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A cluster analytic examination of acculturation and health status among Asian Americans in the Washington DC metropolitan area, United States

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ABSTRACT

Previous studies reported mixed findings on the relationship between acculturation and health status among Asian Americans due to different types of acculturation measures used or different Asian subgroups involved in various studies. We aim to fill the gap by applying multiple measures of acculturation in a diverse sample of Asian subgroups.

A cross sectional study was conducted among Chinese, Korean and Vietnamese Americans in Washington D.C. Metropolitan Area to examine the association between health status and acculturation using multiple measures including the Suinn-Lew Asian Self-Identity Acculturation (SL-ASIA) scale, clusters based on responses to SL-ASIA, language preference, length of stay, age at arrival in the United Sates and self-identity. Three clusters (Asian (31%); Bicultural (47%); and American (22%)) were created by using a two-step hierarchical method and Bayesian Information Criterion values. Across all the measures, more acculturated individuals were significantly more likely to report good health than those who were less acculturated after adjusting for covariates. Specifically, those in the American cluster were 3.8 times (95% Confidence Interval (CI): 2.2, 6.6) more likely and those in the Bicultural cluster were 1.7 times more likely (95% CI: 1.1, 2.4) to report good health as compared to those in the Asian cluster. When the conventional standardized SL-ASIA summary score (range: −1.4 to 1.4) was used, a one point increase was associated with 2.2 times greater odds of reporting good health (95% CI: 1.5, 3.2). However, the interpretation may be challenging due to uncertainty surrounding the meaning of a one point increase in SL-ASIA summary score.

Among all the measures used, acculturation clusters better approximated the acculturation process and provided us with a more accurate test of the association in the population. Variables included in this measure were more relevant for our study sample and may have worked together to capture the multifaceted acculturation process.

Introduction

Acculturation has been an interest of scholars in the social sciences for several decades and has been broadly defined as "those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups" (Redfield, Linton, & Herskovits, 1936). Acculturation has been referred to as one of the most important individual difference constructs in understanding the experiences of racially and ethnically diverse populations (Zane & Mak, 2003). While the acculturation process occurs on both a societal and individual level (J.W. Berry, 2003), individual acculturation is typically the focus of the majority of social science research and refers to the cultural change of the individual as a result of continuous exposure to a second culture (Graves, 1967).

Perhaps the most frequently cited acculturation theory was proposed by John Berry (Berry, 1979) who asserted that it is possible to identify four possible acculturation strategies by assessing the degree to which an individual adheres to both her or his culture of origin and the second culture. The four acculturation

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strategies include integration, assimilation, separation, and marginalization. Integration is a strategy in which an individual maintains adherence to both their culture of origin and a second culture. Assimilation is the strategy in which an individual adheres to a second culture and no longer adheres to their culture of origin. Separation occurs when an individual maintains adherence to the culture of origin and does not adhere to a second culture. Marginalization results when an individual does not adhere to their culture of origin or the second culture.

There are a number of factors that impact the salience and difficulty of the acculturation process. One primary factor is the degree of cultural distance (i.e., difference) between one's culture of origin and the new culture across domains such as language, family structure, status of women and underrepresented populations, religion, legal systems and forms of government, work norms, competitiveness, individualism and collectivism, masculinity and femininity, and orientation to time (Berry, Poortinga, Segal, & Dasen, 2002; Chirkov, Lynch, & Niwa, 2005; Suanet & Van de Vijver, 2009; Zlobina, Basabe, Paez, & Furham, 2006). The greater the cultural distance, the greater the likelihood that the acculturation process will be salient and difficult; in fact, increased cultural distance is associated with poorer mental health outcomes, higher rates of homesickness, decreased involvement in the new culture, smoking, and higher levels of social adjustment difficulties (Chirkov et al., 2005; Hofstetter et al., 2004; Suanet & Van de Vijver, 2009; Ward & Kennedy, 1999; Zlobina et al., 2006). For example, Asian immigrants to the U.S., who have greater cultural distance (e.g., in terms of language, religion, hierarchical nature of relationships, and collectivism and individualism) between their culture of origin and the U.S. culture, have higher levels of adjustment difficulties as compared to European immigrants to the U.S., who have less cultural distance between cultures (Redmond & Bunyi, 1993; Yeh & Inose, 2003). Other factors that impact the acculturation process include lower levels of education, lower levels of language competence, and socioeconomic status (Williams & Berry, 1991).

