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Applying Intersectionality and Acculturation Theories to Explain Disparities in Self-rated Health Among Asian and Hispanic Immigrants in the U.S.

by

Lisa L. Lommel

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

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by

Lisa L. Lommel

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Note: The text of chapter two of this dissertation is a reprint of the material as it appears in *The Journal of Immigrant and Minority Health* (Lommel & Chen, 2015). The co-author listed in this publication directed and supervised the research that forms the basis for the dissertation. Altogether, my dissertation committee's co-authorship of chapters 2, 3, and 4 has resulted in one publication, four poster presentations, five oral and written presentations in both the United States and internationally, and three honors and awards.

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Applying Intersectionality and Acculturation Theories to Explain Disparities in Self-rated Health Among Asian and Hispanic Immigrants in the U.S.

Lisa L. Lommel

Abstract

Minority populations in the United States (U.S.) suffer an unequal burden of morbidity and mortality due to health disparities. The purpose of this descriptive cross-sectional study was to identify factors associated with disparities in self-rated health (SRH) among Asian and Hispanic immigrants. The acculturation theory and intersectionality framework were used to select predictors of SRH that included age, gender, ethnicity, socio-economic status, depressive symptoms, C-reactive protein (CRP) level, acculturation status, social position, and acculturative stress and discrimination events. A systematic review of the literature was completed and data from the 2009-2010 National Health and Nutrition Examination Survey and the 2002-2003 National Latino and Asian American Study were reviewed. This study found that acculturation status was associated with reporting disparities in SRH for both Asian and Hispanic immigrants. Limited English proficiency and being foreign-born was associated with worse SRH for Korean, Chinese, and Mexican immigrants, and in aggregate samples of Asian and Hispanic immigrants, compared to non-Hispanic Whites. Additionally, limited English proficiency was associated with worse SRH for Vietnamese immigrants. Among Mexican immigrants, higher levels of acculturation were associated with better SRH. Other key findings among Mexican immigrants were that depressive symptoms, increasing age, female gender, and elevated CRP were predictors of worse SRH compared to U.S.-born, non-Hispanic Whites. However, female gender and higher

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CRP were not predictors of worse SRH when level of acculturation was controlled for. For Chinese immigrants, acculturative stress was associated with worse SRH in an additive model while the interactions between social position and discrimination, and between gender, acculturative stress, and social position and education were predictive of worse SRH in multiplicative models. In summary, age, gender, ethnicity, socioeconomic status, depressive symptoms, CRP, acculturation status, social position, and acculturative stress and discrimination were associated with disparities in SRH among two ethnic minorities in the U.S. These findings can be used to improve awareness and understanding of these immigrant populations who are vulnerable to poor health outcomes. Additionally, outcomes can assist in developing interventions to reduce the influence of social structures on health and to capture the true complexities of immigrants' lives.

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Chapter One: The Study Problem

According to the World Health Organization (WHO), "the social determinants of health are mostly responsible for health disparities—the unfair and avoidable differences in health status seen within and between countries" (World Health Organization [WHO], 2016). In the United States (U.S.), minority populations including Blacks, Hispanics, American Indians/Alaska Natives, and Asians suffer a disparate burden of disease, injury, premature death, and disability (Koh, Graham, & Glied, 2011). For these populations, health disparities can mean reduced life expectancy, decreased quality of life, loss of economic opportunities, and perceptions of discrimination. For society, these inequalities translate into reduced productivity, increased health-care costs, and social inequity (Koh et al., 2011; Meyer, Yoon, Kaufmann, & Centers for Disease Control and Prevention [CDC], 2013).

In recent years, several public reports have highlighted the urgency related to addressing this national concern. The *Centers for Disease Control and Prevention Health Disparities and Inequalities Report - United States, 2013* (Meyer et al., 2013), *Healthy People 2020* (Healthy People, 2016), the *National Partnership for Action to End Health Disparities* (Koh et al., 2011), and the *National Healthcare Disparities Report* (US Department of Health and Human Services, 2003) have described health inequalities across a wide range of diseases, behavioral risk factors, environmental exposures, social determinants, as well as health-care access by sex, race and ethnicity, income, education, disability status, and other social characteristics. These national disparities elimination efforts provide a compelling argument for action to reduce the burden of racial and ethnic health inequalities. Moreover, by 2050, racial and

ethnic minorities will account for nearly 50% of the total U.S. population and if these populations continue to experience poor health outcomes, the expected demographic changes will magnify the adverse impact on the overall health and well being of the American population (Koh et al., 2011).

The dissertation studies described herein focus on two of the nations largest minority populations. Among one such U.S. population, Hispanics are the largest minority group constituting 17% of the total U.S. population and by 2060, making up approximately 29% of the U.S. populace (U.S. Census Bureau, 2015). Although Hispanics in the U.S. are of Puerto Rican, Salvadoran, Cuban, Dominican, and Guatemalan background, with the remainder from other Central American or South American origins, approximately 64% are of Mexican background with 34% born in Mexico (U.S. Census Bureau, 2015). Mexican immigrants represent a population that is at high risk for health disparities based on several health indicators. For example, 34% of foreign-born Mexicans report speaking English less than very well, 59% have not earned a high school diploma, and the average yearly personal income for Mexican immigrants is \$20,000 (Pew Research Center, 2016). Regarding health outcomes, Hispanics are significantly affected by heart disease, cancer, unintentional injuries, stroke, asthma, HIV/AIDS, and suicide (CDC, 2004). Mexican Americans specifically, are at disproportionality higher risk for obesity, diabetes, liver, and periodontal disease (CDC, 2004).

This dissertation will also focus on Asian Americans who currently make up 5.8% of the total U.S. population and by 2050, it is estimated that they will constitute 10% of the population (U.S. Census Bureau, 2015). U.S. Asians are of Filipino, Asian Indian,

Vietnamese, Korean, and Japanese background (Pew Research Center, 2012). Largest among the Asian population are Chinese Americans who constitute 23% of the total U.S. Asian population (Pew Research Center, 2012). Additionally, Chinese immigrants are now the third-largest foreign-born group in the U.S., comprising 76% of the total U.S. Chinese population and 5% of the overall immigrant population (Hooper & Batalova, 2015). While generally having more favorable health indicators compared to Mexican Americans, Chinese Americans still represent a population at risk for poor health outcomes. For example, 61% of Chinese immigrants report speaking English less than very well, 49% do not have a college education, and the average annual personal income is \$65,050 (CDC, 2004). Additionally, according to the CDC Health Disparities Report (2004), Asian immigrants have higher rates of tuberculosis and hepatitis B, with Chinese Americans at higher risk of dying from liver cancer compared to Whites. In addition, rates of uncontrolled hypertension (Chen & Hu, 2014), colorectal cancer, diabetes, and HIV disease are increasing in Asian populations while lung and bronchial cancer are highest in Chinese Americans compared to other Asian groups (CDC, 2004). Finally, Asians who speak a language other than English at home are more likely to report worse self-perceived health, more physically and mentally unhealthy days, and work in a high-risk occupation (Meyer et al., 2013).

For the present study, self-rated health (SRH) (*How would you rate your overall health? Excellent, very good, good, fair or poor*) was used to assess disparities in health among Asian and Hispanic immigrants. Self-rated health has been used extensively as an independent health indicator, providing an assessment of the population's health, individual life satisfaction, and subjective health (Benyamini,

Leventhal, & Leventhal, 2003). Moreover, SRH has been shown to predict mortality in intervals of just two years (Ho, 1991; Rakowski, Mor, & Hiris, 1991) and more extended periods of up to 13 years (Chipperfield, 1993). Numerous studies have established this relationship in probability models worldwide including Hong Kong, U.S, Poland, and Canada (Idler, Hudson, & Leventhal, 1999).

The selection of factors associated with inequalities in SRH among Asian and Hispanic immigrants was determined by review of the health disparities literature and by examining the acculturation theory and intersectionality framework. The CDC (2004) has demonstrated that despite recent progress, racial and ethnic disparities persist among leading health factors including: socioeconomic (e.g., education and poverty), lifestyle behaviors (e.g., physical activity and tobacco use), social environment (e.g., educational and economic opportunities), and access to clinical preventive services (e.g., cancer screening and vaccination). Other studies indicate that acculturation (Sentell & Braun, 2012; Seo, Chung, & Shumway, 2014), age (Min, Rhee, Lee, Rhee, & Tran, 2014), gender (Huh, Prause, & Dooley, 2008), depression (Ambresin, Chondros, Dowrick, Herrman, & Gunn, 2014; Gunn et al., 2012), C-reactive protein (Christian et al., 2011; Shanahan, Bauldry, Freeman, & Bondy, 2014), social position (Gong, Xu, & Takeuchi, 2012; John, De Castro, Martin, Duran, & Takeuchi, 2012), acculturative stress (Kimbro, Gorman, & Schachter, 2012), and discrimination (Molina, Alegría, & Mahalingam, 2013) are also associated with disparities in SRH. In addition, recent immigration might increase risks for chronic disease and injury among certain populations (CDC, 2004). Although some immigrants are highly educated and have high incomes, inexperience with the health-care system, diverse cultural attitudes about the

use of traditional and conventional medicine, and limited English language proficiency can pose barriers to obtaining appropriate health care (CDC, 2004).

Finally, despite the evidence of continued health disparities among Asian and Hispanic immigrant populations, very little attention has been paid to theoretical frameworks that might illustrate this phenomenon. Consequently, for this dissertation study, acculturation theory (Berry, 2009) and an intersectionality framework (Bowleg, 2012) will be presented, as they offer unique lenses that will assist in demonstrating factors associated with SRH and examining both the consequences of immigrant health disparities and its relationship with inequality.

Statement of the Problem

Immigrants are particularly vulnerable to disparities in health because of cultural conflicts including language differences and racial discrimination as well as social inequities perpetuated by age, gender, socioeconomic status, and social status and as a result of bio-behavioral factors including depression and inflammation. Yet, despite persistent racial and ethnic gaps in health care and health status, understanding of these disparities remains low. According to the CDC (2004), "Identifying disparities and monitoring them over time is a necessary first step toward the development and evaluation of evidence-based interventions that can reduce disparities." Therefore, the purpose of this dissertation is to address this area of need by applying acculturation and intersectionality theories to identify health disparities in SRH among Asian and Hispanic immigrants, focusing on Chinese and Mexican sub-groups where possible. Predictors of SRH include age, gender, ethnicity, socio-economic status (education), depressive

symptoms, C-reactive protein level, acculturation status (nativity, language preference, co-ethnic ties), social position, and acculturative stress and discrimination events.

Organization of the Dissertation

The remainder of this dissertation is organized into four chapters. Chapter two, which has been previously published in the *Journal of Immigrant and Minority Health* (Lommel & Chen, 2015), is a systematic review of the literature that grounds this study by critically analyzing data from nine research studies measuring the impact of nativity and limited English proficiency on SRH in Asian and Hispanic immigrant populations. Because there are limited studies focusing on Asian and Hispanic immigrants using SRH as an outcome variable, this review focused on these immigrant populations in the aggregate and was also able to offer Chinese and Mexican subgroup analysis, when available.

Grounded in acculturation theory, chapter three addresses the contribution of Mexican identity and acculturation status to SRH as well as the mediating effects of C-reactive protein and depression on the association between Mexican identity and acculturation on SRH. Specifically, because this paper was a secondary analysis of a statewide survey that oversampled for Hispanic subgroups, the focus was on the Mexican immigrant population. This paper has been submitted to the *Journal of Psychosomatic Research*.

An intersectionality framework contributes to chapter four as it focuses on the role of age, gender, education, acculturation status, social position, and acculturative and discrimination stress on SRH among Chinese immigrants in the U.S. This paper will be submitted to the *Journal of Public Health*.

Finally, chapter five synthesizes findings from all three papers and proposes recommendations for future research and practice.

Chapter Two: The Relationship Between Self-rated Health and Acculturation in Adult Asian and Hispanic Immigrants: A Systematic Review

Abstract

We systematically reviewed studies to identify the association between acculturation and self-rated health (SRH) and the impact of nativity and language use in Asian and Hispanic adult immigrants. Six electronic databases were searched. Data on nativity and limited English proficiency (LEP) was extracted and analyzed. Nine studies met review criteria. A positive association between acculturation and fair/poor SRH among Asians and Hispanics was found. For both Asians and Hispanics, six out of eight studies showed nativity and all three studies reporting LEP were associated with worse SRH compared to Whites. Nativity and LEP were found to be risk factors for reporting worse SRH in Hispanics compared to Asians. The degree of association between nativity and LEP and worse SRH was found to vary by Asian and Hispanic subgroup. Further studies are needed to accurately assess the health status of these populations, which will be essential to eliminating disparities.

