mexican American	8 (88.9%)	1 (11.1%)
median = 3	Mexico-born Mexican American	181 (84.2%)	34 (15.8%)
min = 0, max = 45	TOTAL	189 (84.4%)	35 (15.6%)

Figure 8

Final Multiple-Group CFA Model from the English Language CESD-R (Manuscript II)

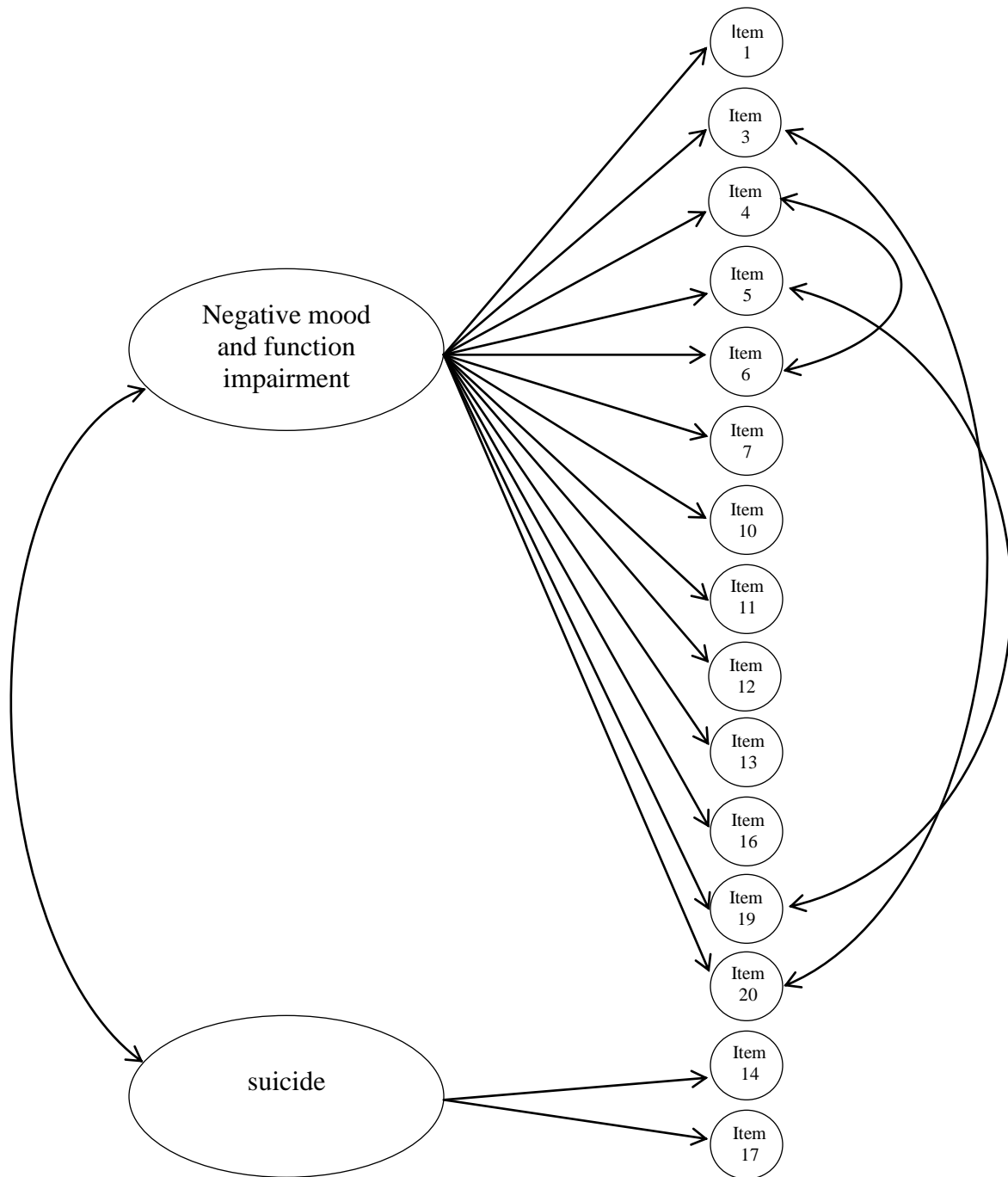


Table 9

Spanish Language CESD-R: Confirmatory Factor Analysis - Fit Indices

Model	$\chi^2$ (df) <i>p</i>	RMSEA [90% CI]	CFI	TLI
2-factor model	124.47 (86) .004	.05 [.03, .06]	.99	.99

$\chi^2$  = chi-square statistic, df = degrees of freedom, RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index

## **Conclusion**

The aims of this dissertation were three-fold:

1. To develop an expanded and integrated explanatory model of Latino acculturative stress that accounts for culture, stress and coping, cognitive appraisal, timing, and family and neighborhood factors.
2. To evaluate the reliability and validity evidence of the English language version of the CESD-R.
3. To evaluate the reliability and validity evidence of the Spanish language version of the CESD-R.

Manuscript I posited an explanatory model that expanded upon and integrates work by Berry (2006) and most notably added the dimension of family and neighborhood. Recent research findings on Latino immigrant depression point toward the importance of understanding and leveraging the protective nature of neighborhood and family (Breslau, 2011; Shell, Peek, & Eschbach, 2013).

