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Acculturation Strategies Among South Asian Immigrants: The Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study

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Abstract In the past, epidemiologic research on acculturation and health has been criticized for its conceptual ambiguity and simplistic measurement approaches. This study applied a widely-used theoretical framework from cross-cultural psychology to identify acculturation strategies among South Asian immigrants in the US and to examine sociodemographic correlates of acculturation strategies. Data were from the Mediators of Atherosclerosis in South Asians Living in America study. We used latent class analysis to identify groups of individuals that were similar based on cultural attitudes and behaviors. We used latent class regression analysis to examine sociode-

mographic correlates of acculturation strategies. We found that South Asian immigrants employed three acculturation strategies, including separation (characterized by a relatively high degree of preference for South Asian culture over US culture), assimilation (characterized by a relatively high degree of preference for US culture over South Asian culture), and integration (characterized by a similar level of preference for South Asian and US cultures). Respondents with no religious affiliation, those with higher levels of income, those who lived a greater percentage of their lives in the US, and those who spoke English well or very well were less likely to use the separation strategy than the assimilation or integration strategies. Using epidemiologic cohort data, this study illustrated a conceptual and methodological approach that addresses limitations of previous research on acculturation and health. More work is needed to understand how the acculturation strategies identified in this study affect the health of South Asian immigrants in the US.

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Introduction

Research on acculturation and health has become increasingly common in the epidemiologic literature (for recent reviews, see [1–4]). However, this work has been criticized for its conceptual ambiguity and simplistic measurement approaches [5–7]. The purpose of this study was to apply a widely-used theoretical framework from cross-cultural psychology [8] to identify acculturation strategies among South Asian immigrants—part of the fastest-growing major ethnic group in the US [9]—and to examine sociodemographic correlates

of acculturation strategies. This work is intended to lay the groundwork for future research on acculturation and health among South Asian immigrants in the US and to illustrate a conceptual and methodological approach that can be used to guide epidemiologic studies on acculturation and health in diverse immigrant populations.

Definitions

In this analysis, we defined culture as the symbolic and learned aspects of human groups or societies, including language, beliefs, attitudes, values, norms, and behaviors [10]. Drawing on Berry's work, we defined acculturation as the process of cultural and psychological change that occurs when members of two or more cultural groups interact [11]. We examined acculturation among South Asian immigrants, defined as current US residents who were born in one of the following countries: India (83.6 %), Bangladesh (0.6 %), Nepal (0.4 %), Pakistan (4.5 %), Sri Lanka (1.0 %), sub-Saharan Africa (3.0 %), Fiji Islands (1.9 %), Burma (0.6 %), or another South Asian diaspora country (2.4 %).

Theoretical Framework

This study was guided by Berry's [8] acculturation framework, which hypothesizes the existence of four acculturation strategies: integration, assimilation, separation, and marginalization. The *integration* strategy is used when individuals maintain their heritage culture and adopt elements of the host culture; the *assimilation* strategy is used when immigrants reject their heritage culture but embrace the host culture; the *separation* strategy is used when individuals maintain their heritage culture and reject the host culture; and the *marginalization* strategy is used when immigrants reject both the heritage and host cultures. In contrast to unidimensional models of acculturation, which tend to equate acculturation with assimilation, Berry's framework recognizes that identification with one's heritage culture exists on a separate continuum from identification with the host culture.

Hypotheses

First, we hypothesized that latent class analysis would identify four subgroups of South Asian immigrants characterized by distinctive patterns of cultural attitudes and behaviors, corresponding to the integration, assimilation, separation, and marginalization strategies described by Berry [8]. Next, we hypothesized that younger respondents, men, the unmarried, those with no religious affiliation, those with higher levels of education, the currently employed, those with greater per capita household income,

those who lived a greater percentage of their lives in the US, and those who speak English well or very well would be more likely to use the integration strategy rather than the assimilation, separation, or marginalization strategies.

Data and Methods

Data

Data for this study were from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study. From October 2010 to March 2013, the study enrolled 906 community-dwelling individuals (46 % women; 98 % foreign-born) in the San Francisco Bay Area and the greater Chicago area who self-identified as having South Asian ancestry. Detailed study methods have been described elsewhere [12]. Briefly, this study was population-based, with random sampling of households with South Asian surnames from the desired geographic locations. Individuals were eligible for the study if they were aged 40–84 years and free from physician-diagnosed cardiovascular disease. Persons were excluded if they could not speak and/or read English, Hindi, or Urdu. The institutional review boards at the University of California, San Francisco and Northwestern University approved the study protocol, and all study participants provided written informed consent.