Keywords: Health disparities, Self-rated health, Acculturation, Asian, Hispanic

Self-rated health (SRH) is an influential predictor of clinical outcome and mortality even after accounting for medical, behavioral, and psychosocial factors, and is frequently used in health policy and research as a key indicator of health status (Benyamini, 2011; Dowd & Zajacova, 2007; Fayers & Sprangers, 2002; Idler & Benyamini, 1997; Idler et al., 1999; Kawada, 2003). The World Health Organization (WHO), United States (U.S.) Centers for Disease Control and Prevention (CDC), and the European Commission have recommended SRH as a reliable measure of monitoring population health (de Bruin, Picavet, & Nossikov, 1996; Hennessy, Moriarty, Zack, Scherr, & Brackbill, 1994; Kramers, 2003). SRH has also been used extensively in population research of ethnic minorities, and disparities in SRH have been found in these populations (Liao et al., 2011).

The two largest immigrant minority populations in the U.S. are Asians and Hispanics. In 2010, individuals who identified only as Asian accounted for 4.8 % of the U.S. population (U.S. Census Bureau, 2015) and are projected to constitute 9.8 % of the U.S. population by 2060, which makes them the third largest minority group behind Hispanics and non-Hispanic Blacks (U.S. Census Bureau, 2015). Hispanics account for about 17 % of the U.S. population and are projected to constitute 31% of the nation's population by 2060 (U.S. Census Bureau, 2015). Because of the burgeoning minority immigrant population, there is an urgent need to understand the perception of health and factors related to SRH in these communities.

One of the factors influencing health and SRH in immigrant populations is acculturation. Acculturation refers to the dynamic process that commences when an immigrant enters into a new country and begins to adapt to its culture (Berry, 2005).

Studies have used numerous variables to measure the acculturation level of an immigrant including birth country, years of residency in the host country, language proficiency, and language preference, to name a few. Although research has shown associations between these measures and SRH, language and nativity (U.S. vs. foreign born) have repeatedly been shown to be the most important predictors of health status (Carter-Pokras & Bethune, 2009). However, as a result of studies using diverse measures of acculturation, conclusions have led to inconsistencies in the relationship between acculturation and health outcomes (Alegria, 2009). Moreover, for Asian and Hispanic immigrants, differences in the effect of acculturation on SRH have not been clearly described in the literature or extensively examined.

The "Hispanic health paradox" posits that, although first generation Hispanics have poorer socioeconomic (SES) profiles, they experience better health for some outcomes including lower prevalence of hypertension, cardiac disease, asthma, diabetes, and cancer compared to their U.S.-born counterparts (Bostean, 2013; Ruiz, Steffen, & Smith, 2013; Viruell-Fuentes, 2007). This phenomenon has been well described in the literature but yet still remains unexplained because of the complex interplay of culture, uniqueness of Hispanic subgroups, discrimination, social structure, and immigrants' behavior (Viruell-Fuentes, 2007; Zsembik & Fennell, 2005). Equally as puzzling is the oft-quoted stereotype of Asians being the "model minority," which describes all Asian Americans as healthy and successful (Sorkin, Tan, Hays, Mangione, & Ngo-Metzger, 2008).

Although several studies have examined SRH in Hispanic populations (Benjamins, Hirschman, Hirschtick, & Whitman, 2012; Borrell & Dallo, 2008; Dubard &

Gizlice, 2008; Finch, Hummer, Reindl, & Vega, 2002; Franzini & Fernandez-Esquer, 2004; Johnson, Carroll, Fulda, Cardarelli, & Cardarelli, 2010; Lee, Schwarz, & Goldstein, 2014; Liang et al., 2010; Shetterly, Baxter, Mason, & Hamman, 1996; Su, Wen, & Markides, 2013; Zsembik & Fennell, 2005), there are limited studies that focus on Asians' perception of health (De Castro, Rue, & Takeuchi, 2010; Erosheva, Walton, & Takeuchi, 2007; Frisbie, Cho, & Hummer, 2001; Gomez, Kelsey, Glaser, Lee, & Sidney, 2004; Kandula, Lauderdale, & Baker, 2007; Maty, Leung, Lau, & Kim, 2011; Sorkin et al., 2008). Moreover, U.S. based researchers often use non-Hispanic Whites (NHWs) as the reference group for minority populations, but given the diverse populations that exist in the U.S., it is difficult to distinguish what constitutes a NHW "culture." This is especially salient for second (and beyond) generation minority immigrants who adapt to the dominant culture (i.e. NHW), but who are not considered in the dominant culture. Additionally, immigrants residing in communities that are predominately immigrant, acculturate differently than those living in a dominant culture community (Miller et al., 2009). Finally, other researchers have purported that using NHWs as the well-qualified reference group to which all other minority groups are compared, supports hegemonic, or dominant culture, generalizations (Bowleg, 2012; Viruell-Fuentes, 2007). This study makes a unique contribution to the literature in that in addition to making comparisons to NHWs, it makes an attempt to eliminate dominant culture generalizations by comparing Asians to Hispanics in order to provoke a richer understanding of immigrant health patterns. Therefore, the aims of this systematic review are to: (1) describe the association between acculturation and fair/poor SRH in Asian and Hispanic adult immigrants, (2) examine the impact of nativity and language

on fair/poor SRH in Asian and Hispanic adult immigrants compared to NHWs, and (3) examine the impact of nativity and language on fair/poor SRH between Asian and Hispanic adult immigrants.

Methods

Data Sources

The authors searched six electronic databases (CINAHL, PubMed, PsychINFO, Web of Science, Sociological Abstracts, and SCOPUS), the "related links" feature in

PubMed, and references of included studies. The databases were searched for articles published from 1961 through 2014 using the primary outcome keyword self -rated health or self -reported health, and were combined with either an acculturation measure keyword or an ethnicity keyword. The outcome keyword, health status, was also combined with an acculturation or ethnicity keyword and produced a significantly larger number of retrieved articles. In addition, we used cross-referencing and manually screened the reference lists of pertinent studies for any potentially missed articles (Table 1).

Inclusion/Exclusion Criteria

Inclusion criteria included studies that: (1) were in English, (2) were conducted in the U.S., (3) included both Asian and Hispanic racial/ethnic groups in order to make comparisons between these two groups, where possible, (4) sampled adult participants 18 years and older, (5) included at least one measure of acculturation, (6) measured SRH (*Question: How do you rate your current health status? Answer choices: excellent, very good, good, fair, or poor*), and (7) examined the relationship

between fair/poor SRH and an acculturation measure among Asians and Hispanics.

Studies were not limited by publication date because there were only a small number of studies that met the full inclusion criteria. The earliest study that met inclusion criteria was published in 2007; with the most recent studies published in 2014. Unpublished manuscripts (i.e. dissertations), editorials, and opinions were excluded.

Methodological Rigor Assessment

This systematic review used the quality assessment tool, adapted from Cummings and colleagues (Cummings et al., 2008; Cummings et al., 2010) for correlational studies to assess four areas: research design, sampling, measurement, and statistical analysis. The tool is comprised of 10 items and a maximum of 10 points could be assigned. Each item was scored as zero (not met) or one (met). Based on the total points, each study was placed into one of three categories: high (7–10), medium (4–6), or low (0–3) quality. A second nurse-scientist (Jyu-Lin Chen, Ph.D.) appraised the quality of the nine studies using the same quality assessment tool to reduce bias. Consensus was reached on the methodological rigor assessment (Table 2).

Results

The original search yielded 29,146 abstracts. After eliminating duplicates, a total of 13,597 abstracts were considered for review. These abstracts were further reviewed and screened solely for the presence of self-rated/reported health and all unpublished manuscripts, editorials, and opinions were excluded, which yielded 248 abstracts.

These abstracts where further examined for the presence of at least one acculturation measure and the inclusion of Asian and Hispanic adult immigrants in the study sample.

This led to the selection of 24 articles that were fully read and screened, and whose reference lists were hand searched. An additional 16 articles were eliminated because they did not directly measure poor/fair SRH or associations were not made between SRH and acculturation by specific ethnicity (Asian and Hispanic). One article was added at this step through manual searching of reference lists of pertinent articles, which yielded a total of nine studies that met search criteria (Figure 1).

Data Extraction and Synthesis

Nine studies met the inclusion and exclusion criteria and assessment for quality. Eight studies were rated as moderate quality (scores 4–6) and one as high quality (scores 7–10). The following data from these nine studies were extracted and synthesized: author, publication year, sample/ participants, design, survey type, survey years, respondent rate, acculturation measure(s), covariates, and key findings.

Characteristics of Studies Included

Of the final nine studies included in this review, all of them used crosssectional designs, probability sampling, anonymity, sampling from more than one site, and were conducted as a secondary data analysis of larger surveys (Health Interview Survey [CHIS], Current Population Survey [CPS], National Health Interview Survey [NHIS]). Four of the nine studies were conducted nationally with the remaining five limited to California. All study participants were adults and ranged in age from 18 and older (five studies), 25–64 years (one study), 60 years and older (one study), and 65 years and older (one study), with the remaining study not specifying the adult age. All nine studies included Asian and Hispanic participants, with three studies further categorizing Asians in subgroups and one study specifying Hispanic subgroups. Total

study samples ranged from 1745 to 637,209 (non-weighted). Of the two studies that reported response rate, both were recorded as greater than 60% (Table 3).

The statistical method used to examine the association between acculturation and SRH in Asians and Hispanics compared to NHWs was the correlation coefficient in two studies: unstandardized regression coefficient *b* (Huh et al., 2008) and logit coefficient *b* (Min et al., 2014). Two studies used probability analysis: difference in adjusted probability (Kandula et al., 2007) and predicted probability (Kimbro, Bzostek, Goldman, & Rodríguez, 2008). Four studies reported the relationship as an odds ratio (Acevedo-Garcia, Bates, Osypuk, & McArdle, 2010; Gorman, Ecklund, & Heard, 2010; Kandula et al., 2007; Sentell & Braun, 2012; Seo et al., 2014). One study presented data as means and standard deviations (Kim et al., 2011).

Aim 1: Association Between Acculturation and SRH

While all nine studies analyzed the association between at least one measure of acculturation and SRH, eight studies used SRH as an outcome variable, with acculturation measures as the predictor variables (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). Using content analysis, a total of seven acculturation measures in the nine studies were identified (generation, nativity, duration of U.S. residence, limited English proficiency [LEP], English proficiency, non-English interview, U.S. citizenship). Although no one single measure of acculturation was used in all nine studies, we reported the impact of LEP and nativity (foreign-born) on SRH because both variables have been shown to be the most significant predictors of health status (Carter-Pokras & Bethune, 2009). All nine studies showed a significant

association between at least one of these measures of acculturation and SRH: two studies reported a significant negative association with at least one measure of acculturation and SRH (Huh et al., 2008; Kimbro et al., 2008), while eight studies reported a significant positive association with at least one measure of acculturation and SRH (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). Aim 2: Impact of Nativity and Language on SRH in Asians and Hispanics Compared to NHWs

Seven studies provided a direct comparison between measure of acculturation and Asian and Hispanic race/ethnicity compared to NHWs (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). One study provided data on Asians, Hispanics, and NHWs but did not make a direct comparison between Asians or Hispanics and NHWs. However, sufficient data was provided to perform such comparisons (Kimbro et al., 2008). One study presented data on Asians and Hispanics only (did not include NHWs), and sufficient data was available to make a comparison between the two (Kim et al., 2011).

Asians Versus NHWs.

Nativity. Eight of the nine studies examined the association between nativity in Asians and fair/poor SRH (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014), with six studies showing a significant association (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al.,

2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). Examining SRH before nativity was included in regression models revealed that in three of these six studies. Asians or Asian subgroups reported worse SRH compared to NHWs (Kandula et al., 2007; Min et al., 2014; Seo et al., 2014), although one of these three studies specifically found only Chinese, Vietnamese, and Koreans reported worse SRH (not Filipinos) compared NHWs (Kandula et al., 2007). When nativity was controlled for in regression models, all three of these studies found that differences in SRH by race/ ethnicity were reduced substantially or disappeared (Kandula et al., 2007; Min et al., 2014; Seo et al., 2014), although only for Koreans in one study (Kandula et al., 2007), and in another study, only for Chinese (Seo et al., 2014), indicating a strong association between nativity and worse SRH. Three of the six studies found that Asians reported better SRH compared to NHWs (Acevedo-Garcia et al., 2010; Huh et al., 2008; Kimbro et al., 2008) however, the significant association no longer remained after including generation status in one study (Acevedo-Garcia et al., 2010), and nativity and ethnicity in another study (Huh et al., 2008). The remaining study found that after including nativity, only foreign-born Asians had a reduced probability of reporting worse SRH compared to NHWs (Kimbro et al., 2008). While several studies suggest that nativity is significantly associated with reporting worse SRH in Asians, the effect of nativity on SRH varies by ethnic subgroup.

Language. For language proficiency, LEP was found to be strongly associated with worse SRH in Asians compared to NHWs in all three studies that examined this variable (Kandula et al., 2007; Min et al., 2014; Sentell & Braun, 2012). However, the effect of LEP on SRH varies by ethnic subgroup. Sentell and Braun

(2012) found that only Vietnamese with LEP reported significantly worse SRH compared to English proficient NHWs, whereas Kandula and colleagues (2007) found that Chinese, Koreans, and Vietnamese with LEP were significantly more likely to report fair/poor SRH compared to English proficient NHWs.