The "healthy immigrant effect" – the paradox that recent immigrants who often face sociodemographic (i.e., language) disadvantages have better health profiles than their native-born counterparts – has been observed in various immigrant populations including Asians (Dey & Lucas, 2006; Frisbie, Cho, & Hummer, 2001; Gomez, Kelsey, Glaser, Lee, & Sidney, 2004; Markides & Eschbach, 2005). A higher level of acculturation has been found to be associated with a number of worse health outcomes. For example, those who were more acculturated were found to be more likely to be overweight or obese (Marmot & Syme, 1976; Roshania, Narayan, & Oza-Frank, 2008; Steffen, Smith, Larson, & Butler, 2006; Ziegler et al., 1993), to have breast cancer (Goel, McCarthy, Phillips, & Wee, 2004; John, Phipps, Davis, & Koo, 2005), higher blood pressure (John et al., 2005) and coronary heart disease (Lauderdale & Rathouz, 2000). As individuals spend longer time in the U.S. and acculturate to American culture, the advantage of the healthy immigrant effect seems to wane (Akresh, 2007; Frisbie et al., 2001; Hofstetter et al., 2004; Uretsky & Mathiesen, 2007). One plausible explanation for this reduction in health is the assimilation to American lifestyle such as changes in dietary pattern, smoking and physical activity that result from the acculturation process (Ayala, Baquero, & Klinger, 2008; Lee, Sobal, & Frongillo, 2000; Singh, Yu, Siahpush, & Kogan, 2008).

Self-reported health status is often measured by a single question "How would you rate your overall health" with four or five response categories, ranging from "poor" to "excellent". There are a few studies that have examined acculturation and self-reported health status among Asian Americans, but their results have been somewhat conflicting. Lee et al., used a two-culture matrix model (e.g., four components of the model includes American structural, American cultural, Korean structural and Korean cultural, where structural components focus on individuals' social participation and social network and cultural components measure one's familiarity to a certain culture) to measure acculturation among Korean Americans and found that those who were less acculturated were more likely to report "poor or fair" health (Lee et al., 2000). Another study involving Chinese, Koreans, Vietnamese and Filipinos also suggested that Asian Americans who had limited English ability (as a measure of acculturation) had worse self-reported health (Kandula, Lauderdale, & Baker, 2007). However, when birth place was used as a measure of acculturation, Huh et al., found that foreign born Asians and U.S. born Asians rated their health similarly, but foreign born Asians had a better health profile when examined by specific disease outcomes such as heart disease and cancer (Huh, Prause, & Dooley, 2008). These studies varied in the measurement of acculturation and involved different Asian subgroups, which may explain the discrepancy among these findings.

To fill the gap identified in the previous research, our study will apply multiple measures of acculturation in a diverse sample of Asian subgroups including creating acculturation clusters tailored to our study sample. This may help clarify the inconsistent relationship between acculturation and health status found in previous studies. The current study applied seven acculturation measures including a shortened version of the Suinn-Lew Asian Self-Identity Acculturation (SL-ASIA) scale and other individual measures to further examine the association between acculturation and health status among a large Asian population recruited from Chinese, Korean and Vietnamese communities in Washington D.C. metropolitan area ($n = 863$). The SL-ASIA was specifically designed to assess acculturation in Asian immigrants including Chinese, Korean, and Vietnamese populations and has been tested on several health outcomes such as mental health service use and seeking professional psychological help with satisfactory internal consistency (Atkinson & Gim, 1989; Lese & Robbins, 1994; Suinn, Suinn, Rickard-Figueroa, Lew, & Vigil, 1987; Tata & Leong, 1994). A shortened version of the SL-ASIA scale was developed by Hoffstetter et al. and was found to have as good internal consistency as the original scale (Cronbach's $\alpha = 0.88–0.90$) (Ayers et al., 2009; Hofstetter et al., 2007, 2004). Although the shortened version of SL-ASIA has been considered as a good measure of acculturation among Asian Americans, interpreting the scores in a meaningful way has proven challenging because the measure provides a range of continuous scores (e.g., −1.37 to 1.41 in our study) without specifying the value that is attached to a one point increase in the score. Previously, Song et al. (2004) performed cluster analysis to create acculturation groups based on the responses to the SL-ASIA continuum. We used cluster analysis by the partitioning the data into meaningful subgroups. Using this method, we created three acculturation clusters: Asian, Bicultural, and American. We hypothesized that acculturated Asian Americans are more likely to report good health compared to less acculturated Asian Americans. We also hypothesized to observe similar trends across the different types of acculturation measures.