Measures

Acculturation indicators include attitudes about the practice of South Asian traditions in the US, frequency of fasting, foods normally eaten at home and in restaurants, frequency of shopping in South Asian markets, and ethnic composition of friendship networks. Prior research has used similar measures to identify acculturation strategies [13]. Respondents were asked to report how much they wish the following traditions from South Asia would be practiced in America (1 = absolutely; 5 = not at all): (1) performing religious ceremonies or rituals; (2) serving South Asian sweets for ceremonies or rituals; (3) fasting on specific occasions; (4) living in a joint family; (5) having an arranged marriage; (6) having a staple diet of chapattis, rice, daal, vegetables, and yogurt; and (7) using spices for healing and health [14]. Next, respondents were asked to report how often they fast (1 = two or three times per week; 6 = almost never or never), what foods they normally eat at home and in restaurants (1 = only South Asian food; 6 = never eat at home/in restaurants), how often their family shops at South Asian grocery stores or markets (1 = two or three times per week; 5 = almost never or never), and which country or culture most of their friends

belong to (1 = only South Asian; 5 = only other ethnic groups).

Hypothesized sociodemographic correlates of acculturation strategies include age (in years), gender (female vs. male), marital status (not married vs. married), religion (Hinduism/Jainism as the reference category, none, and all other religions), education (high school or less, some college, bachelor's degree, and more than a bachelor's degree as the reference category), occupation (unemployed, retired, and employed as the reference category), per capita household income¹ (in \$10,000s), country of birth (born in South Asian country other than India vs. born in India), percentage of life lived in the US (continuous), and English language proficiency (speaks English poorly or not at all, speaks English fairly well, and speaks English well or very well as the reference category).

Plan of Analysis

The original dataset consists of observations from 906 individuals. For our analysis we excluded 19 subjects who were born in the US. We further created a complete-case analytic dataset that had no missing values in the variables used in our analysis, leading to a dataset with 857 participants. We compared the complete case data with the one containing missing values in terms of descriptive statistics and comparability. We used latent class analysis (LCA), a technique for identifying unobservable subgroups within a population, to identify groups of individuals that were similar based on cultural attitudes and behaviors. LCA is similar to other data reduction techniques, such as cluster analysis, but with the advantage of being model-based. LCA uses maximum-likelihood methods to produce estimates of the probability of class membership. Model fit statistics, such as the BIC and AIC, can be used along with contextual theory to determine the number of classes in the data. LCA can accommodate any combination of continuous, categorical, or count variables, and standardization of variables is not required [15]. We fit a multinomial regression model for the estimated class membership using the hypothesized sociodemographic correlates as covariates. This is done via latent class regression, which maximizes the joint log-likelihood of the latent class model and the multinomial regression model. This ensures correct propagation of uncertainty associated with the latent class identification to the regression model. We used the *poLCA* package in the statistical software R [16] for latent class regression models.

¹ Annual family income was measured on a sixteen-point scale, from less than \$5000 (1) to \$250,000 or more (12). To calculate per capita income, we divided the midpoint of each category (\$275,000 for the upper category) by the number of people supported by the income, including individuals who live outside the household.

Results

Descriptive statistics for the analysis dataset ($n = 857$) are presented in Table 1. Mean age was approximately 55 years. The sample had a higher proportion of men (54.0 %), and over 90 % of respondents were married. A small percentage of respondents reported no religion (5.7 %), while 74.3 % described their religion as Hinduism or Jainism. The majority of respondents had more than a bachelor's degree (59.6 %), and 70.4 % were currently employed. Average per capita household income was approximately \$50,000 per year. Most respondents were born in India (85.2 %), and the average percentage of life lived in the US was just over 48 %. Nearly all respondents reported speaking English well or very well (87.0 %). Descriptive statistics for the full sample after excluding the 19 US born subjects ($n = 887$) is presented in supplementary Table S1.