Hispanics Versus NHWs

Nativity. Eight of the nine studies examined the association between nativity in Hispanics and SRH (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014), with seven studies showing a significant association (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). Before nativity was introduced into regression models, six of these seven studies showed Hispanics reported worse SRH compared to NHWs (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014), although one of these studies found only Puerto Ricans and "Other Hispanics" reporting worse SRH compared to NHWs (Gorman et al., 2010). After including nativity in the models, the significant associations were diminished or no longer remained in five of the six studies (Acevedo-Garcia et al., 2010; Gorman et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014), with one of the five studies showing a diminished association in only foreign-born Hispanics (Kimbro et al., 2008). In the remaining study that found Hispanics reporting worse SRH compared to NHWs, Huh and colleagues (Huh et al., 2008) found that foreign born Hispanics, and not U.S.-

born, reported significantly better SRH compared to NHWs after nativity was included in the model. In contrast, one study found that Hispanics (Acevedo-Garcia et al., 2010), and in another study only Mexicans (Gorman et al., 2010), reported significantly better SRH compared to NHWs, with the significant association no longer remaining after including generation status (Acevedo-Garcia et al., 2010), and in the second study, nativity in the model (Gorman et al., 2010).

Although several studies indicate that nativity accounted for the ethnic difference in SRH, the effect of nativity on SRH decreased when other covariates were also considered. For example, the significant association between nativity and SRH decreased after entering other acculturation variables such as LEP (Min et al., 2014), and no longer remained after including years in U.S. and self-rated English proficiency in a study by Seo and colleagues (2014).

Language. Three studies found a significant association between language and SRH in Hispanics (Kandula et al., 2007; Min et al., 2014; Sentell & Braun, 2012). These studies suggest the influence of LEP in Hispanics' reporting of fair/poor SRH compared to NHWs.

Aim 3: Impact of Nativity and Language on SRH in Asians Compared to Hispanics

Two studies provided enough data to make comparisons between Asian and Hispanic race/ethnicities (Kim et al., 2011; Kimbro et al., 2008). In one study, LEP older Hispanics had worse SRH compared to LEP older Asians (Kim et al., 2011). In a study examining nativity that compared foreign-born Hispanics to foreign-born Asians and U.S.-born Hispanics to U.S.-born Asians, Hispanics in both comparison groups had a higher predicted probability of reporting fair/poor health compared to Asians (with the

exception of U.S.-born Hispanic vs. US born Asian high school graduates) (Kimbro et al., 2008).

Discussion

To our knowledge, this is the first systematic review that has made an attempt to compare the association between acculturation and SRH in Asians and Hispanics compared to NHWs. Furthermore; this is the first systematic review to compare Asians and Hispanics. Available evidence from this review provides support for the first aim showing there is a moderate to strong association between acculturation and fair/poor SRH among Asians and Hispanics. In examining the second aim, there is evidence to support a relationship between nativity and language proficiency and SRH in Asians and Hispanics, but the degree of association may vary by subgroup. The results indicate discrepancies in worse SRH among Asian subgroups with Vietnamese, Chinese, and Koreans reporting worse SRH most often. In addition, strong evidence found that being foreign-born and/or LEP contributed a vital source of vulnerability among certain Asian subgroups. Further evidence was revealed in another language based study by Kimbro and colleagues (2008) when Chinese, Filipinos, and Vietnamese, who were Asian-language dominant, were found to be significantly more likely to report worse SRH compared to bilingual study participants of the same ethnicity.

This systematic review also highlights the importance of subgroup analysis for Hispanics. There is evidence to support that while Mexicans may report better SRH more often (compared to Puerto Ricans and "Other Hispanics"), further evidence supports a stronger relationship between nativity and worse SRH for

Mexicans. In reviewing the third aim, data suggests that nativity and LEP is a risk factor for reporting worse SRH in Hispanics compared to Asians.

There is increasing acknowledgement that culture and language affect perceptions of personal health, attitudes, and behaviors (Kandula et al., 2007). These acculturation factors then influence how individuals respond to questions about their self-reported health. The literature offers several explanations as to why Asians and Asian subgroups report worse SRH compared to NHWs. Kandula and colleagues (2007) have reported that Vietnamese' worse SRH may be related to immigration trauma as many Vietnamese came to the U.S. as war refugees. On the other hand, Filipinos' reporting of similar or better SRH compared to NHWs may be due to English being the dominant language among Filipinos. Asians may also have a different cultural perspective when assessing their SRH. NHWs often rate their health based on physical health, whereas Asians have a more holistic approach looking at physical, emotional, and spiritual health (Kandula et al., 2007). Finally, Seo and colleagues (2014) suggested that native language interviewees might experience more obstacles to receiving and negotiating health care and as a consequence, report worse SRH.

In this systematic review, being Hispanic is associated with worse SRH and being a foreign-born Hispanic appears to have a stronger negative association than being U.S.-born. In addition, nativity and LEP are strongly associated with worse SRH in Hispanics. These findings suggest that Hispanics may rate their health lower than NHWs because they may not want to be overly positive, and the validity and meaning of health may be different for Hispanic populations compared to NHWs (Finch et al., 2002; Kandula et al., 2007).

Although studies directly comparing Asians and Hispanics are limited, this systematic review found that LEP Hispanics, and in another study, U.S.- and foreignborn Hispanics, reported worse SRH compared to Asians. These results indicate that being Hispanic or Hispanic with LEP is a risk factor for worse SRH. There are several explanations for this racial/ethnic group disparity. First, despite Hispanics reporting worse SRH compared to Asians in two studies (Kim et al., 2011; Kimbro et al., 2008), neither study disaggregated by subgroup. Therefore, it is unknown if the difference in reporting SRH is consistent across subgroups (Kandula et al., 2007; Sentell & Braun, 2012). Second, Acevedo-Garcia and colleagues (2010) found no difference in SRH across Asian generations, which according to Portes and Rumbault (2001) may be reflective of Asian's relatively more successful integration experience. Finally, for Hispanics (Min et al., 2014) with LEP (Kim et al., 2011), education (a proxy for SES) was found to be a more salient factor for worse SRH compared to Asians, and because Hispanics have lower educational attainment compared to Asians (Acevedo-Garcia et al., 2010; Huh et al., 2008; Kandula et al., 2007; Kim et al., 2011; Min et al., 2014), this may contribute to Hispanics (with LEP) reporting worse SRH more often than Asians.

Limitations

There are several important limitations to this systematic review. First, all of the studies were cross-sectional which limits the understanding of causality. Second, there are a variety of factors that affect the acculturation process or self- reporting of health by mediating or moderating the relationship between these two variables. This review did not delineate possible influencing factors when reporting results. Further studies should explore these factors when examining the relationship between

acculturation and SRH. Third, there was self-reporting of outcome and acculturation variables, which introduces the possibility of bias. Fourth, this review did not attend to ethnic and cultural variations, which has been documented in the literature as important to understanding and responding to the question about SRH (Seo et al., 2014). Fifth, only three studies disaggregated Asian subgroups and only one study delineated Hispanic subgroups. As evidenced in this systematic review however, the association between acculturation and SRH varies widely by ethnic subgroup. Finally, every effort was made to conduct a thorough review of the literature and to avoid missing relevant data. However, it is still possible that studies were missed because of inadequate indexing or because not all of the relevant search terms were used to capture the associations.

Recommendations for Future Research

This systematic review suggests that ethnic differences in SRH may have a cultural and linguistic foundation. In order to better understand the influence of acculturation on SRH in Asians and Hispanics, several gaps across this body of literature have been identified and recommendations to enhance the research process are offered. First, there is a need for longitudinal studies that focus on measurements of SRH at the time of immigration and across several years of the acculturation process, which includes multiple observations, in order to examine the causal relationship between acculturation and SRH. Additionally, covariate factors can be measured over time so as to understand the moderating and mediating effects on the association between acculturation and SRH. Importantly, as evidenced from this review, there is variation within racial/ethnic groups regarding reporting of SRH. It is important to

disaggregate Asians and Hispanics, as they are heterogeneous in terms of language, immigration, and culture (Ghosh, 2010). This systematic review also revealed that only a few studies included a conceptual or theoretical framework. Understanding the acculturation process gives context to the study's model and provides a valuable tool for understanding covariates, mediators, and moderators that influence the relationship between acculturation and SRH. Finally, there are a wide variety of factors used to measure acculturation as well as little consensus on the definition of acculturation. Future research should focus on identifying additional factors that encompass the acculturative process.

Conclusion

Findings of this systematic review highlight the importance of nativity and language proficiency distinctions involving immigrant minority groups. However, acculturation measures can vary across ethnic groups making the role of nativity and language on SRH in different ethnic subgroups as yet unknown (Huh et al., 2008; Kandula et al., 2007). Despite limitations, this systematic review identified the need for additional high-quality research on racial/ethnic subgroup differences in the association between acculturation and SRH. It is suggested that prospective longitudinal and qualitative studies, including appropriate samples sizes for Asian and Hispanic subgroups, and focusing on uniform measures of acculturation and SRH, should be conducted.



Figure 1. Flow Diagram of Article Retrieval Process

Table 1. Search Strategy for Databases								
CINAHL, PubMed, PsychINFO, Web of Science, Sociological abstracts, SCOPUS								
Acculturation		Ethnicity		Outcome				
Acculturation		Hispanic(s)		Self-rated health				
Immigrant(s)		Latino(s)		Self-reported health				
Immigration	OR	Asian(s)	AND	Health status				
Nativity		Hispanic(s) and Asian(s)						
Foreign-born		Latino(s) and Asian(s)						
Hispanic/Latino Paradox		Ethnicity						

Table 2. Quality Assessment Scoring											
	Quality Criteria									_	
	Design		Sample			Measu	irement		Ana	lysis	
Study	Probabi lity Samplin g?	Sampl ed from more than one site?	Sampl e size justifie d?	Anony mity protecte d?	Respon se rate greater than 60%?	Acculturati on measured other than self- report?	Accultura tion measure validated ?	Theoreti cal framewo rk?	If multiple outcome s studied, correlati ons analyze d?	Covariat es and confound ers controlle d for?	Total
Aceve											
do- Garcia et al. (2010)	1	1	1	1	1	0	1	1	0	1	8/10
Gorma n et al											
(2010)	1	1	1	1	0	0	0	1	0	1	6/10
Huh et al								_			
(2008)	1	1	1	1	0	0	0	0	0	1	5/10
Kandul a et al.	4	4	4	4	4	0	0	0	0	4	0/10
(2007)	1	1	1	1	1	0	U	U	U	1	6/10
Kim et al.	4		4	4	0	0	0	0	0	0	4/40
(2011)	1	1	1	1	U	U	U	U	U	0	4/10
Kimbro et al.						<u> </u>	0	0	0	<u> </u>	
(2008)	1	1	1	1	0	0	0	0	0	0	4/10
Min et al.	4	1	1	4	0	0	0	0	1	4	6/10
(2014)	I	I	I	I	0	0	0	U	I	I	6/10
Sentell and	1	1	1	1	0	0	0	0	0	1	5/10
Braun (2012)	I	ı	1	I	0	0	U	0	0	I	5/10
Seo et al.	1	1	1	1	0	0	1	0	0	1	6/10
(2014)					0	U		U	U		0/10

Note. 1 = met criteria, 0 = did not meet criteria. Adapted from "Factors contributing to nursing leadership: A systematic review," by G. Cummings, H. Lee, T. MacGregor, M. Davey, C. Wong, L. Paul, & E. Stafford, 2008, *Journal of Health Services Research & Policy, 13*, p. 243, Copyright 2014 by Sage Publications. Adapted from "Leadership styles and outcome patterns for the nursing workforce and work environment: A systematic review," G. Cummings, T. MacGregor, M. Davey, H. Lee, C. Wong, E. Lo, ... E. Stafford, 2010, *International Journal of Nursing Studies, 47*, p.365, Copyright 2014 by Elsevier B.V.
Table 3. Cl	haracteristics	s of Included	d Studies			
Author(s) Year	Participants Sample	Design Survey Years	Respondent Rate	Acculturation Measure(s)	Covariates	Key Findings
Acevedo- Garcia et al. (2010)	637,209 NHW (n=447,894) Asian (n=30,946) Hispanic (n=89,428)	Cross- sectional Current Population Survey 2003-07	82.6-85%	Nativity Other acculturation measures: Immigrant generation, Years in U.S.	Age Gender Marital status Health insurance Metropolitan area U.S. region Education Occupation Homeownership Household income	Asians and Hispanics reported <i>better</i> SRH compared to NHW. Significant association no longer remained after including generation status.
Gorman et al. (2010)	31,732 NHW (n=23,027) Asian (n=472) Hispanic: Mexican (n=2,227) Puerto Rican (n=371) Cuban (n=241) Other Hispanic (n=888)	Cross- sectional Health Interview Survey 2001		Nativity Other acculturation measures: Citizenship status, Interview language	Age Gender Ethnicity Education Income Employment status Medical insurance Hypertension Heart disease Family structure Family structure Family support Friend support Worship services Current smoker Binge drinker Exercise Obesity Depressed mood	Asians did not report worse SRH than NHWs. Puerto Ricans and other Hispanics reported worse SRH than NHWs. No significant association between nativity and worse SRH in Asians or Hispanics.