Data and methods

Participants

The current study used data from a randomized community trial on liver cancer prevention conducted in Chinese, Korean and Vietnamese communities in Washington D.C. metropolitan area from November 2009 to June 2010. Considering the fact that participants were hard-to-reach population, a non-probability sampling method was employed to recruit participants. They were

recruited through community-based and faith-based organizations (such as churches, temples, or language schools) and through other channels such as Asian grocery markets/restaurants, nail salons, universities, and individual networks. Eligibility criteria included: (1) self-identified Chinese/Korean/Vietnamese Americans; (2) 18 years of age and over; and (3) those who had never participated in other hepatitis B or liver cancer education program. Organizational membership was not required for participation, and potential participants were encouraged to bring their family members, friends and neighbors to the study. Each participant was asked to fill out a 51-item questionnaire, from which information on demographic characteristics, health status and acculturation were obtained for the current study.

A total of 877 participants were recruited for the trial, consisting of 303 Chinese, 294 Koreans and 280 Vietnamese Americans. We excluded 12 participants who had missing values on the key items of the SL-ASIA scale (detailed explanation in the next section) and performed cluster analysis on the remaining 865 participants. Two additional subjects who had no information on health status and other individual measures were removed afterward, resulting in a sample of 863 subjects for descriptive and logistic regression analysis.

Independent variables: acculturation

The primary measure of acculturation in this study was the revised version of SL-ASIA (Hofstetter et al., 2007). The revised SL-ASIA includes three language questions (what language do you speak, what language do you read, and what language do you prefer), three friendship choice questions (ethnic origin of peers up to age six, ethnic origin of peers between age six to eighteen, and people associated within the community), three behavior questions (music preference, food preference at home, and food preference in restaurants), and one self identity question (how would you rate your self). Each item was measured on a 5-point Likert scale and the five categories were: exclusively Asian (=1), somewhat Asian, equal, somewhat American, and exclusively American (=5). Other questions included in this revised version of SL-ASIA were: generation status, years of education in home country and in the US, years of residence in the US and in the country of origin. Proportions of life living in the U.S. and education in the U.S. were then calculated. The summary score of the revised SL-ASIA was taken as the average of the standardized score (i.e., *z*-score) for each scale item.

In addition to the use of SL-ASIA summary score, we conducted a two-step cluster analysis based on seven key variables of acculturation measures. The seven key items were language speaking, language reading, language preference, people associated within the community, music preference, food preference in restaurants, and self-identity. These variables were selected because they were more valid measure of acculturation for our population, and they captured more variation in acculturation status than the other SL-ASIA items in our sample. Because 97% of our participants were first generation immigrants and 76% came to the U.S. after age 20, questions such as "ethnic origin of peers up to age six" and "ethnic origin of peers between ages six to eighteen" had very few responses on the American end. Therefore, we believed that using these seven key variables to create clusters would better reflect our data and reduce noise from other variables that had less variation in acculturation.