Although Berry's [8] acculturation framework hypothesizes the existence of four acculturation strategies, previous research using LCA or similar techniques, such as

Table 1 Descriptive statistics for analytic sample ($n = 857$)

Age (M, SD)	55.4 (9.4)
Women (N, %)	394 (46.0 %)
Men (N, %)	463 (54.0 %)
Marital status (N, %)	
Married	780 (91.0 %)
Not Married	77 (9.0 %)
Religion (N, %)	
Hinduism/Jainism	637 (74.3 %)
Other religion	171 (20.0 %)
None	49 (5.7 %)
Education (N, %)	
High school or less	57 (6.7 %)
Some college	42 (4.9 %)
Bachelor's degree	247 (28.8 %)
More than bachelor's degree	511 (59.6 %)
Occupation (N, %)	
Unemployed	137 (16.0 %)
Employed	603 (70.4 %)
Retired	117 (13.6 %)
Per capita household income, in \$10,000 s (M, SD)	5.0 (3.6)
Country of origin (N, %)	
India	730 (85.2 %)
Other South Asian country	127 (14.8 %)
Percentage of life lived in US (M, SD)	48.5 (16.5)
English language proficiency (N, %)	
Speak English poorly or not at all	27 (3.2 %)
Speak English fairly well	84 (9.8 %)
Speak English well or very well	746 (87.0 %)

cluster analysis, found that the number of strategies varied depending on the characteristics of the sample [13, 17–19]. For this reason, we used the 12 indicators of acculturation described above to fit models with 2–7 latent classes (see supplementary Table S2 for the model fit statistics for each of the latent class models examined). Based on the model selection consistency of BIC and contextual theoretical considerations, we concluded that the three-class model with the smallest BIC value provided the best fit and interpretation for the data. Table 2 presents the latent class probability estimates and the conditional probability estimates for the three-class model along with 95 % confidence intervals.

The first row in Table 2 includes the estimated proportion of respondents that were most likely to belong in each acculturation strategy class: 0.54 (95 % CI 0.50, 0.58) in the *Integration* class, 0.23 (95 % CI 0.20, 0.26) in the *Assimilation* class, and 0.22 (95 % CI 0.19, 0.25) in the *Separation* class. The conditional probabilities presented in the remaining rows of Table 2 report the probability, within each latent class, of providing a particular response to each of the acculturation questions. Members of the *Separation* class reported a strong desire for South Asian traditions (e.g., fasting on specific occasions, living in a joint family, and using spices for health and healing) to be practiced in the US. In addition, members of the *Separation* class reported high levels of fasting, eating South Asian food at home, shopping in South Asian grocery stores, and having South Asian friends. In contrast, members of the *Assimilation* class reported very little desire for South Asian traditions to be practiced in the US. Members of this class also reported low levels of fasting, an equal preference for eating South Asian and other foods, and an equal number of friends from South Asian and other ethnic groups. Members of the *Integration* class reported less desire for South Asian traditions to be practiced in the US compared to members of the *Separation* class but greater desire compared to members of the *Assimilation* class. On many of the other acculturation measures, such as frequency of fasting and shopping in South Asian grocery stores, members of the *Integration* class were similar to members of the other two classes.

While explaining the latent class membership via measured sociodemographic covariates using a multinomial regression model, we had to collapse certain categories in Table 1 due to separability issues commonly encountered in categorical regression models. The number of subjects in the “some college” category of the education variable and the “speaks English poorly or not at all” category of the English language proficiency variable are relatively small. This can potentially cause an unstable estimate for the odds ratio parameter with large standard errors. Therefore we merged “high school and less” and “some college” for the

education variable and “speaks English poorly or not at all” and “speaks English fairly well” for the English language proficiency variable.

As shown in Table 3, religious affiliation, per capita household income, percentage of life in the US, and English language proficiency were significant predictors of acculturation strategies identified through LCA. Respondents with no religious affiliation had substantially higher odds of being in the *Assimilation* class (OR 19.62; 95 % CI 1.16, 332.47) versus the *Separation* class. Higher per capita household income was associated with higher odds of being in either the *Integration* class (OR 1.15; 95 % CI 1.03, 1.28) or the *Assimilation* class (OR 1.30; 95 % CI 1.16, 1.46) versus the *Separation* class. Each additional percentage of life lived in the US was associated with 1 % higher odds of being in the *Assimilation* class versus the *Separation* class (OR 1.01; 95 % CI 1.00, 1.06). Compared to those who speak English well or very well, those who speak English fairly well or poorly/not at all had 58 % lower odds of being in the *Integration* class versus the *Separation* class (OR 0.42; CI 0.21, 0.85) and 87 % lower odds of being in the *Assimilation* class versus the *Separation* class (OR 0.13; CI 0.03, 0.54).