Author(s) Year	Participants Sample	Design Survey Years	Respondent Rate	Acculturation Measure(s)	Covariates	Key Findings
Huh et al. (2008)	46,318 NHW (n=35,370) Asian (n=1,540) Hispanic (n=9,408)	Cross- sectional National Health Interview Survey 2000-01		Nativity	Age Gender Martial status BMI Family income Education Survey year Smoking status Drinking status Physical activity Health insurance Place to go when sick Comorbid disease	Asians reported better SRH compared to NHWs. Association no longer remained after adding acculturation measures. Hispanics reported worse SRH compared to NHWs. After including acculturation, U.Sborn Hispanics more likely to report worse SRH than NHWs. Foreign-born Hispanics more likely to report better SRH than NHWs.

Author(s) Year	Participants Sample	Design Survey Years	Respondent Rate	Acculturation Measure(s)	Covariates	Key Findings
Kandula et al. (2007)	39,699 NHW (n=36,660) Latino (n=9,399) Chinese (n=298) Filipino (n=944) Korean (n=803) Vietnamese (n=857) Other Asian (n=1,036)	Cross- sectional California Health Interview Survey 2001	64%	Nativity English proficiency	Age Ethnicity Gender Marital status Employment status Income as percent of poverty level Chronic disease Current smoking	Chinese, Vietnamese and Koreans reported worse SRH than NHWs. Only Koreans no longer reported worse SRH after adding acculturation measures. Chinese, Korean and Vietnamese with LEP reported worse SRH compared to English proficient NHWs. Hispanics (with and without LEP) reported worse SRH compared to English proficient NHWs. Hispanics (with and without LEP) reported worse SRH compared to English proficient NHWs.
Kim et al. (2011)	1,745 Latino (n=783) Asian (n=962)	Cross- sectional California Health Interview Survey 2007		English proficiency Other acculturation measures: Years in U.S., Naturalized U.S. citizen		LEP Hispanics had worse SRH compared to LEP Asians.

Author(s) Year	Participants Sample	Design Survey Years	Respondent Rate	Acculturation Measure(s)	Covariates	Key Findings
Kimbro et al. (2008)	14,039 NHW (n=93,459) Hispanic (n=27,167) Asian (n=4,902)	Cross- sectional National Health Interview Survey 2000-06		Nativity	Age Gender Education Race/ethnicity Current smoking Drinking status Work limitations Obesity Physical activity	No significant association between nativity and worse SRH in Asians. Hispanics had higher predicted probability of reporting worse SRH compared to Asians and NHWs.
Min et al. (2014)	9,158 NHW (n=8,065) Hispanic (n=482) Asian (n=611)	Cross- sectional California Health Interview Survey 2005		Nativity English proficiency	Age Gender Ethnicity Marital status Education Household income Poverty status Health insurance Usual source of care MD in last year Psychological distress Chronic illnesses	Asians and Hispanics significantly less likely to report better health than NHWs. Significant difference remained after adding acculturation measures. Foreign-born LEP Asians and Hispanics reported worse SRH compared to NHWs.

Author(s) Year	Participants Sample	Design Survey Years	Respondent Rate	Acculturation Measure(s)	Covariates	Key Findings
Sentell and Braun (2014)	48,427 Latino (n=5,724) Vietnamese (n=466) Korean (n=622) Chinese (n=1,234)	Cross- sectional California Health Interview Survey 2007		Nativity English proficiency	Age Gender Ethnicity Martial status Health literacy Education Poverty level Rural status Insured	No significant association between nativity and worse SRH in Asians and Hispanics. Vietnamese and
Seo et al. (2014)	74,190 NHW (n=62,730) Latino (n=8,280) Chinese (n= 525) Korean (n=1,103) Vietnamese (n=962)	Cross- sectional California Health Interview Survey 2003, 2005		Nativity English proficiency Other acculturation measure: Years in U.S.	Age Gender Ethnicity Marital status Education Employment Mental and physical health Interview Ianguage Smoking status BMI Chronic conditions Insurance MD visits	Asians reported significantly worse SRH compared to NHWs. Controlling for acculturation measures, no difference from NHWs in odds of reporting poor SRH for Chinese only. Hispanics reported significantly worse SRH compared to NHWs. Significant association no longer remained after including acculturation measures.

Note. NHW = non-Hispanic White; SRH = self-rated health; LEP = limited English proficiency; BMI = body mass index; MD = medical doctor

Chapter Three: Acculturation, Inflammation, and Self-rated Health in Mexican American Immigrants

Abstract

Objective. This cross-sectional study examined the bio-behavioral pathways that may account for poorer SRH among Mexican American immigrants compared to non-Hispanic Whites in the U.S.

Methods: The 2009-2010 National Health and Nutrition Examination Survey (NHANES) enrolled 592 Mexican American immigrants and 2,391 U.S.-born, non-Hispanic Whites. Predictor variables included Mexican American ethnicity and a validated Acculturation Index comprised of language spoken at home, interview language, and proportion of life residing in the U.S. The mediator variables were depressive symptoms and log₁₀ transformed CRP, a measure of inflammation.

Results: Compared to U.S.-born, non-Hispanic Whites, Mexican American immigrants reported poorer SRH, b = -0.74, p < .001. Mexican American immigrant status was also indirectly associated with worse SRH via greater CRP, b = -0.02, 95% biased-corrected *CI* [-.03, -.01]. Among Mexican American immigrants, greater acculturation was associated with better SRH, b = 0.17, p < .001.

Conclusion: Poorer SRH among Mexican American immigrants may be partially attributable to greater inflammation. However, Mexican American immigrants with higher levels of acculturation report better SRH.

Keywords: Self-rated health, Acculturation, C-reactive protein, Depression, Mexican Americans, Hispanics/Latinos

Significance

There is increasing recognition that disparities in health are preventable inequitable differences seen within and between populations (Meyer, Yoon, Kaufmann, & Centers for Disease Control and Prevention (CDC), 2013). According to the World Health Organization, social, personal, environmental, and economic factors are important determinants of health that have been linked to racial/ethnic inequalities in health outcomes (Meyer et al., 2013). Identification and awareness of gaps in health outcomes are essential to reducing health disparities.

Self-rated health (SRH) is a dynamic indicator of health as it has been found to be a robust predictor of future disability and mortality and is sensitive to health and social factors, such as physical function and engagement in social activities (Idler et al., 1999). Self-rated health is often measured using a single question--*In general, would you say your health is excellent, very good, good, fair or poor*? Fair or poor SRH has been strongly associated with psychological and functional disability (Ocampo, 2010) and mortality (Jylhä, 2009). Conversely, excellent or very good SRH has been found to be an independent predictor of survival (Kawada, 2003). While there is substantial literature focusing on the association between SRH and health, there is a dearth of literature that focuses on what factors explain SRH, particularly in Hispanic immigrants in the United States (U.S.), a population that has experienced persistent inequalities in health outcomes (Meyer et al., 2013). Therefore, the purpose of this study is to understand factors that may explain SRH, one such determinant of health, to better recognize health disparity and improve health equity among Hispanics in the U.S.

Hispanics and SRH

Research on Hispanic health has focused on the "Hispanic/Latino health advantage" and the "Hispanic/Latino health paradox." The Hispanic/Latino health advantage indicates, among other findings, that although Hispanics and Latinos have lower rates of harmful health behaviors, including cigarette smoking and heavy drinking, they report worse health compared to non-Hispanic Whites (Viruell-Fuentes, Morenoff, Williams, & House, 2011). The "Hispanic/Latino health paradox" posits that, although first generation Hispanics have poorer socio-economic profiles, they experience better health for some outcomes, including lower prevalence of hypertension, cardiac disease, asthma, diabetes, and cancer compared to their U.S.-born counterparts (Bostean, 2013; Ruiz et al., 2013). By gaining an understanding of the bio-behavioral factors related to SRH, researchers may begin to understand why, despite better health behaviors and outcomes, Hispanic immigrants often report worse SRH compared to non-Hispanic Whites (Menec, Shooshtari, & Lambert, 2007).

Acculturation and SRH

Acculturation is one factor that influences health and SRH in immigrant populations. Acculturation is a dynamic process, commencing when an immigrant enters into a new country and begins to adapt to its culture (Berry, 1980). Acculturation is multidimensional, and includes many aspects of an immigrant's life including language competence and use, cultural identity, attitudes and values, preferred music and food, ethnic pride, social relations, and customs (American Psychological Association Task Force, 2011). Lower levels of acculturation (measured by English proficiency and nativity) have been associated with worse SRH in Hispanic immigrants

(Acevedo-Garcia et al., 2010; Kandula et al., 2007; Kimbro et al., 2008; Min et al., 2014; Sentell & Braun, 2012; Seo et al., 2014). Shetterly and colleagues (1996) found that Hispanics with limited English were more likely to report lower SRH than non-Hispanic Whites and Hispanics who spoke English well remained almost twice as likely as non-Hispanic Whites to report worse SRH. This finding prompted the authors to postulate that somatization may be more common in Hispanics, which could translate into poorer SRH (Shetterly et al., 1996). Other acculturation studies demonstrated that Spanishspeaking foreign-born immigrants reported similar SRH to Spanish-speaking U.S.-born residents (Franzini & Fernandez-Esquer, 2004). English-speakers, whether U.S. or foreign born, reported better SRH compared to Spanish-speakers (Franzini & Fernandez-Esquer, 2004). Angel and Guarnaccia (1989) and Bzostek and colleagues (2007) propose that language may distort the meaning of SRH for Hispanics, which may bias reporting toward worse SRH for Spanish-speakers. Still others have suggested that worse SRH among Hispanics may be due to semantic differences about what constitutes good, fair, or poor health (Parrish, 2010; Salomon, Nordhagen, Oza, & Murray, 2009). Finally, overrating one's health may be socially unacceptable in some Hispanic cultures (Franzini & Fernandez-Esquer, 2004). Culture and language may be critical factors in understanding differences in SRH among ethnically diverse populations.

Depression and SRH

Depression is a serious medical illness with mood, cognitive, and physical symptoms and is associated with higher rates of chronic disease, increased health care utilization, and impaired functioning (CDC, 2012). In a recent national study,

approximately 27 percent of Hispanics reported high levels of depressive symptoms with women almost twice as likely as men to experience depressive symptoms (Wassertheil-Smoller et al., 2014). Poorer SRH has been associated with depression and risk of future depression in diverse racial/ethnic populations (Ambresin et al., 2014; Benjamins et al., 2012; Gunn et al., 2012). For Hispanics, having a lifetime diagnosis of depression is significantly associated with poorer SRH compared to non-Hispanic Whites (Benjamins et al., 2012; Chowdhury, Balluz, Zhao, & Town, 2014; Jang, Park, Kang, & Chiriboga, 2014; Lee, Donlan, Cardoso, & Paz, 2013). These findings indicate that depression may contribute to differences in SRH in Hispanic populations.

C- Reactive Protein (CRP) and SRH

While several studies have focused on the psychosocial variables that influence SRH, few have examined biological pathways that may affect SRH such as inflammatory processes (Christian et al., 2011). CRP is an acute-phase protein of hepatic origin that increases following interleukin-6 secretion from macrophages and Tcells in response to a wide range of acute and chronic inflammatory conditions (Ridker, 2003), including social and psychological stressors (Petersen et al., 2008; Steptoe, Hamer, & Chida, 2007). Research focusing on pro-inflammatory cytokines has found elevated CRP to be associated with poorer SRH in diverse populations including those in Israel (Leshem-Rubinow et al., 2015), U.S. (Christian et al., 2011; Dowd & Zajacova, 2010; Shanahan et al., 2014), Japan (Tanno et al., 2012), and Sweden (Janszky, Lekander, Blom, Georgiades, & Ahnve, 2005). Specifically, cytokines convey to the brain that an infection has occurred in the periphery via the endocrine route, blood, or by direct neural transmission. This inflammatory response induces symptoms of illness

behavior, including lethargy and decreased appetite (Dantzer & Kelley, 2007), which may affect subjective appraisals of health contributing to poorer SRH (Christian et al., 2011).

Although the above-mentioned studies have provided a wealth of knowledge about Hispanic health, limited attention has been paid to factors that contribute to SRH in the nation's largest subpopulation of Hispanic immigrants. To date, the authors are unaware of any studies that have focused on correlates of SRH in Mexican American immigrants. Therefore, this study makes a unique contribution to the literature in that it will determine whether Mexican ethnicity and acculturation level are associated with poorer SRH status via higher CRP level and greater depressive symptoms.