This new model has implications for future research and social work practice. The new model provides a conceptual framework that lends itself to evaluating whether family and neighborhood factors mediate, by themselves or in combination with other positive coping mechanisms (i.e., accurate appraisal, active problem solving), the adverse psychosocial factors of acculturative stress.

The new expanded and integrated model provides social workers with a framework to accurately position interventions at different levels (micro, meso, macro; upstream, mid-stream and downstream), and within different systems (family, individual, cultural, community) to positively influence psychosocial outcomes.

Manuscript II evaluated the validity and reliability evidence of the English language version of the CESD-R. The internal consistency of the English language CESD-R, as applied to the current data, was very good. The results of the EFA, CFA and multiple-group CFA of the English version of the CESD-R suggest that a 15-item version of the CESD-R best fit the study data. The final two-factor solution of *negative mood and functional impairment* and *suicide*, fit the data well. Findings from this study partially support the CESD-R as a valid measure of depression. The original 20-item CESD-R (Eaton, 2004) did not fit the data well. A 15-item, two-factor model version of the CESD-R that excluded the items “I could not shake off the blues,” “Nothing made me happy,” “I felt like a bad person,” and “I lost a lot of weight without trying to,” and “I want to harm myself” fit the data best and made the most theoretical sense. “I want to harm myself” had to be removed during the multiple-group CFA as there were too few Mexico-born Mexican Americans who endorsed the item. In sum, the 15-item version of the CESD-R appears to be a valid measure across three separate groups, non-Hispanic Whites, U.S.-born Mexican Americans and Mexico-born Mexican Americans. Though there appeared to be cultural differences that led to the need to exclude 5 items, there was good fit across the groups for the 15-item scale.

The results of Manuscript II have implications for social work research and practice. Further research is needed to confirm that a 15-item version of the English language CESD-R

is optimal when used with Mexico-born Mexican Americans. In addition, it is recommended that the 15-item scale be compared to the original 20-item version with clinical samples of Mexico-born Mexican Americans. This is important in determining if the reason why the 15-item version fits better for Mexico-born Mexican Americans is due to cultural differences, clinical differences, or both. Specifically, the results of Manuscript II appear to imply that suicide may not be an indicator of depression for Mexico-born Mexican Americans, but this result may be attributed to non-clinical sampling. For social workers, the results confirm that depression may manifest differently due to cultural and acculturation differences. Therefore, it is important for social workers to augment self-report measures with a semi-structured, biopsychosocial interview that includes questions about level of acculturation.

Manuscript III evaluated the reliability and validity evidence of the Spanish language version of the CESD-R. The scores of the Spanish Language version of the CESD-R fit the same CESD-R factor structure of Manuscript II. The results support the use of the 15-item version of the CESD-R with a Spanish speaking sample. This suggests that despite cultural differences, there are common cross-cultural components of depression that relate to *negative mood and functional impairment* and *suicide*. This is particularly true when considering that language is strongly correlated to level of acculturation (Berry, 2006). In other words, those individuals who selected to take the Spanish language version of the CESD-R may be less acculturated to US culture than persons of Mexican origin who chose to take the English language version.

Additionally, results from Manuscript III seem to indicate that the Spanish language version of the 15-item CESD-R has reasonable semantic equivalence, conceptual equivalence, and normative equivalence. Hence, at least for this study population, the 15-



item CESD-R - translated well from English to Spanish. Specifically, the conceptualization of depression did not change even though the language did.

The main implication of Manuscript III is that the translation of the English language CESD-R to Spanish language did not compromise the conceptual understanding and factor structure of the CESD-R that was shown to be valid and reliable in Manuscript II.

Consequently, it seems warranted that the Spanish language version of the 15-item CESD-R can be used in future research involving Spanish-speaking individuals.

## Appendix A

Center for Epidemiologic Studies Depression Scale - Revised (CESD-R) (Eaton et al., 2004)

Below is a list of the ways you might have felt or behaved. Please check the boxes to tell me how often you have felt this way in the past week or so.	LAST WEEK				Nearly every day for 2 weeks
	Not at all <i>or</i> Less than 1 day	1-2 days	3-4 days	5-7 days	
1. My appetite was poor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I could not shake off the blues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I had trouble keeping my mind on what I was doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I felt depressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. My sleep was restless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I felt sad.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I could not get going.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Nothing made me happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I felt like a bad person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I lost interest in my usual activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I slept much more than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I felt like I was moving too slowly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I felt fidgety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I wished I were dead.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I wanted to hurt myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I was tired all the time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I did not like myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I lost a lot of weight without trying to.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I had a lot of trouble getting to sleep.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I could not focus on the important things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Appendix B

### SF-36 Health Survey, Mental Health Subscale (Ware 2004)

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
b. Have you been very nervous?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Have you felt so down in the dumps that nothing could cheer you up?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Have you felt calm and peaceful?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Have you felt downhearted and depressed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Have you been happy?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Appendix C

### Concern About Petrochemical Health Risk Scale (CAPHRS)

	Not at all concerned	A little concerned	Moderately concerned	Very concerned	Extremely concerned	Don't know	Refused
How concerned are you that pollution from the oil and chemical plants might harm your health or your family's health?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How concerned are you that accidents, such as explosions or spills, from the oil and chemical plants might harm your health or your family's health?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How concerned are you that stored waste from the oil and chemical plants might harm your health or your family's health?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How concerned are you that the oil and chemical plants might cause health problems or disease in you or your family?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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