Discussion

This study applied a widely-used acculturation framework from cross-cultural psychology [8, 11] to data from the MASALA study, an epidemiologic cohort study designed to identify risk factors for the progression of subclinical cardiovascular disease in a population-based sample of South Asian people living in the US. Using latent class analysis, we found that South Asian immigrants employed three acculturation strategies, including separation (characterized by a relatively high degree of preference for South Asian culture over US culture), assimilation (characterized by a relatively high degree of preference for US culture over South Asian culture), and integration (characterized by a similar level of preference for South Asian and US cultures). More than half of participants used the integration strategy, while one-quarter used the assimilation strategy and one-fifth used the separation strategy. Contrary to expectations, we did not find evidence to support the existence of a marginalization strategy (characterized by rejection of both the heritage and host cultures), although it is possible that marginalized individuals declined to participate in the study. Consistent with expectations, we found that those with no religious affiliation, those with higher per capita household income, those who lived a greater percentage of their lives in the US, and those who speak English well or very well were less likely to use the separation strategy than the assimilation or

Table 2 Estimated proportion of respondents belonging to a given latent class with maximal probability, and conditional probabilities of responses to each acculturation question within the three latent acculturation strategy classes with accompanying 95 % CI (n = 857)

	Integration	Assimilation	Separation
Proportion of sample in class	0.54 (0.50, 0.58)	0.23 (0.20, 0.26)	0.22 (0.19, 0.25)
Performing religious ceremonies or rituals			
Absolutely	0.13 (0.09, 0.17)	0.02 (0.00, 0.04)	0.74 (0.65, 0.83)
Very much so	0.39 (0.34, 0.44)	0.01 (0.00, 0.03)	0.14 (0.07, 0.21)
Quite a bit	0.33 (0.28, 0.38)	0.17 (0.10, 0.24)	0.05 (0.01, 0.09)
A little bit	0.15 (0.11, 0.19)	0.54 (0.45, 0.63)	0.04 (0.00, 0.08)
Not at all	0.00 (0.00, 0.02)	0.26 (0.17, 0.35)	0.03 (0.00, 0.06)
Serving South Asian sweets for ceremonies or rituals			
Absolutely	0.09 (0.06, 0.12)	0.00 (0.00, 0.00)	0.46 (0.36, 0.56)