Methods

Data Collection

We conducted a secondary data analysis of cross-sectional data from The National Health and Nutrition Examination Survey (NHANES), which is designed to assess the health and nutritional status of U.S. adults and children. The NHANES is a stratified multistage probability sample survey of the U.S. civilian population and is conducted by the National Center for Health Statistics (NCHS) and Centers for Disease Control and Prevention (CDC, 2012). Beginning in 1999, the NHANES was conducted continuously and released in 2-year cycles. Participants complete a detailed home survey on demographic, socioeconomic, and health data followed by a physical examination and laboratory measurements in mobile health centers. Additional information about NHANES has been described elsewhere (CDC, 2012). For the

present study, data from the 2009-2010 cycle was used because during this cycle year NHANES oversampled for Hispanic populations.

The present study focused on acculturation level among Mexican American immigrants; only Mexican Americans who were born in Mexico were included (n=592). The comparison group includes U.S. born, non-Hispanic Whites (N=2,391). The study sample was limited to 20 years of age or older.

Measures

SRH was assessed by the question: *How do you rate your current health status?* Choice of responses included: *excellent, very good, good, fair, or poor.* Race and ethnicity were self-reported as Mexican American or non-Hispanic White. Age at time of survey and gender were additional covariates of interest.

Level of acculturation was measured by language spoken at home, interview language, and proportion of life residing in the U.S. An acculturation index was created, emulating the Proxy Acculturation Scale-3 developed by Cruz, Marshall, Bowling, and Vallaveces (2008). For language spoken at home, a value of 0 was given if the participant answered "only Spanish or more Spanish than English," and a value of 1 was given if the participant answered, "Both Spanish and English equally, more English than Spanish or only English." For interview language, a score of 0 was given if the interview was conducted in Spanish and a value of 1 was given if the interview was conducted in English. For proportion of time resided in the U.S., the number of years lived in the U.S. was divided by the participant's age, which elicited a value between zero and one. These three values were added together, with a total possible score ranging from zero to three.

In NHANES, CRP is measured using latex-enhanced nephelometry with a serum ultra sensitive lower limit of 0.02 mg/L. In cases where the result was below the limit of detection, the value for that variable was the detection limit divided by the square root of two (CDC, 2012). For the present study, CRP was log₁₀ transformed because the CRP levels were positively skewed.

Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9), a nine-item screening instrument that asks questions about the frequency of symptoms of depression over the past two weeks. Response categories "*not at all*," "*several days*," "*more than half the days*," and "*nearly every day*" were given a score ranging from zero to three, respectively. A total score was calculated ranging from zero to 27 (Cronbach's α = 0.89 for non-Hispanic Whites; Cronbach's α = 0.83 for Mexican American immigrants). The PHQ-9 has been previously validated in Spanish-speaking participants (Gilbody, Richards, Brealey, & Hewitt, 2007; Merz, Malcarne, Roesch, Riley, & Sadler, 2011).

Method of Analysis

Guided by acculturation theory (Berry, 2005) and Shetterly and colleague's (1996) study findings, path analysis was used to examine whether the association between Mexican American immigrant status (compared to non-Hispanic Whites) and poorer SRH was co-mediated by greater depressive symptoms and elevated CRP. A second path analysis among only Mexican American immigrants was used to determine if the association between higher acculturation level and better SRH was co-mediated by greater depressive symptoms and elevated CRP. Linear regression was employed and results were expressed as unstandardized beta coefficients with

relevant *p*-values or confidence intervals. Gender and age were controlled for in all analyses. Age and depressive symptoms were mean-centered to facilitate interpretation of the parameter estimates.

Research indicates that mediating and indirect effects are not normally distributed; therefore, nonparametric bootstrapped analysis to obtain the bias-corrected confidence intervals for the specific and total indirect effects of ethnicity on SRH via depressive symptoms and CRP was carried out with 1,000 repetitions (data not shown) (Cheung, 2007; lacobucci, Saldanha, & Deng, 2007; Shrout & Bolger, 2002). Alpha was set at 0.05 (two-tailed test) and the analyses were performed with Stata 13 using the structural equation modeling module and surveyset for complex survey data with maximum likelihood estimation.

Results

Sample Characteristics

Mexican American immigrants reported fair or poor SRH significantly more often (44%) than U.S.-born, non-Hispanic Whites (13%), p < .001 (Table 1). Although not significantly different, Mexican American immigrants had a higher mean log_{10} CRP at -0.89 mg/L, Standard Deviation (*SD*) = 0.04 mg/L compared to -0.91 mg/L, *SD* = 0.01 mg/L for U.S.-born, non-Hispanic Whites. Additionally, Mexican American immigrants (mean [*M*] 3.56, *SD* = 0.29) reported greater depressive symptoms compared to U.S.born, non-Hispanic Whites (*M* 3.22, *SD* = 0.16), although the difference was not significant. Among Mexican American immigrants, the mean acculturation score was 0.86, *SD* = 0.04 (range 0-3). There was a significant age difference among participants (p < .001). The mean age for Mexican American immigrants was 41 years (*SD* = 1.11)

and 49.35 years (*SD* = 0.56) for non-Hispanic Whites. Mexican American immigrants were comprised of 54% male participants whereas non-Hispanic Whites were made up of 49% male participants (p < .01).

Path Analysis for Mediation Models

A path model was estimated with SRH as the outcome of interest predicted jointly by Mexican American immigrant status, depressive symptoms, and CRP (Figure 1). The direct associations of the three predictors of SRH were estimated, as well as the indirect associations of Mexican American immigrant status with SRH via depressive symptoms and CRP. We found non-significant path coefficients for the associations of Mexican American immigrant status with depressive symptoms, *b* = 0.06, *p* = .86, and CRP, *b* = 0.07, *p* = .15. However, Mexican American immigrant status, *b* = -0.74, *p* < .001, greater depressive symptoms, *b* = -0.08, *p* < .001, and higher CRP levels, *b* = -0.29, *p* < .001, were independently associated with reporting worse SRH, controlling for age at survey and gender. When examining the effect of gender and age, increasing age was significantly associated with reporting worse SRH, *b* = -0.004, *p* = .002, and women reported significantly better SRH, *b* = 0.16, *p* < .001, compared to men. Mexican American immigrant status, CRP, and depressive symptoms accounted for approximately 19% of the variability of SRH.

A similar path model was estimated for acculturation predicting SRH with the same two mediator variables, depressive symptoms and CRP (Figure 2). Nonsignificant path coefficients were found for the associations of acculturation with depressive symptoms, b = -0.11, p = .38, and CRP with SRH, b = 0.03, p = .52. Higher levels of acculturation were significantly associated with higher CRP levels, b = 0.07, p

= .008, and better SRH, b = 0.17, p < .001. Greater depressive symptoms were significantly associated with reporting worse SRH, b = -0.06, p < .001. Increasing age predicted worse SRH in this model, b = -0.014, p < .001. There was no difference between men and women in reporting SRH, b = -0.004, p = .96. These three variables, acculturation level, depressive symptoms and CRP, explained 15% of the model variance in SRH.

Mediating Effects

The indirect effect of Mexican American immigrant status on SRH via CRP was significant, b = -0.019, nonparametric 95% bias-corrected (BC) *CI* [-0.04, -0.004]. The indirect effect of Mexican American immigrant status on SRH via depressive symptoms was not significant, b = -0.01, nonparametric 95% BC *CI* [-0.04, 0.03]. There were no significant indirect effects of acculturation on SRH via CRP or depressive symptoms.

Discussion

In this study of a nationally representative sample, Mexican American immigrant status was significantly associated with poorer SRH compared to U.S.-born, non-Hispanic Whites. This is consistent with previous literature that demonstrated that Mexican American ethnicity was a significant predictor for worse SRH compared to non-Hispanic Whites (Kimbro et al., 2008; Min et al., 2014). We did not find a difference in depressive symptoms or level of CRP between Mexican American immigrants and U.S.born, non-Hispanic Whites. It is conceivable that the "Hispanic/Latino health paradox" may explain this result. Although first generation Hispanics (who often report lower levels of acculturation, which represented the preponderance of this sample) have

poorer socio-economic profiles, they experience a lower risk of certain acute and chronic inflammatory conditions that have been demonstrated to cause elevations in CRP (Bostean, 2013; Ridker, 2003; Ruiz et al., 2013; Viruell-Fuentes, 2007). Furthermore, the Hispanic/Latino health advantage posits that Hispanics have lower rates of harmful health behaviors, such as cigarette smoking and heavy drinking, which in turn may positively influence depressive symptoms and CRP level, despite reporting worse SRH compared to non-Hispanic Whites (Brewer et al., 2013; Kimbro et al., 2012; Min et al., 2014).

Unique to this study was the finding that depressive symptoms and elevated CRP were significant predictors of worse SRH in Mexican American immigrants compared to U.S.-born, non-Hispanic Whites. These findings do not meet the definition of classic mediation (Kenney, 2014) due to the absence of a significant association of Mexican-American immigrant status with higher CRP however, by calculating the significance of the indirect effect, we observed that greater CRP partially mediated the relationship between Mexican American immigrant status and poorer SRH. These outcomes may indicate that elevated CRP serves a unique function for worse SRH in Mexican American immigrants. Explanations include the possibility that elevated CRP caused by inflammation may induce subjective feelings of illness contributing to poorer SRH (Christian et al., 2011; Dantzer & Kelley, 2007).

Informed by Berry's acculturation theory (1980) and previous research, the present study demonstrates that a higher level of acculturation is significantly associated with better SRH among Mexican American immigrants. This finding is complemented by several studies that reported that lower levels of acculturation are

associated with worse SRH (Benjamins et al., 2012; Franzini & Fernandez-Esquer, 2004; Shetterly et al., 1996). This study finding suggests that less acculturated Mexican American immigrants may be more unwilling to rate their health highly and somatization may be more common as has been found in other studies (Shetterly et al., 1996). This is reflected in Uebelacker and colleagues' study (2009) that demonstrated that Hispanic respondents were more likely to endorse appetite/weight disturbances compared to non-Hispanic respondents given the same level of depression severity.

The influence of Mexican American culture can also be observed in the present study with the findings of the associations of acculturation with higher CRP and better SRH. It was demonstrated that higher levels of acculturation significantly predict elevated CRP among Mexican American immigrants. This conclusion may be explained as a consequence of adopting a more traditional American culture, whereby Mexican American immigrants put themselves at higher risk for acute and chronic inflammatory conditions by engaging in less healthy behaviors, which may increase CRP levels (Bostean, 2013; Ridker, 2003; Ruiz et al., 2013; Viruell-Fuentes, 2007). C-reactive protein however, did not mediate the relationship between acculturation and better SRH. These findings support the Hispanic/Latino health paradox by underscoring that level of acculturation influences health behaviors and as a consequence, health outcomes as well as reporting of SRH.

In this sample of Mexican American immigrants, acculturation level was not significantly associated with depressive symptoms. This finding is corroborated in a study by Masten and colleagues (2004) but is contradictory to other studies that reported that less acculturated Hispanics (González, Haan, & Hinton, 2001; Lorenzo-

Blanco, Unger, Baezconde-Garbanati, Ritt-Olson, & Soto, 2012) and Mexican Americans (Chiriboga, Jang, Banks, & Kim, 2007) were more likely to experience depressive symptoms. The discrepancy in these findings is important because it implies that there may be different perceptions and beliefs of depression across and within subgroups. Additionally, higher or lower acculturation scores may have different implications for people in different racial/ethnic subgroups (Chiriboga, Jang, Banks, & Kim, 2007). Differences in acculturation measurement among studies may also contribute to the inconsistency in results.

This study is characterized by several limitations. First, results may not represent current national trends because the data were collected in 2009-10. However, this dataset was chosen because it offered both a comprehensive set of acculturation measures as well as biologic markers. Second, because the study was cross-sectional, it is not possible to draw definitive conclusions about direction and cause-effect of the associations. Third, although this study used a previously validated acculturation index (Cruz et al., 2008), there are a wide variety of proxy factors used to measure acculturation as well as little consensus on the definition of acculturation. For example, as Berry (2005) theorized, acculturative stress is an important factor when evaluating acculturation contexts.

There are several strengths of this study. First, we focused only on Mexican American immigrants, which make up the largest Hispanic subgroup in the U.S. This provided a unique opportunity, as there are substantial differences between Hispanic subgroups reporting of SRH because they are heterogeneous in terms of language, immigration experiences, and culture (Ghosh, 2010). Second, the use of

Spanish language surveys enhanced the study's validity compared to previous studies that only used English surveys. Finally, while this study relies on self-reported data for several measures, it includes CRP as an objective measure of health, which reduces measurement bias.

Although this study found several factors to be associated with worse SRH, results did not fully explain what mediates ethnic and acculturation differences in SRH. Only CRP partially explained why Mexican American ethnicity is related to worse SRH. Because CRP, as a marker for inflammation, has been found to induce symptoms of illness behavior, which may affect subjective appraisals of health contributing to poorer SRH (Christian et al., 2011), further research should consider inflammatorymediated illnesses generally and additional inflammatory markers specifically as potential mediators in the pathway between ethnicity and SRH. Also, because of the limited explanatory power of depressive symptoms in explaining the mediation relationship, there is a need for research to examine more direct measures of behavioral pathways. For example, several studies have demonstrated that lower socioeconomic status serves as a risk factor for depression among Hispanics (Cuellar & Roberts, 1997; Lorant et al., 2003; Walsh, Levine, & Levav, 2012). Thus, a more nuanced understanding of SRH might be achieved by taking into account economic factors. Finally, as evidenced in this study, further studies should consider how gender differences might contribute to disparities in health.