Individual measures, including age at arrival in the U.S., length of stay in the US, self- identity, and language preference were also used to assess acculturation. The first two measures were derived from the revised SL-ASIA scale. Length of stay in the U.S. was categorized into 0–5, 6–10, 11–15, 16–20, and 21 years or over. Age at arrival was calculated by subtracting years of residence in the U.S. from current age, and then categorized into five groups (0–15, 16–20, 21–30, 31–40, and 41 or above). Language preference and self-identity were both chosen from the SL-ASIA scale because these two variables were found to have greater associations with health status when used individually. They were both collapsed into three levels: English/American, equal, and Asian. To summarize, we used six acculturation measures to compare and contrast the results. Two were summary measures: SL-ASIA summary score and clusters based on seven key variables from SL-ASIA and four were individual measures either derived or selected from the scale (age at arrival, length of stay, self-identity, and language preference).

Dependent variable: health status

Health status was assessed by a single question "Would you say in general your health is excellent, very good, good, fair or poor?" The responses were later collapsed into two categories: good (excellent, very good and good) and poor (fair and poor). Although we used one question to measure self-reported health status, this item has been well validated, widely used as a robust indicator for general health status, and has shown to predict subsequent mortality in Americans (DeSalvo et al., 2006; Idler and Angel, 1990; Idler and Benyamini, 1997; McGee et al., 1999).

Covariates

We used multiple logistic regressions to adjust for confounders including age (as a continuous variable), gender, income and education. We obtained information on these variables from the self-administered questionnaire mentioned previously. Age was calculated from the date of data collection subtracting participants' date of birth and rounded to years. The question assessing participants' annual household income had eight response categories: <$10,000, $10,000–$19,999, $20,000–$29,999, $30,000–$39,999, $40,000–$49,999, $50,000–$74,999, $75,000–$99,999, $100,000 or more. Based on the distribution of our sample, we further collapsed the income variable into five categories: <$20,000, $20,000–$49,999, $50,000–$74,999, $75,000–$100,000 and $100,000 or more. Those who did not answer this question ($n = 30$) were categorized into a separate missing category. With regards to education, we asked participants the highest degree they had completed with the following response categories: less than high school, high school graduate or GED (General Educational Development), business or vocational school, some college, college graduates, and attended graduate or professional school. To have a sufficient number of participants at each level, we collapsed the education variable into three categories: high school or less, some college, college graduates or higher.

Statistical analysis

Cluster analysis was used to identify empirical acculturation profiles. Using a person-oriented approach, those who had similar patterns of acculturation were grouped together. Clustering methods ranged from those that are largely heuristic to more formal procedures based on statistical models. They usually followed either a hierarchical strategy or one in which the observations are relocated among tentative clusters (Fraley & Raftery, 1998). In this study, the two-step technique was used. This method consists of creating 'pre-clusters' and then clusters the pre-clusters using hierarchical methods, which recommend the number of clusters. Partitions were determined using the expectation-maximization (EM) algorithm for maximum likelihood, with initial values from agglomerative hierarchical clustering. Models

were compared using an approximation to the Bayes factor based on Schwarz's Bayesian Information Criterion (BIC); unlike significance tests, this allows for comparison of more than two models at the same time, and removes the restriction that the models compared be nested (Fraley & Raftery, 1998). The choice of a similarity measure and the determination of the number of clusters were based on the smallest change in BIC values (Chan et al., 2008). SPSS v19 (SPSS Inc.) was used to perform the cluster analysis.

Descriptive analysis was performed to assess the sociodemographic characteristics of the study participants ($n = 863$). ANOVA and Chi-square tests were used to compare the distribution of the sociodemographic characteristics by levels of acculturation and p-values were reported (Table 1). Bivariate analysis was conducted to assess the crude association between individual acculturation variables (i.e., language preference, self- identity, age at arrival and length of stay) and health status. Multiple logistic regression was used to assess the adjusted association between acculturation variables (i.e., individual measures as mentioned above, SL-ASIA summary score and acculturation clusters) and health status, adjusting for age, gender, education and income. These models only contained one acculturation variable at a time, so in total there were six multivariate adjusted logistic models.