Very much so	0.33 (0.28, 0.38)	0.04 (0.01, 0.07)	0.21 (0.14, 0.28)
Quite a bit	0.31 (0.26, 0.36)	0.14 (0.07, 0.21)	0.16 (0.09, 0.23)
A little bit	0.24 (0.19, 0.29)	0.54 (0.45, 0.63)	0.11 (0.05, 0.17)
Not at all	0.03 (0.01, 0.05)	0.28 (0.19, 0.37)	0.07 (0.02, 0.12)
Fasting on specific occasions			
Absolutely	0.04 (0.01, 0.07)	0.00 (0.00, 0.00)	0.61 (0.51, 0.71)
Very much so	0.18 (0.14, 0.22)	0.01 (0.00, 0.03)	0.17 (0.10, 0.24)
Quite a bit	0.28 (0.24, 0.33)	0.03 (0.00, 0.06)	0.06 (0.01, 0.11)
A little bit	0.37 (0.33, 0.42)	0.44 (0.35, 0.53)	0.09 (0.04, 0.14)
Not at all	0.13 (0.09, 0.17)	0.53 (0.44, 0.62)	0.07 (0.02, 0.12)
Living in a joint family			
Absolutely	0.03 (0.01, 0.05)	0.01 (0.00, 0.02)	0.50 (0.40, 0.60)
Very much so	0.17 (0.13, 0.21)	0.01 (0.00, 0.03)	0.15 (0.08, 0.22)
Quite a bit	0.23 (0.19, 0.27)	0.05 (0.01, 0.09)	0.12 (0.06, 0.18)
A little bit	0.35 (0.29, 0.41)	0.33 (0.25, 0.41)	0.11 (0.05, 0.17)
Not at all	0.21 (0.15, 0.27)	0.60 (0.52, 0.68)	0.12 (0.06, 0.18)
Having an arranged marriage			
Absolutely	0.04 (0.02, 0.06)	0.00 (0.00, 0.00)	0.41 (0.31, 0.51)
Very much so	0.09 (0.06, 0.12)	0.01 (0.00, 0.02)	0.16 (0.10, 0.22)
Quite a bit	0.21 (0.17, 0.25)	0.02 (0.00, 0.04)	0.22 (0.15, 0.29)
A little bit	0.45 (0.40, 0.50)	0.26 (0.18, 0.34)	0.14 (0.07, 0.21)
Not at all	0.22 (0.18, 0.26)	0.72 (0.64, 0.80)	0.07 (0.02, 0.12)
Having a staple diet of chapattis, rice, daal, vegetables, and yogurt			
Absolutely	0.10 (0.07, 0.13)	0.04 (0.01, 0.07)	0.70 (0.61, 0.79)
Very much so	0.38 (0.33, 0.43)	0.10 (0.05, 0.15)	0.20 (0.13, 0.27)
Quite a bit	0.35 (0.30, 0.40)	0.22 (0.15, 0.29)	0.07 (0.03, 0.11)
A little bit	0.16 (0.12, 0.20)	0.45 (0.36, 0.54)	0.03 (0.00, 0.06)
Not at all	0.01 (0.00, 0.02)	0.19 (0.11, 0.27)	0.00 (0.00, 0.00)
Using spices for healing and health			
Absolutely	0.18 (0.14, 0.22)	0.12 (0.06, 0.18)	0.61 (0.52, 0.70)
Very much so	0.33 (0.28, 0.38)	0.15 (0.08, 0.22)	0.12 (0.06, 0.18)
Quite a bit	0.28 (0.23, 0.33)	0.29 (0.22, 0.36)	0.13 (0.07, 0.19)
A little bit	0.17 (0.13, 0.21)	0.29 (0.21, 0.37)	0.11 (0.05, 0.17)
Not at all	0.03 (0.01, 0.05)	0.15 (0.08, 0.22)	0.03 (0.00, 0.06)
How often do you fast?			
Two or three times per week	0.01 (0.00, 0.02)	0.00 (0.00, 0.01)	0.08 (0.03, 0.13)
About once a week	0.10 (0.07, 0.13)	0.03 (0.00, 0.06)	0.15 (0.09, 0.21)
About once or twice per month	0.07 (0.05, 0.09)	0.01 (0.00, 0.02)	0.12 (0.07, 0.17)