Study findings could inform practitioners in public health, clinical medicine, academia, and research about what factors operate to determine SRH in Mexican American immigrants. Understanding biologic and behavioral pathways that may

account for poorer SRH among Mexican Americans may assist in reducing psychological and functional disability (Ocampo, 2010) and mortality (Jylhä, 2009) while improving survival (Kawada, 2003).

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Table 1. Description of Sample by Ethnicity: Non-Hispanic Whites vs. Mexican American Immigrants

* Measured using Patient Health Questionnaire-9 (PHQ-9), a nine-item screening instrument that asks questions about the frequency of symptoms of depression over the past two weeks. Response categories "not at all," "several days," "more than half the days," and "nearly every day" were given a score ranging from zero to three, respectively. A total score was calculated ranging from zero to 27.

** Measured by: language spoken at home, a value of 0 was given if the participant answered "only Spanish or more Spanish than English," and a value of 1 was given if the participant answered, "Both Spanish and English equally, more English than Spanish or only English"; interview language, a score of 0 was given if the interview was conducted in Spanish and a value of 1 was given if the interview was conducted in English; proportion of time resided in the U.S., the number of years lived in the U.S. was divided by the participant's age, which elicited a value between zero and one. These three values were added together, with a total possible score ranging from zero to three.



Figure 1. Mediation Model for Mexican Americans Compared to Non-Hispanic Whites. b = unstandardized coefficients; * Women compared to men; bold = statistically significant. n = 2,391 (weighted 120,806,075) for non-Hispanic Whites; n = 592 (weighted 9,674,188) for Mexican Americans.



Figure 2. Mediation Model for Acculturation in Mexican American Immigrants. b = unstandardized coefficients; * women compared to men; bold = statistically significant. n = 592 (weighted 9,674,188) for Mexican Americans. Chapter Four: Disparities in Self-rated Health Among Chinese Immigrants: Exploring Inequality Identities

Abstract

Objectives. We investigated factors associated with disparities in self-rated health (SRH) among Chinese immigrants.

Methods. Data from 472 adult Chinese immigrants from the National Latino and Asian American Study were analyzed based on an intersectionality framework. Analysis included both additive and multiplicative models. R-squared values assessed the magnitude of the multiplicative model's contributions in explaining SRH beyond the additive model's.

Results. In the additive model, male gender, English language preference, lower acculturative stress, and higher social position were associated with higher SRH. The multiplicative model showed significant interactions between age and language preference, b = .004, 90% *CI* [.001, .01], social position and discrimination, b = .07, 90% *CI* [.01, .14], and between gender, b = -.05, 90% *CI* [-.10, -.004], acculturative stress, b = -.03, 90% *CI* [-.05, -.01] and social position, b = .01, 90% *CI* [.001, .03], and education. Significant interactions contributed 7-11% of predicted variability in SRH beyond the additive model.

Conclusion. A multiplicative modeling approach captures the complexities of immigrants' lives. Interactions between gender, language, education, and acculturative stress contributed to risk for health disparities.

Keywords: Self-rated Health, Chinese, Immigrants, Acculturation, Disparities, Intersectionality

Health disparities, or gaps in the quality of health and health care across racial, ethnic and socioeconomic (SES) groups, are increasing in the United States (U.S.) and the rate of increase is greater among ethnic minorities (Kelly, 2009; Thomson & Hoffman-Goetz, 2009). One such U.S. minority group, Chinese immigrants, is the largest U.S. Asian sub-population and third largest foreign-born group in the U.S., comprising 76% of the total U.S. Chinese population and 5% of the overall immigrant population in 2013 (Hooper & Batalova, 2015). This large and increasing U.S. minority immigrant population highlights the importance of understanding Chinese immigrant health and its impact on the overall health and well being of the American population (Antecol & Bedard, 2006).

Self-rated health (SRH) is an important indicator of the population's health that has been used across social science disciplines. Self-rated health has also been found to be a critical factor in individual life satisfaction and subjective well being (Benyamini et al., 2003). Evaluations of SRH emphasize a holistic view of health including an individual's subjective experience (Ocampo, 2010) and are influenced by multiple factors including demographic (Van Doorslaer & Gerdtham, 2003), biologic and functional, and psychological and social/spiritual variables (Ocampo, 2010). Moreover, SRH predicts mortality in brief follow-up periods of just two years (Rakowski et al., 1991) and more extended intervals of up to 13 years (Chipperfield, 1993). A review of numerous studies have confirmed this robust relationship in probability samples from all over the world including Hong Kong, the U.S, Poland, and Canada (Idler et al., 1999). However, little is known about SRH reported by Chinese immigrants as well as factors contributing to SRH in this population.

An intersectionality framework has been used to examine factors contributing to health and health disparities. This framework originated from the work of African-American scholars (Patricia, 1990) and is defined by the central concepts of oppression, inequality, and social justice. Intersectionality contributes to the study of immigrant health disparities by looking for causes of human behavior both upstream and downstream and examining how different social categories depend on each other for meaning (Cole, 2009). It promises to consider sources that capture the complexities of immigrants' lives that are not limited to the framework's original categories of oppression that include gender, race, and class but rather include language, nativity, immigration, SES, and acculturation states as well as religion, geography, place, and spirituality (Bowleg, 2012). An intersectionality perspective will be an important addition to the study of immigrant health disparities because current research often attributes adverse health consequences (e.g. higher risk of diabetes) to a variety of individual social categories (e.g. SES, ethnicity) (additive approach), often ignoring how the social categories *interact* at the micro level of individual experience and *intersect* at the macro structural level of poverty, sexism and racism (multiplicative approach) (Bowleg, 2012).

This study focused on several health determinants that have been shown to impact SRH in Asian immigrants (Bowleg, 2012). They include: female gende*r* and increasing age, both of which have demonstrated to be associated with worse SRH (Gorman et al., 2010; Sentell & Braun, 2012). Additionally, lower levels of education (as a proxy for SES) (John et al., 2012), limited English proficiency (as a proxy for acculturation) (Kandula et al., 2007; Maty et al., 2011; Mui, Kang, Kang, & Domanski, 2007), lower self-perceived social status (Gong et al., 2012), and an increase in

acculturative stress (Kimbro et al., 2012) have all been associated with fair/poor SRH. Finally, although discrimination has not been included in studies with Asian groups, Molina (2013) found discrimination stress to be associated with worse SRH in Hispanics. While previous studies have investigated SRH in Asian immigrants, limited studies have employed subgroup analysis (Gong et al., 2012; Kandula et al., 2007; Kimbro et al., 2012; Maty et al., 2011; Mui et al., 2007; Sentell & Braun, 2012) and furthermore, these studies have considered the axes of inequality only individually (additive approach). Veenstra (2011) did use a multiplicative approach to analysis however, he did not include acculturation or Asian subgroup analysis. Whether SES influences health differently for Chinese immigrant men and women, for example, has not been investigated.

Despite research that has highlighted health disparities among minority immigrants in the U.S., limited attention has been paid to factors that contribute to SRH in the nation's third largest foreign-born population. By using an intersectionality framework, this study presents a new way of understanding social inequalities that has the potential to reveal and clarify previously unknown health inequalities. Therefore, this study will investigate health outcomes associated with the intersection between inequality identities (age, gender, SES, social position, acculturation status, acculturative stress and discrimination) that constitute the complexities of adult Chinese immigrants' lives.

Methods

Data Collection

We conducted a secondary data analysis of cross-sectional data from The National Latino and Asian American Study (NLAAS), which was designed to examine mental health and health care among U.S. Asians and Latinos aged 18 and older. NLAAS is a multistage, stratified national probability sample drawn from the noninstitutionalized U.S. population, with oversampling of areas with a moderate-to- high density of Latinos and Asian Americans. Data was collected between May 2002 and November 2003. Eligibility criteria for the NLAAS included age (persons 18 years or older), ethnicity (persons who were of Latino, Spanish, or Asian origin), and language (persons who spoke English, Spanish, Vietnamese, Chinese [Mandarin or Cantonese] or Tagalog). The NLAAS instrument was administered in the respondent's choice of the following languages: English, Spanish, Chinese, Vietnamese, or Tagalog by bilingual lay interviewers. The response rate was 65.6% for Asian Americans. A detailed description of the NLAAS protocol and methods of data collection have been previously documented (Alegria et al., 2004). Because the present study focused on acculturation level among Chinese immigrants, only Chinese who were born outside of the U.S. were included (n=472) (out of a total of 2,095 Asian respondents).

Measures

The outcome variable, SRH, was assessed by the question: *How do you rate your current health status*? Choice of responses included: *excellent, very good, good, fair or poor.*

The key predictor variables, which represent inequality identities, include age, gender, SES, social position, acculturation status, acculturative stress and discrimination. Age was assessed by eliciting *age at interview*. *Gender* was measured with the dichotomous variable male or female. Socioeconomic status is represented by years of *education*.

Social position is measured by a response to a question about how respondents compare their social position to others (e.g., "Compared to other people in the U.S., where do you stand at this time in your life if 10 represents people who are the best off [most money, most education and most respected jobs] and 1 represents those who are the worst off [least money, least education and least respected jobs])?" De Castro and colleagues (2010) used this question to measure subjective social status in their study.

Acculturation is represented by *language preference* and *co-ethnic ties*. Language preference is measured by using the average response to three questions about how often they use each language (Chinese and English) in context on a fivepoint scale including: with friends, family, and when thinking (Chinese all the time, Chinese language most of the time, Chinese language and English equally, English most of the time, English all of the time) (Cronbach's alpha [α] = .90). Higher scores represented using English language more often. *Co-ethnic ties* is based on the average response to four questions that elicit how close respondents feel to others of the same racial/ethnic group (e.g., "How closely do you identify with other people who are of the same racial and ethnic descent as yourself?) (Very close, somewhat, not very, not at all)

(α = .64). Co-ethnic ties have been used in other studies as a measure of acculturation (Bulut & Gayman, 2015; Cheng et al., 2010; Kimbro et al., 2012)

Stress and discrimination measures include *acculturative stress*, which is a summed index based on responses to nine yes-no questions about stress experienced since migrating to the U.S. (e.g., "Do you feel that in the U.S. you have the respect you had in your country of origin?") (α = .69). Also included is the frequency of day-to-day *discriminatory treatment* on the basis of national origin/ancestry, race, or skin color, constructed from the average of twelve questions about routine experiences with racial discrimination (e.g., being treated with less respect than other people, being called names, or insulted) (never to almost every day) (α = .91). Other studies have used the NLAAS summed index and set of questions to measure acculturative stress (DeVylder et al., 2013; Kimbro et al., 2012) and everyday discrimination (Cheng et al., 2010; Chu, Chi, Chen, & Leino, 2014; Kimbro et al., 2012).

Method of Analysis

Descriptive statistics for demographic characteristics were calculated for all major study variables. All continuous inequality identities were centered (age, education, language preference, co-ethnic ties, social position, acculturative stress, and frequency of discrimination) to decrease multicollinearity between an interaction term and the main effects (Migration Policy Institute, 2015). Next, the individual main effects, additive models, and interaction (multiplicative) models were computed. `

In an intersectionality framework, the principles of simultaneity and directionality are demonstrated in the strength and direction of the main effects in additive regression models (Veenstra, 2011). Simultaneity is determined when the

inequality identities make meaningful contributions to the models before and/or after controlling for one another. Directionality is established when inequality identities reveal better or poorer health outcomes. For this study, simultaneity was exhibited starting with a series of eight individual main effects regression models followed by an additive regression model. Because of multicollinearity, the additive regression model represents only the significant main effects from an initial additive model (not shown), achieved by dropping the least significant inequality identity with each model run until only significant main effects remained (Hosmer Jr, Lemeshow, & Sturdivant, 2013). Directionality is revealed when assessing the positive or negative unstandardized beta coefficients.

The principles of multiplicatively are demonstrated when the inequality identities interact meaningfully with one another as predictors of health (Veenstra, 2011). Multiple risk is implied when statistical interactions between the inequality variables show meaningful effects above and beyond their main effects in the additive models. This strategy was executed in this study by testing two-way interactions between the six inequality identities (15 interactions, tested one at a time in separate models). Results are presented as unstandardized regression coefficients and confidence intervals (*CI*). Alpha was set at 0.10 for the interaction models because of the lesser power of tests of significance for interactions (Aguinis, Beaty, Boik, & Pierce, 2005). R-squared (R²) values of the main effects regression models were subtracted from the R² values of the interaction models to assess the magnitude of their contributions in explaining SRH beyond the contributions of the main effects. All analyses were performed with Stata 13 using the surveyset command for complex survey data with maximum likelihood estimation

Results

Characteristics of the Sample

The sample of 592 adult Chinese immigrant respondents was predominantly female (53%) with a mean age of 42.25 years (standard deviation [SD] 1.27) and who had, on average, a postsecondary education, mean 13.5 years; SD .27. A mean language preference of 2.02 out of 5 (SD .07) demonstrated that this sample of Chinese respondents spoke and thought in their native Asian language "most of the time." On average, this sample "sometimes" (compared to often, not very often and not at all) felt close to others of the same racial/ethnic group (3.02 out of 4; SD .04). The mean acculturative stress score was 1.49 (SD .03) out of 9 and the mean frequency of discrimination score was 1.73 (SD .04), demonstrating that this sample of Chinese respondents, on average, had low acculturative stress and experienced discrimination, on average, less than twice a year. Mean social position was 5.84 (SD.14) out of a possible 10.