For all multivariate-adjusted logistic regression models, multicollinearity tests were performed using the variance inflation factor (VIF). All VIF values were found to be within an acceptable range (1.0–3.2). For each acculturation measure (i.e., length of stay, age at arrival, language preference, self identity, SL-ASIA summary score, and acculturation clusters), interactions with ethnicity, gender, education and income were tested.

Results

Participant characteristics

Table 1 shows the sociodemographic characteristics of our participants by levels of acculturation clusters (Asian, Bicultural, and American). Age, gender, education, income and ethnicity varied significantly by levels of acculturation (Table 1). Therefore, we considered these variables as potential confounders in our model building procedure. The mean age of the study sample was 45 years and those in the Asian cluster were in general older than those who were in the bicultural and American clusters. Overall, there were more females (58.5%) than males in the sample, but there were more males than females within the American clusters. More than half of our participants had a college education or more, yet about one third had a high school education or less. Education level differed significantly by acculturation clusters: while 64% had a high school education or less in the Asian cluster, whereas the same was true for only 10.6% in the American cluster. Similarly, household income also varied considerably by acculturation cluster, with the Asian cluster having the largest proportion (43.9%) of individuals with an annual income of $20,000 or less. Though in general, we had a balanced sample in terms of ethnicity, when examined by acculturation clusters, Vietnamese individuals accounted for 46.3% of the American cluster. This may be due to the age composition of each ethnicity: 58% of participants younger than 30 years were Vietnamese and young people were in general more acculturated than those who were older (Data not shown).

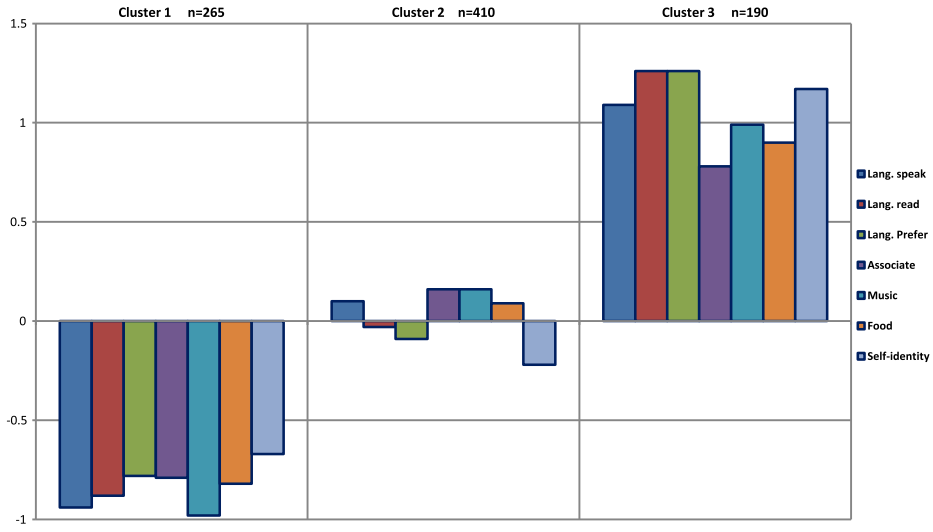
Description of clusters

The two-step cluster analysis yielded three clusters based on BIC change (=−185.15). Cluster 1 (30.6%, $n = 265$) included individuals who were characterized as being mostly Asian with the standardized means of all seven key acculturation items being were lower than 0. This cluster was labeled "Asian." The second cluster (47.4%, $n = 410$) included individuals who were characterized as being bicultural, with standardized means of around 0. This cluster was labeled "Bicultural". Cluster 3 (22.0%, $n = 190$) included individuals who were characterized as being mostly American with standardized means of all seven items being higher than 0. This third cluster was labeled "Americans" (Fig. 1).

Table 1
Sample characteristics by acculturation clusters ($n = 863$).