Table 2 continued

	Integration	Assimilation	Separation
Less than once a month	0.11 (0.08, 0.14)	0.03 (0.01, 0.05)	0.11 (0.06, 0.16)
Once a year for a specific period	0.19 (0.15, 0.23)	0.11 (0.06, 0.16)	0.33 (0.25, 0.41)
Almost never or never	0.52 (0.47, 0.57)	0.83 (0.77, 0.89)	0.20 (0.12, 0.28)
What food do you normally or usually eat at home?			
Only South Asian food	0.06 (0.03, 0.09)	0.01 (0.00, 0.02)	0.28 (0.18, 0.38)
Mostly South Asian food	0.52 (0.47, 0.57)	0.25 (0.17, 0.33)	0.49 (0.40, 0.58)
Equally South Asian and other	0.39 (0.34, 0.44)	0.58 (0.49, 0.67)	0.22 (0.14, 0.30)
Mostly other food	0.03 (0.00, 0.06)	0.16 (0.09, 0.23)	0.02 (0.00, 0.05)
Only other food	0.00 (0.00, 0.00)	0.01 (0.00, 0.02)	0.00 (0.00, 0.00)
Never eat at home	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
What food do you normally or usually eat in restaurants?			
Only South Asian food	0.02 (0.00, 0.04)	0.00 (0.00, 0.00)	0.16 (0.09, 0.23)
Mostly South Asian food	0.10 (0.07, 0.13)	0.03 (0.00, 0.06)	0.22 (0.14, 0.29)
Equally South Asian and other	0.45 (0.40, 0.50)	0.35 (0.31, 0.39)	0.43 (0.34, 0.52)
Mostly other food	0.40 (0.35, 0.45)	0.57 (0.49, 0.65)	0.16 (0.09, 0.23)
Only other food	0.01 (0.00, 0.02)	0.05 (0.01, 0.09)	0.01 (0.00, 0.03)
Never eat in restaurants	0.00 (0.00, 0.01)	0.00 (0.00, 0.00)	0.03 (0.00, 0.06)
How often does your family shop at South Asian grocery stores or markets?			
Two or three times per week	0.06 (0.04, 0.08)	0.03 (0.00, 0.06)	0.15 (0.09, 0.21)
About once a week	0.51 (0.46, 0.56)	0.29 (0.21, 0.37)	0.49 (0.41, 0.57)
About once or twice per month	0.32 (0.27, 0.37)	0.41 (0.33, 0.49)	0.27 (0.22, 0.32)
Less than once a month	0.09 (0.06, 0.12)	0.25 (0.17, 0.33)	0.08 (0.07, 0.09)
Almost never or never	0.01 (0.00, 0.02)	0.02 (0.01, 0.03)	0.01 (0.00, 0.02)
Which country or which culture do most of your friends belong to? Are they:			
Only South Asian	0.05 (0.03, 0.07)	0.03 (0.00, 0.06)	0.24 (0.16, 0.32)
Mostly South Asian	0.52 (0.47, 0.57)	0.33 (0.24, 0.42)	0.44 (0.35, 0.53)
Equally South Asian groups and Other groups	0.38 (0.33, 0.43)	0.41 (0.33, 0.49)	0.27 (0.29, 0.35)
Mostly Other (not South Asian) ethnic groups	0.04 (0.02, 0.06)	0.23 (0.15, 0.31)	0.04 (0.00, 0.08)
Only Other ethnic groups	0.01 (0.00, 0.02)	0.01 (0.00, 0.03)	0.01 (0.00, 0.03)

AIC = 27,535.58; BIC = 28,290.63. Proportions in bold font are the most frequently reported response to each acculturation question, within the three latent classes. 95 % confidence intervals are shown in parentheses

integration strategies. Sensitivity analyses examining years in the US rather than percentage of life lived in the US produced substantively similar results.

Strengths, Limitations, and Directions for Future Research

A key strength of this study was the use of a multidimensional model of acculturation, which recognizes that identification with one's heritage culture exists on a separate continuum from identification with the host culture. Despite advantages over more simplistic unidimensional models of acculturation, some critics have argued that Berry's framework implicitly assumes that heritage and host cultures are internally homogeneous and distinct from

one another [5]. While we acknowledge that there is neither a single monolithic South Asian culture nor a single monolithic American culture, we contend that South Asian people who migrate to the US are likely to encounter differences in the *predominant* language, beliefs, attitudes, values, norms, and/or behaviors in their country of birth compared to their country of residence. Thus, South Asian immigrants in the US are likely to experience opportunities for acculturation; and the acculturative strategies that they employ in response to these opportunities could have implications for health and well-being (see, for example, prior work on acculturation strategies and mental health [20, 21]). This is an important area for future research, and data from the MASALA study are well-suited to answer questions about the health-related consequences of acculturation strategies used by immigrants from South Asia. To

Table 3 Results from the multinomial logistic regression model relating sociodemographic characteristics to the odds of belonging to three latent acculturation classes (n = 857). The odds ratio estimate, 95 % CI, and the P-values corresponding to a Wald test are reported