Main Effects and Additive Models

In the main effects model, male gender, language preference, and higher social position were significantly associated with better SRH and the association remained significant even after controlling for all other inequality identities (Table 1). Higher acculturative stress was significantly associated with poor SRH, before and after controlling for the other variables. Increasing age was significantly associated with worse SRH whereas higher education and frequency of discrimination were significantly associated with better SRH. However, the associations disappeared after controlling for other inequality identities. Comparisons of R² values indicate that language preference

(R^2 = .09), followed by social position (R^2 = .07), and education (R^2 = .06) were the strongest predictors of SRH in Chinese immigrants. For single predictors, an R^2 of .04 - .06 is considered a medium effect size and .07-.09 is considered a large effect size (Cohen, 1992).

Multiplicative models

The multiplicative model shows five statistically significant two-way interactions among foreign-born Chinese adults predicting better SRH (Table 2). For older individuals, the positive relationship between language preference and SRH is stronger compared to those at mean age and younger (mean age 42.25 years) (Figure 1A). The change in \mathbb{R}^2 from the addition of the interaction effect to the additive model for this interaction is .07. For women, an increase in years of education predicts a decrease in SRH but the opposite relationship was found for males (R^2 change =.11) (Figure 1B). It is also demonstrated that for foreign-born Chinese adults with an average level of education (mean 13.5 years) or higher, an increase in acculturative stress is associated with a decrease in SRH. However, for those with lower levels of education, an opposite relationship was found (R² change = 10) (Figure 1C). Additionally, with average levels of education (mean 13.5 years) or higher, an increase in social position predicts an increase in SRH but the opposite relationship was found for those with lower levels of education (R² change = .09) (Figure 1D). Finally, for those with average social position (mean 5.84 out of 10) or greater, an increase in frequency of discrimination predicts an increase in SRH. However, the opposite relationship was found for those with lower social position. Because the distribution of frequency of discrimination was strongly right-skewed (mean 1.73; range 1-5), the results for the estimated lower and upper

regression lines were plotted at the 25th and 75th percentiles (R² change =.10) (Figure 1E).

Discussion

The present study, based on an intersectionality framework, demonstrated that all six inequality identities manifested independent relationships with SRH in the additive stage and interacted significantly with at least one other inequality identity in the multiplicative stage. We found a predicted decrease in SRH for women and those with increasing levels of acculturative stress both of whom had higher levels of education. Chinese immigrants with lower social position and a greater frequency of discrimination events also had a predicted decrease in SRH. Finally, even with lower levels of education term and letting the models take into account the difference in SRH with respect to one inequality identity's effect on another increased the model's fit in all five statistically significant interaction models at a medium effect size (Cohen, 1992).

We found that all five significant interactions contributed between 7-11% of the predicted variability in SRH. Our findings are consistent with the principles of multiplicatively; modeling the main effects of inequality identities (additive) and then the statistical interactions between them (multiplicative), demonstrates whether intersections between axes of inequality contribute to explaining variability in health over and above the additive approach (Bowleg, 2012). These relevant findings point to the importance of including an intersectionality lens to the study of immigrant health disparities.

English language preference was the largest single predictor of better

SRH and as shown in the interaction model, serves as a mitigating effect for worse SRH in older Chinese immigrant adults. The positive relationship between language preference and SRH is stronger in older adults compared to those at younger ages suggesting that acculturation (as represented by English language preference) exerts a stronger influence on older immigrants. This can be seen as a protective effect for more positive health outcomes such that as immigrants age, and have likely spent more years in the U.S. with improvement in English language skills, they learn to negotiate their health care better and feel more positive and less isolated. Other studies also support our findings, with a few caveats. Kandula and colleagues (2007) revealed an association between English language proficiency and better SRH in Chinese immigrants although this study did not measure age. Min and colleagues (2014) did consider age when they found that older foreign-born Asian adults with greater English proficiency were more likely to report better SRH. However, this study did not report findings by Asian subgroup, which has been found to be an important predictor for SRH (Sentell & Braun, 2012). As an additional measure of acculturation, the present study did not find co-ethnic ties to be an important predictor for SRH, which has been also evidenced in other studies of Chinese immigrants (Kimbro et al., 2012).

Another important finding in this study is that education appears to be a central inequality factor in this population as it interacted significantly with three other factors; gender, acculturative stress, and social position, to affect SRH. It is important to note that this study's sample of Chinese immigrants has an overall high level of education (mean 13.5 years; SD .27). These findings are emulated in the literature, which has demonstrated that Chinese immigrants have much higher educational
attainment compared to the overall foreign- and native-born populations. For example, in 2013, 47% of Chinese immigrants (ages 25 and over) had a bachelor's degree or higher, compared to 28% of the total immigrant population and 30% of the native-born population (Migration Policy Institute, 2015). In this study among higher educated Chinese immigrants, higher acculturative stress was found to be associated with poorer SRH whereas higher social position and being a male was associated with better SRH. For Chinese immigrants who have lower education, we found the opposite associations. Higher social position and being a female was associated with worse SRH whereas higher acculturative stress and was related to better SRH. It is plausible that education, as a harbinger for health knowledge, is responsible; those with lower education may not understand the consequences of acculturative stress on health or other factors that were not examined in this study that may influence SRH more than acculturative stress (John et al., 2012). This study also proposes that even for those who have the advantage of prominence in the larger social structure, lower levels of education continues to present as a meaningful axes of inequality. Regarding gender inequality, it is conceivable that certain characteristics of the Chinese immigrant population may be unfavorable for the health of women and beneficial for men. If male-dominated gender relations among Chinese are responsible (Xie, 2013) then inequality by gender is clearly a factor but education perhaps is not. Finally, and as expected, for Chinese immigrants with lower social positions, a greater frequency of discrimination events predicts a decrease in SRH. On the other hand, this effect is not seen in those with average or higher social positions. These findings indicate that social position could serve as a protective effect against worse SRH even in the presence of increased frequency of

discrimination events. This outcome could be explained by the role social status plays in Chinese culture. The Chinese strongly consider the importance of *shehui dengji* in their society, which can be particularly witnessed in the business world (Graham & Lam, 2003; Ho, 1976). Future studies should focus on the determinants of self-perceived social status in order to define and further refine the importance of this inequality identity on health.

This study is one of the few studies that utilized the principles of intersectionality and to our knowledge the only study that employed these principles to examine multiple factors related to SRH in Chinese immigrants. This study however, has several limitations. First, results may not represent current national trends because the data were collected in 2002-03. However, this dataset was chosen because it provided a robust Asian sample. Second, because the study was cross-sectional, it is not possible to draw definitive conclusions about direction and cause-effect of the associations. Further research including longitudinal studies is needed to elucidate the implications of the intersections of these important factors for health outcomes. Third, although this study used one or more proxy measures for each inequality identity, there are a wide variety of proxy factors used to measure, for example, acculturation and SES, with little consensus about how to do so accurately (Berry, 2005; Diemer, Mistry, Wadsworth, López, & Reimers, 2013). A more nuanced understanding of what constitutes these inequality identities will be of great value to the understanding of health disparities in this population.

Public Health Implications

In summary, each of the six axes of inequality including age, gender, SES, social position, acculturation status, acculturative stress, and discrimination interacted significantly with at least one other, suggesting they all belong to the compendium that contribute to health inequalities for foreign-born Chinese adults in the U.S. These results suggest the possibility of simultaneous experiences of privilege and oppression (Hankivsky, 2012). Experiences of privilege are demonstrated in those with (English) language preference, males, and those with higher social position and levels of education. Chinese immigrants at greater risk of experiencing health disparities are women and those with lower social positions and levels of education. Future research should focus on: including a multiplicative approach to studies of health disparities to capture true complexities of immigrants' lives, examining the influence of social structures on health, exploring how inequality identities influence immigrant's health choices, and instituting ethnographic investigations including interpersonal relations and structural arrangements to refine these results.

The present study will inform research to examine how and under what circumstances these axes of inequality may predict health outcomes in Chinese immigrants. This study suggests that in order to reduce health disparities in Chinese immigrants on a policy level, we should expand and improve federal programs to: reduce "isms" (e.g. gender equality, access to education, expose class systems based on social status), increase translation and English language education services, foster culturally competent health promotion, advance the diversity and cultural competence of the (healthcare) workforce, and on a community/individual level, encourage the

immigrants' use of community resources to improve health information and emphasize the importance of inter-group contact to reduce discrimination.

Inequality Identities	Individual Main Effects <i>b</i> , 95% <i>Cl</i>	R²	Additive Model ^a b, 95% Cl
Gender (male)	.27** [.06, .47]	.02	.28** [.07, .49]
Age	01** [02,01]	.05	01 [01, .001]
SES			
Education	.06*** [.04, .09]	.06	.01 [02, .04]
Acculturation			
Language Preference	.26*** [.16, .36]	.09	.21*** [.13, .28]
Co-ethnic Ties	08 [25, .08]	.003	
Stress & Discrimination			
Acculturative Stress	24*** [35,14]	.03	14* [26,02]
Frequency of	.19* [.02, .35]	.02	.05 [08, .18]
Discrimination			
Social Position	.12*** [.07, .17]	.07	.09*** [.04, .14]

Table 1. Unstandardized Linear Regression Coefficients from Regression Models among Foreign-Born Chinese Adults, Predicting Better Self-Rated Health (weighted)

Note. *b* = unstandardized coefficients; *CI* = confidence interval; R^2 = multiple correlation squared; ^a = controlled for only significant individual main effects; ^{*}p ≤ .05, ^{**}p ≤ .01, ^{***}p ≤ .001. n = 592 (unweighted)

Table 2. Significant Two-way Statistical Interactions and Explained Variances for Interaction and Main Effects Models among Foreign-Born Chinese Adults Predicting Better Self-Rated Health (weighted)

Significant Interactions	b	90% CI	Change in <i>R</i> ² from addition of interaction effect to additive model
Age & Language Proficiency	.005	[.001, .01]	.07
Gender & Education	05	[09,01]	.11
Education & Acculturative Stress	03	[05,01]	.10
Education & Social Position	.01	[.001, .03]	.09
Social Position & Frequency of Discrimination	.07	[.01, .14]	.10

Note. *b* = unstandardized coefficient; CI = confidence interval; R^2 = multiple correlation squared. n = 592 (unweighted)









Figure 1. Estimated Plots for Two-way Linear Interactions among Foreign-Born Chinese Adults Predicting Better Self-Rated Health: A: Age by Language Preference; B: Gender by Education; C: Education by Acculturative stress; D: Education by Social Position; E: Social Position by Frequency of Discrimination. Weighted. n = 592 (unweighted).

Chapter Five

This dissertation study sought to explore factors that influence disparities in SRH among Asian and Hispanic immigrants in the U.S. Self-rated health was chosen as the outcome variable because it is an important indicator of chronic disease (Kandula et al., 2007), a valid predictor of mortality (Chipperfield, 1993), and is a subjective and holistic measure that captures the totality of an individual's health status (Kimbro et al., 2012). Health disparities literature, as well as acculturation and intersectionality frameworks, were used for selecting factors that influence SRH. Berry's (2005) acculturation theory contributed to the understanding of the complex biological, psychological, social, and cultural processes that new immigrants undergo when they enter a new country. The intersectionality framework added to this study by focusing on the influence of social structures of poverty, including access and discrimination, while capturing the true complexities of immigrants' lives. Together, these two frameworks also highlighted the similarities and differences in factors that contribute to disparities in SRH among Asian and Hispanic immigrants in the U.S.

While acculturation remains a critical factor is examining disparities in SRH among these immigrants, the specific proxy measures for acculturation differ across this study's three papers. Because the acculturative experience is dynamic, multifaceted and complex, it makes it difficult to measure. Psychometric scales and proxy measures of acculturation are abundant in the literature reflecting the diverse complexity of the phenomena (Abraído-Lanza, Armbrister, Flórez, & Aguirre, 2006). According to acculturation theory (Berry, 2005) and several studies, a variety of factors have been used to measure acculturation however, language and nativity have

consistently been shown to be the most important predictors of health status (Carter-Pokras & Bethune, 2009). Therefore, the first paper was designed as a systematic review to understand how language and nativity, as proxy measures of acculturation, predict SRH in two of our nation's largest immigrant populations.