	Total		Acculturation clusters based on 7 key variables[a]						p-value
			Asian		Bicultural		American		
	$n = 863$		$n = 264$		$n = 409$		$n = 190$		
Health status (n, %)									<0.0001
Excellent, very good, good	535	62.0	99	37.5	272	66.5	164	86.3	
Fair, poor	328	38.0	165	62.5	137	33.5	26	13.7	
Age (mean, SE)	45.0	13.4	52.4	12.6	43.8	12.3	37.2	11.5	<0.0001
Gender (n, %)									0.0005
Male	358	41.5	89	33.7	170	41.6	99	52.1	
Female	505	58.5	175	66.3	239	58.4	91	47.9	
Education (n, %)									<0.0001
Less than high school	113	13.1	83	31.4	27	6.6	3	1.6	
High school	177	20.5	86	32.6	74	18.1	17	9.0	
Some college	111	12.9	20	7.6	52	12.7	39	20.5	
College graduates and above	462	53.5	75	30.6	256	62.6	131	69.0	
Annual household income (n, %)									<0.0001
Missing	30	3.5	14	5.3	11	2.7	5	2.6	
Less than $20,000	206	23.9	116	43.9	71	17.4	19	10.0	
$20,000 to $49,999	261	30.2	86	32.6	137	33.5	38	20.0	
$50,000 to $74,999	111	12.9	19	7.2	52	12.7	40	21.1	
$75,000 to $99, 000	98	11.4	18	6.8	50	12.2	30	15.8	
$100,000 or more	157	18.2	11	4.1	88	21.5	58	30.5	
Ethnicity (n, %)									<0.0001
Korean	290	33.6	88	33.3	158	38.6	44	23.2	
Chinese	298	34.5	84	31.8	156	38.1	58	30.5	
Vietnamese	275	31.9	92	34.9	95	23.2	88	46.3	

[a] Seven variables were: language read, language speak, language preference, people associated with in the community, music preference, food preference in restaurants and self identity.



[a]Cluster 1 is Asian, Cluster 2 is Bicultural, and Cluster 3 is American.

Fig. 1. Acculturation clusters[a] relative distribution of variables (z-scores).

Findings from logistic regression analysis of individual acculturation measures

Four individual measures (language preference, self-identity, age at arrival and length of stay) were used to examine the unadjusted and adjusted association between acculturation and health status (Table 2). All four acculturation measures were significantly associated with health status with or without adjusting for age, gender, education and income. The direction of the association was consistent for all variables. Participants, who preferred English or preferred English and their Asian language equally, were 2.6 and 2.3 times more likely to report having good health compared to participants who preferred their native Asian language. Participants who self-identified as American were 3.5 times more likely, and those who identified themselves as equally Asian and American were 2.1 times more likely to report good health as compared to those who self-identified themselves as Asian. Age at arrival was the strongest variable associated with health status. In particular, those who were born in the U.S. or arrived in the U.S. before 15, were almost six times more likely to report good health compared to those who arrived in the U.S. after 40. Participants who stayed in the U.S. 21 years or over were more than twice likely to report good health compared to those who stayed in the U.S. less than five years. The change in the unadjusted and adjusted odds ratio was mainly due to the confounding effects of education and income. When we added education and income variables to the model that tested an association between acculturation and health status, the estimates for the measures of acculturation were reduced by more than 10%. For models testing all individual acculturation measure and health status, education and income were positive confounders.

Table 2
The association between acculturation and current health status using individual measures ($n = 863$).

	n (%)	Unadjusted OR[a]		Multivariate-adjusted OR[a,b]	
		OR	95% CI	OR	95% CI
Language preference					
English	78 (9.0)	6.3	(3.2, 12.5)	2.6	(1.3, 5.4)
Equal	196 (22.7)	4.4	(3.0, 6.6)	2.3	(1.4, 3.5)
Asian	589(68.2%)	REF		REF	
Self-identity					
American	20 (2.3)	4.3	(1.2, 14.7)	3.5	(0.9, 14.2)
Equal	184 (21.3)	2.5	(1.7, 3.7)	2.1	(1.4, 3.2)
Asian	659 (76.4)	REF		REF	
Age at arrival (in years)					
0–15	117 (13.6)	16.0	(8.2, 31.1)	5.8	(2.4, 14.0)
16–20	85 (9.9)	4.1	(2.3, 7.3)	2.1	(1.0, 4.4)
21–30	284 (32.9)	4.0	(2.6, 6.0)	1.6	(0.9, 2.9)
31–40	221 (25.6)	3.0	(2.0, 4.6)	1.3	(0.8, 2.2)
41 or above	156 (18.1)	REF		REF	
Length of stay in the US					
21 or over	156 (18.1)	1.4	(0.9, 2.2)	2.2	(1.3, 3.7)
16–20	221 (25.6)	1.3	(0.8, 2.1)	1.4	(0.8, 2.3)
11–15	284, (32.9)	1.7	(1.1, 2.7)	1.4	(0.8, 2.6)
6–10	85 (9.9)	1.2	(0.8, 1.8)	1.0	(0.6, 1.6)
0–5	117 (13.6)	REF		REF	