	Integration versus Separation			Assimilation versus Separation		
	OR	95 % CI	p value	OR	95 % CI	p value
Age	1.00	(0.97, 1.03)	0.88	0.99	(0.95, 1.03)	0.50
Female (Male)	0.87	(0.50, 1.51)	0.62	1.48	(0.75, 2.95)	0.26
Not married (Married)	0.87	(0.34, 2.25)	0.78	1.29	(0.43, 3.84)	0.65
Religion (Hinduism/Jainism)						
Other religion	0.67	(0.35, 1.27)	0.22	0.82	(0.36, 1.90)	0.66
None	1.83	(0.10, 36.37)	0.69	19.62	(1.16, 332.47)	0.04
Education (More than bachelor's degree)						
Less than Bachelor's degree	0.50	(0.21, 1.19)	0.12	0.55	(0.17, 1.80)	0.33
Bachelor's degree	0.69	(0.41, 1.17)	0.16	0.56	(0.28, 1.11)	0.09
Occupation (Employed)						
Unemployed	0.93	(0.33, 1.78)	0.82	0.81	(0.33, 1.98)	0.64
Retired	1.14	(0.59, 2.68)	0.76	1.59	(0.59, 4.34)	0.36
Per capita household income, in \$10,000 s	1.15	(1.03, 1.28)	0.01	1.30	(1.16, 1.46)	<0.01
Born in other South Asian country (Born in India)	0.92	(0.47, 1.84)	0.82	1.12	(0.47, 2.69)	0.80
Percentage of life lived in US	1.01	(0.99, 1.03)	0.10	1.01	(1.00, 1.06)	<0.01
English language proficiency (Speak English well or very well)						
Speak English fairly well or poorly/not at all	0.42	(0.21, 0.85)	0.02	0.13	(0.03, 0.54)	0.03

Reference category is shown in parentheses. Results significant at 5 % level of significance are highlighted in bold

the extent that contextual variables, such as ethnic density, social cohesion, and quality of the natural environment, are a common cause of acculturation strategies and health-related outcomes [22, 23], it will be important for future research in this area to incorporate measures of the neighborhood environment. Geocoded data will soon be available for the MASALA cohort, making this type of analysis possible.

While many epidemiologic studies rely on simplistic markers of acculturation (e.g., nativity or years in the US) that are inconsistent with the conceptualization of acculturation as a multidimensional construct, this study used multiple questions about acculturation, some of which were based on the results of focus group interviews conducted with South Asian Indians in the US [24]. Questions included attitudes about the practice of South Asian traditions in the US, frequency of fasting, foods normally eaten at home and in restaurants, frequency of shopping in South Asian markets, and ethnic composition of friendship networks. Some measures, such as language usually spoken at home, were not available in the data set but would be useful to include in future studies. In addition, longitudinal data would enable researchers to examine acculturative change among South Asian immigrants. A longitudinal approach would be more consistent with the notion that acculturation is a dynamic process [6].

A potential limitation of this study was that the hypothesized acculturation strategies in Berry's framework are based on the assumption that individuals have the freedom to decide how they want to acculturate [11]. This freedom is determined, in large part, by the extent to which immigrants from a particular cultural group are welcome in the host country. Data from the Pew Research Center indicate that the vast majority of Americans view Asian immigrants favorably, with approximately 80 % of respondents agreeing that immigrants from Asian countries work very hard and have strong family values [25]. Compared to other immigrant groups in the US, South Asians tend to be better-educated and to have higher levels of English language proficiency and lower levels of poverty, and are more likely to arrive in the US on employment-based visas [26]. These characteristics likely contribute to the currently high level of favorable attitudes toward immigrants from South Asia [27]. In the future, however, changing characteristics of South Asian immigrants and/or changing attitudes toward immigrants from South Asian countries could yield Berry's acculturation framework less relevant. Furthermore, it is unclear whether results from this study are generalizable to the entire population of South Asian immigrants in the US, including those who immigrated more recently (the mean age in our study was over 55, and the average percentage of life spent in the US

was just under 50 %) and those with lower levels of education (nearly 60 % of our sample completed more than a bachelor's degree).

Conclusions

In the past, epidemiologic research on acculturation and health has been criticized on several grounds, including (1) the failure to define key concepts, such as culture; (2) the conceptualization of acculturation as a unidimensional process, whereby maintenance of one's heritage culture and adoption of one's host culture are seen as opposite ends of a single continuum; (3) an overreliance on simplistic markers of acculturation; and (4) the failure to consider the role of context in the acculturation process [5–7, 28]. Using epidemiologic cohort data, this study illustrated a conceptual and methodological approach that addresses limitations of previous studies and could serve as a model for future epidemiologic research in diverse immigrant populations. This study also laid the groundwork for additional research on acculturation and health among South Asian immigrants—part of the fastest-growing major ethnic group in the US [9]. More work is needed to understand how the acculturation strategies identified in this study affect the health and well-being of South Asian immigrants living in the US.

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