The systematic review found that being foreign-born was associated with worse SRH for Koreans, Chinese, and Mexican immigrants, and in aggregate samples of Asian and Hispanic immigrants compared to NHWs (Lommel & Chen, 2015). In addition, limited English proficiency was associated with worse SRH for Chinese, Koreans, and Vietnamese immigrants as well as in aggregate samples of Asian and Hispanic immigrants compared to NHWs (Lommel & Chen, 2015).

As a result of the findings from the systematic review paper, the final two papers in this study also included acculturation measures as predictors of SRH although these papers focused on Chinese and Mexican immigrants; two populations found to be at higher risk for health disparities (Lommel & Chen, 2015). Furthermore, while most research exploring factors influencing SRH has focused on social and cultural variables, the second paper broadens this scope by examining bio-behavioral pathways, such as inflammatory processes, that may account for poorer SRH among Mexican immigrants.

Applying acculturation theory, the second paper demonstrated that Mexican immigrants reported worse SRH compared to U.S.-born non-Hispanic Whites. It is most notable however, that Mexican immigrant status was also indirectly associated with worse SRH via greater CRP and among Mexican immigrants, greater acculturation was associated with better SRH.

Finally, the third paper used an intersectionality framework to investigate factors associated with disparities in SRH among Chinese immigrants. It compared the extent to which the multiplicative model predicts variability in SRH above and beyond the additive model as well as described Mexican immigrants at highest risk for disparities in SRH. In the final paper, the multiplicative model showed significant interactions between age and language preference, social position and discrimination, and between gender, acculturative stress, and social position and education. The significant interactions contributed 7-11% of the predicted variability in SRH beyond the additive model.

Significance and Interventions

Together, these three papers explored factors that influence SRH in Asian and Hispanic immigrants in the U.S. While the first paper laid the foundation for this study, the last two papers each took their own path in terms of theoretical framework and ethnic group focus. Moreover, because of limited studies in Asian and Hispanic immigrants, each of the last two papers attempt to break new ground by exploring different factors that influence SRH as well as implement different analyses techniques to achieve this goal.

First, examining proxy measures that have been found to represent acculturation, nativity was determined to be significant across papers, impacting the reporting of SRH. Foreign-born Asians and Hispanics (in aggregate samples) reported worse SRH more often. Although several studies have corroborated these findings (Lommel & Chen, 2015), this study suggests that the effect of nativity on SRH varies by subgroup, with Koreans, Chinese, and Mexicans reporting worse SRH most often.

Because nativity is considered a non-modifiable risk factor for worse SRH, it cannot be directly impacted by interventions. However, these findings contribute to the literature in that they identify specific populations at highest risk for health disparities, and as a result, public health efforts can then be targeted to these immigrant groups.

English language proficiency, as a proxy for acculturation, was also found to be a key factor in reporting SRH among Asian and Hispanic immigrants. While findings from one paper demonstrated that Chinese, Koreans, and Vietnamese with limited English proficiency reported worse SRH, findings from a second paper reinforced these outcomes by indicating a relationship between English language preference and better SRH among Chinese immigrants. The second paper found evidence that Mexican immigrants, who spoke English more often and chose to be interviewed in English, reported better SRH. This study provided evidence that language may be a critical factor in appreciating differences in SRH among ethnically diverse populations as inequalities might be related to cultural differences in understanding SRH. The literature offers inadequate accounts demonstrating why Asians and/or Chinese immigrants with limited English proficiency report worse SRH more often. Additional research in this area is warranted, as language appears to be a significant inequality factor in Asian populations. The literature however, offers several explanations as to why Spanish-speakers report worse SRH. Angel and Guarnaccia (1989) found that Mexican Americans expressed much greater affective and physical distress compared to physician's assessment of health. The authors postulated that Hispanics' lower SRH might be related to somatization, which is demonstrated in Mexican culture. Angel and Guarnaccia (1989) and Bzostek and colleagues (2007)

proposed that language may distort the meaning of SRH for Hispanics, which may bias reporting toward worse SRH for Spanish-speakers. It has also been suggested that the Hispanic culture does not support overrating health, as it is not socially acceptable to do so (Franzini & Fernandez-Esquer, 2004). Still others have submitted that Hispanics' reporting worse SRH may be due to language differences of what constitutes good, fair, or poor health, as there are no equivalents in the Spanish language for these concepts (Parrish, 2010; Salomon et al., 2009). Taken together, results of the present study indicate that interventions geared toward reducing language barriers may impact SRH directly and indirectly increase health knowledge and improved health outcome. Targeted interventions should include accessible English-as-a-second language programs, health interpreters, culturally diverse and bi/multilingual providers, and culturally appropriate health education, as well as interventions to reduce structural barriers to care.

Finally, although co-ethnic ties have been used in several studies as a measure of acculturation (Bulut & Gayman, 2015; Cheng et al., 2010; Kimbro et al., 2012). Kimbro (2012) corroborated findings in this study, which found a lack of evidence for an association between co-ethnic ties and SRH. For this study, a measure of co-ethnic ties elicits how close respondents feel to others of the same racial/ethnic group. It is conceivable that relationships with others of the same racial/ethnic group is not significant to the acculturative process and in fact, strong co-ethnic ties may signify lowers levels of acculturation or even biculturalism (Berry, 2005). Support for this explanation is demonstrated in this study by observing that as co-ethnic ties increase, reported SRH worsens in this sample of Chinese immigrants, b = -.08, 95% *Cl* [-.25,

.08]. Future qualitative studies are necessary to understand how racial/ethnic group closeness impacts SRH.

In addition to acculturation, several other factors were considered to impact SRH in Chinese and Mexican immigrants. Namely, increasing age among Chinese and Mexican immigrants was predictive of worse SRH. However, in this same group of Chinese immigrants, age appeared to moderate the relationship between language preference and SRH whereby the positive relationship between language preference and SRH was stronger among older Chinese immigrants compared to those at younger ages. While all Chinese and Mexican immigrants should be targeted for intervention, English language proficiency appears to protect against worse SRH especially in older Chinese, which further supports the need for interventions focused on reducing language barriers.

Gender elicits mixed results in these studies. Mexican immigrant women reported significantly better SRH compared to men. However, when controlling for level of acculturation, there was no difference between men and women in reporting SRH. Because this sample of Mexican immigrants reported overall lower levels of acculturation, b = 0.86, SD = 0.04, range 0-3, it can be inferred from this study that women with lower levels of acculturation report better SRH compared to men with lower levels of acculturation. This finding is inconsistent with other researchers who found that Mexican women report fair/poor SRH more often than Mexican men (Read & Gorman, 2006) and Kimbro and colleagues (2012) who found in a sample of Mexicans immigrants, there was no difference between men and women in reporting SRH. Further investigation is warranted to elucidate these findings. For Chinese immigrants,

being female was predictive of reporting worse SRH and this negative association persisted despite higher levels of education. However, for males, an increase in years of education predicted an increase in SRH. This could be explained by the dominant role males have in Chinese culture (Xie, 2013). This finding speaks to targeting social structures on health including rallying for equal gender access to and quality of healthcare as well as reducing sexism in the workplace, at school, and at home. It also communicates the need for more research focused on the physical, cultural, and social barriers to health.

In examining the bio-behavioral factors that may be associated with reporting SRH, it was found that Mexican immigrant status and higher acculturation among this population were not associated with depressive symptoms. However, depressive symptoms were associated with worse SRH. This finding points to the need to increase depression screening among Mexican immigrants in order to identify those at risk for poorer health outcomes. C-reactive protein however, offered different results. Mexican immigrant status was not associated with increased CRP although the opposite was true for higher acculturated Mexican immigrants. This outcome can be partially explained by the "Hispanic/Latino health paradox" which suggests that although Hispanic immigrants have poorer socio-economic profiles, they experience better health for some outcomes (Ridker, 2003). Additionally, as they become more acculturated and adopt unhealthier American lifestyle habits, Mexican immigrants are at increased risk for elevated CRP in response to a range of acute and chronic inflammatory conditions resulting from poor lifestyle choices (Bostean, 2013; Ruiz et al., 2013). This study also demonstrated that elevated CRP in Mexican immigrants was associated with worse

SRH compared to non-Hispanic Whites, while the opposite was true for higher acculturated Mexican immigrants with elevated CRP. The literature may again offer an explanation for these findings. Inflammation causing elevations in CRP has been found to induce symptoms of illness behavior including lethargy and decreased appetite (Dantzer & Kelley, 2007). Additionally, because research has also suggested that somatization may be more common in less acculturated (measured by English proficiency and nativity) Hispanics (Shetterly et al., 1996), this study's sample of predominately less acculturated Mexican immigrants may be at risk for reporting worse SRH. Lastly, this study adds new knowledge to disparities research in that it suggests that worse SRH may be partially attributable to greater inflammation in Mexican immigrants. By developing culturally sensitive interventions to promote better lifestyle and health habits in Mexican Americans, there is the potential to impact acute and chronic conditions and reduce inequalities in SRH.

Finally, education (as a proxy for SES), social position, and acculturative and discrimination stress are all associated with the compendium of inequalities in SRH among Chinese immigrants as guided by an intersectionality framework. This study indicates that higher levels of education are protective for male Chinese immigrants and those with higher social position. Although gender differences appear to be a central inequality factor in the relationship in the former interaction, level of education was shown to be an important factor in the latter. In a third interaction, education also emerges as an important inequality factor as only those with higher levels of acculturation and higher levels of education have a predicted decrease in SRH compared to Chinese immigrants with lower levels of education. Here education likely

serves to create disparities in SRH, as those with lower education may not understand the consequences of acculturative stress on health. Another unique finding in this study is the protective effect of higher social position against higher levels of discrimination. Although one interaction demonstrates that level of education is more central to predicting better SRH in the presence of higher social position, this latter interaction highlights social position as a potential inequality factor. Lastly, this study found that all five significant interactions contributed between 7-11% of the predicted variability in SRH above and beyond the additive approach, which is consistent with the principles of multiplicatively in an intersectional framework.

Limitations

There are some limitations to our study. First, this study employs crosssectional data so any significant associations between inequality factors and SRH should not be taken as proof of causation. A longitudinal study design would provide information about Asian and Hispanic immigrants over time, which would enable cause and effect relationships to be developed. Additionally, although multiple measures of acculturation are included in order to develop a more nuanced view of immigrants' cultural experiences, it is possible that additional factors such as immigrants' ties to the U.S., and not only their ties to their own ethnic group, may more accurately capture immigrants' level of acculturation. However, because this study's selection of acculturation measures is based on the current literature, we are confident that these findings are highly relevant and contribute to the existing literature as they significantly expand on the current norm by including several additional inequality factors with a more nuanced analysis. In addition to acculturation, the literature is replete with proxy

measures for SES with little consensus about how to do so correctly (Diemer et al., 2013). Because this study used only one measure for SES, unique differences across SES are not appreciated. A more precise understanding of what constitutes this inequality identity will be of great value to the understanding of health disparities in these populations. Finally, data from the NHANES paper, collected in 2009-10, and the NLAAS dataset, collected in 2002-03, may not represent current national trends. However, these datasets were chosen because they provided large Chinese and Mexican immigrant samples.

It is important to note also, several key strengths of this study. The NHANES and NLAAS datasets offer large subpopulation sample sizes of Chinese and Mexican immigrants and the ability to make population estimates. Also, for this study's samples, missing data was less than 5%, which limited non-response bias. Finally, and very importantly, because both datasets were countrywide surveys, the results of this population-based study can be generalized nationally.

Potential Impact of the Research

Outcomes from this research can be used to address health disparities by improving awareness and understanding of two immigrant populations vulnerable to poor health outcomes. The findings and conclusions are intended for scholars in public health, research, academia, and clinical medicine to confront disparities and assist Asian and Hispanic immigrants in the U.S. live longer, healthier, and more productive lives. Additionally, findings can be used to develop interventions to reduce the influence of social structures on health.

Recommendations for Future Studies

The findings from this dissertation study highlight several important areas of needed research. First, there is a lack of data on population characteristics, which is a barrier to documenting health disparities (CDC, 2004). Although race/ethnicity data is frequently collected, some data sources have incomplete information on social and demographic characteristics (e.g., place of birth, poverty status, education, primary language). Future studies should focus on standardization and expansion of data collection and analysis for health research by gender, language, race/ethnicity, SES, acculturation, and discrimination measures, to name a few, in order to better identify and address factors associated with health disparities. Second, as proposed by The National Prevention Council, in order to eliminate health disparities, the first step is to focus on communities at greatest risk (CDC, 2004). As demonstrated herein, both Chinese and Mexican immigrant populations are at risk for poor health outcomes therefore; future studies should focus on factors contributing to health inequality in these populations. Finally, exploring alternative methods to elucidate the true intricacies of immigrants' lives and the effect of social constructions on health will be incumbent of future researchers. Results of this study provide evidence for including a multiplicative approach to studies of health disparities. In addition, designing ethnographic investigations to include the examination of interpersonal relations and structural inequalities will broaden the scope of health inequality factors and advance the research in this important area.

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