[a] Odds of having good health.
[b] Adjusted for age, gender, education and income.

Findings from multivariate-adjusted cluster analysis

The association between summary measures of acculturation and health status are shown in Table 3. Findings are based on the multivariate-adjusted analysis. For the acculturation clusters, the American cluster was 3.8 times (95% CI: 2.2, 6.6) and the bicultural cluster was 1.7 times (95% CI: 1.1, 2.4) as likely as the Asian cluster to report better health adjusting for covariates. In the analysis using continuous SL-ASIA summary score, one unit increase in the SL-ASIA summary score (range: −1.4, 1.4) resulted in a 2.2 times

Table 3
Multivariate-adjusted association between summary measures of acculturation and health status ($n = 863$).

	Acculturation clusters based on key seven SL-ASIA variables		SL-ASIA summary score	
	OR[a]	95% CI	OR[a]	95% CI
American	3.8	(2.2, 6.6)	2.2	(1.5, 3.2)
Bicultural	1.7	(1.1, 2.4)		
Asian	REF			

[a] Adjusted for age, gender, education and income. Odds of having good health.

(95% CI: 1.5, 3.2) increase in the odds of reporting better health adjusting for covariates.

We tested the interactions between six acculturation variables (length of stay, age of arrival, language preference, self -identity, SL-ASIA summary score and acculturation clusters) and all covariates. No significant interactions were detected.

Discussion

The current study provides several new contributions to understanding the association between acculturation and self-reported health status among Asian Americans. First, we employed cluster analysis to significantly improve the interpretation of a well-validated, comprehensive measure of acculturation for Asian Americans (SL-ASIA). Instead of examining what degree of acculturation is associated with one unit increase in a continuous measure that ranges from −1.4 to 1.4, we applied a new analytical method by clustering SL-ASIA scores into multiple acculturation categories. For example, when one unit increase in continuous SL-ASIA score resulted in a 2.2 times increased odds of having good health, findings from the cluster analysis indicated that compared to participants in the Asian cluster, those in Bicultural and American clusters had 1.7 and 3.8 times increased odds of having good health respectively. This indicates that we had three distinct degrees of acculturation by forming clusters (Asian, Bicultural, and American) and shows a gradient in relation to outcome. Furthermore, variables included in the cluster analysis (language, peer, music and food preference in restaurants) were more relevant for our study sample (because the selection of items were based on our population's characteristics) and may have worked together to better capture the multifaceted acculturation process. Second, this study included multiple measures of acculturation and multiple subgroups of Asian Americans in one study to overcome previous mixed findings, which stemmed from including a single measure of acculturation or only one group of Asian Americans. Consequently, we were able to cross-compare various types of acculturation measures within one study, and provide a comprehensive picture of the association between acculturation and health status in Asian Americans.

Results from our study suggest a strong to moderate association between acculturation and self-reported health status among Asian Americans. Those who were more acculturated, as measured by individual measures (i.e., language preference, length of stay, age at arrival and self-identity) and the composite measures (i.e., clusters based on seven key SL-ASIA variables and SL-ASIA summary score), were more likely to report better health than their less acculturated counterparts after adjusting for age, gender, income and education. In our sample, the association between acculturation and health status did not vary by gender, ethnicity or the level of education and income.

Our findings were consistent with some previous studies among Asian Americans where acculturation was positively associated with health status (Kandula et al., 2007; Lee et al., 2000), but not consistent with another study where the authors found that acculturation was not associated with health status (Huh et al., 2008). One of the main reasons for this discrepancy in findings may be due to differences in the types of measures of acculturation employed and the different population groups examined. By examining multiple individual measures of acculturation and composite measures at the same time, the current study was able to provide more comprehensive understanding of the relationship between acculturation and health status.

Our findings were different from studies that examined acculturation with specific health outcomes, where foreign born Asians were less likely to have heart disease, asthma and cancer than U.S. born Asians (Huh et al., 2008). It is challenging to explain the seemingly contradictory phenomenon among Asian Americans that those who are less acculturated have worse self-reported health statuses despite having a lower prevalence of some major diseases. Though there have been speculations on the response bias due to Asian culture and language difference or the different understanding of the concept of health (Kandula et al., 2007; Lee et al., 2000; Leung, Luo, So, & Quan, 2007), our preliminary findings from the analysis on acculturation and health screening behaviors may provide some explanation. The same participants in our study were asked whether they had received the following tests/examinations in the past year: a complete physical exam, blood pressure check-up, cholesterol test, dental exam, eye exam, screening for colon cancer, a blood stool test, pap smear test, mammogram, and prostate cancer screening. Participants scored one if they answered "yes" to any of the question resulting in an index score ranging from 0 to 9 for females and 0–8 for males. We observed a significant increase in health screening behavior by acculturation levels. Adjusting for age, men in the American cluster had a 0.9 (95% CI: 0.2, 1.6) point increase compared to those in the Asian cluster. The difference was more prominent among women: those in the American cluster had a 1.2 (95% CI: 0.2, 2.1) point increase compared to their Asian counterparts. We also investigated the relationship between smoking and acculturation. Smoking behavior was categorized into nonsmokers, past smokers, and current smokers. Among people who had ever smoked, those who were in the American cluster were significantly more likely to have quit smoking than those in the Asian cluster (OR = 3.4, 95% CI: 1.1, 10.9). Though not conclusive, our preliminary findings suggest that health screening behavior as well as health care utilization may work as potential mediators in the association between acculturation and health status. Furthermore, according to literature, there is a relationship between acculturation stress and mental health and stress. (Hwang & Ting, 2008; Miller, Kim, & Benet-Martinez, 2011; Miller, Yang, Farrell, & Lin, 2011; Miller, Yang, Hui, Choi, & Lim, 2011; Oh, Koeske, & Sales, 2002; Williams & Berry, 1991) Acculturation stress is especially salient for less acculturated individuals. This might account for worse self-reported health status despite having lower prevalence of major disease among less acculturated individuals.

Caution is needed in interpreting our findings. First, cluster analysis is a data-driven method and the clusters established in this study are specific to our sample, especially because that the clusters were based on the seven items of the SL-ASIA that we believed would better capture the features of our study population. For another population, items that are considered to be important may be different from what we have selected in this study and thus the cluster results may vary. Second, our participants were recruited using a non-probability sampling method. Chinese, Korean and Vietnamese only account for 5% of the total population in Washington, D.C. metropolitan area, and they are a hard to reach population (U.S. Census Bureau, 2010). Culturally tailored recruiting strategies helped us to maximize the outreach of the study, but this method also resulted in a somewhat different population profile for each ethnicity. For example, there were more young participants in the Vietnamese group than the Chinese and Korean groups. These differences may limit our ability in detecting ethnic difference in the association between acculturation and health status as well as the generalizability of our findings.

Our study is one of the first to compare different uses of SL-ASIA in assessing acculturation, including its individual components (i.e., language preference, self-identity), computed summary score, and clusters based on the summary scores and specific items. Cluster analysis based on the selected scale items better represented the composition of our study population and improved the

interpretation of the SL-ASIA scores. Results suggest that a higher level of acculturation is associated with better health status among Asian Americans. Future studies may examine possible mediators of the association between acculturation and health status among Asian Americans (e.g., health care utilization) to provide more insight in understanding the impact of acculturation on health.

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