A Short Acculturation Scale for Mexican-American Populations

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Acculturation is important to examine variables that differentiate members of ethnic groups so that interventions can be appropriately targeted. By using a population-based sample of Mexican-origin adults, we sought to validate an acculturation scale for Mexican-American populations. The acculturation instrument included eight items adapted from the Acculturation Rating Scale for Mexican Americans (ARSMA). By using principal component analysis, we calculated eigenvalues for the eight items. The first principal component accounted for 66% of the variance. Language spoken most of the time, by itself, explained 62.4% of the variance of the full model, whereas birthplace, by itself, accounted for 74%. Slight increases in correlation values were observed beyond a four-item model that included language spoken most of the time, language thought, ethnic identity, and birthplace. Future studies should compare this scale with other multidimensional scales. (*Ethn Dis*. 2005;15:53–62)

Key Words: Acculturation, Hispanic, Immigration, Latino, Mexican, Mexican-American

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Introduction

The Hispanic population has surpassed Blacks to become the largest ethnic population in the United States.[1,2] Data from the 2000 US Census show that the Hispanic population grew 57.9% from 1990 to 2000.[1,2] This trend is partially explained by high immigration rates. In fact, residents from Latin American make up nearly half of the United States' 25.8 million foreign-born residents.[3] Immigrants from Mexico are reported to represent 40% of the total Mexican-origin population in the United States; more than one quarter of these immigrants arrived in the past five years.[4]

Previous research reported that immigration affects the structure of roles and values of Mexican immigrants and their families.[5] National health surveillance data on disease incidence show different patterns of occurrence among US-born Hispanics relative to foreign-born Hispanics for many health conditions, including cancer. Historic data from a study conducted in Los Angeles county, for example, showed that Hispanics have a higher incidence than non-Hispanic Whites of certain types of cancer (buccal cavity, colon, rectum, larynx, lung, breast, bladder, prostate, and testes) and a higher overall incidence for other cancers such as stomach, gallbladder, liver, and cervix.[6] Rates diverged from non-Hispanic Whites most in immigrant Mexican Americans, and rates in US-born Mexican Americans fell between the two groups.[6] Some of the excess risk has been attributed to lifestyle differences (eg, dietary behaviors, tobacco use, physical activity, and cancer screening practices).[6,7] One key factor thought to predict some of the difference is level of acculturation—the degree to which mainstream values are adopted by immigrants.

Acculturation is thought to involve contact with and adaptation to divergent cultural customs, beliefs, and practices. The acculturation process varies by individual and is influenced by degree of interaction with mainstream culture, age at immigration, reasons for immigrating, etc. Acculturation is linked to attitudes and behaviors, such as language acquisition and use,[8,9] mental health status,[9] cigarette smoking,[10] alcohol and drug use,[10] and use of preventive health services.[11,12] Knowing acculturation level allows researchers to identify groups within a culture that may experience differential risks for diseases or have distinct behavioral patterns. Because acculturation is linked to cultural beliefs and attitudes, understanding level of acculturation can help design health promotion programs and materials.

While the importance of acculturation is generally accepted among the scientific community, consensus is limited about factors that should be included in instruments designed to measure it. Some studies have attempted to construct and validate acculturation scales (Table 1), but dimensions included in such scales have varied markedly, including such items as language, socioeconomic status, and ethnic interaction.

Previous research on acculturation has relied on various premises to construct acculturation measures. A recent premise is that acculturation is a multidimensional construct and cannot be analyzed by a single question or set of questions about one factor, such as education, age, sex, or fluency in Spanish or English.[13,14] A single question may fail to distinguish important subgroups in the immigrant population. English language use alone may measure functional integration but not the adoption of new values.[15] Birthplace or generation status are unchanging factors and do not

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fully measure the continuous process of acculturation.[15]

Approaches to measuring acculturation vary, but they typically rely on one of three models that define acculturated groups. The first, defined as the single-continuum model, reflects replacing a native custom with a mainstream practice, such as greeting an acquaintance with a handshake rather than a kiss on the cheek. The replacement is assumed to be consistent across all traits. A second model, known as the two-culture matrix model, defines acculturation on two independent axes, one representing the traditional culture and a second representing mainstream culture.[5] The model recognizes that an individual may vary in adhering to and accepting the two cultures: he may exhibit behaviors characteristic of one culture, both cultures, or neither culture. A third model, the multidimensional model, recognizes that accepting new cultural traits and losing traditional traits vary.[5] An individual can gain new cultural values, behaviors, and customs, while retaining other traditional customs and values. For example, traits such as language may be lost in one generation, while other traits, such as religious affiliation or ethnic identification may persist through multiple generations.

In a study of Mexican-origin Hispanics, we assessed and validated a short acculturation scale. The purpose of this work was to construct a scale that would be brief enough for large-scale studies of people in population settings rather than clinic settings. The scale was validated on the basis of comparing single questions and combinations of questions to the entire eight-item scale. The goal was to find an instrument that maintained the dimensions of the larger scale while minimizing the number of questions.

METHODS

Setting

The Hispanic population in the state of Washington is concentrated in

Table 1. Characteristics of previous acculturation scales for Mexican Americans

Author	Year	Number of Items	Description of Items
Olmedo E	1978	20	Nationality and language Socioeconomic status Potency ascribed to the concepts of ''father'' and ''male''
Cuellar I	1980	20	Language use and preference Ethnic identification and classification Cultural heritage and ethnic behaviors Ethnic interaction
Ramirez M	1984	83	Demographic and linguistic characteristics Socialization and educational history Cultural participation
Deyo RA	1985	4	Language use, preference, ability, and first language
Burnam MA	1987	26	Language use and preference Generation Ethnic interaction
Hazuda H	1988	25	*Childhood* Experience with English vs Spanish language (2 questions) *Adult* Proficiency in English (3 questions) Pattern of English vs Spanish language usage (10 questions) Value placed on preserving Mexican cultural origin (3 questions) Attitude toward traditional family structure and sex-role organization (7 questions)
Marin G	1987	12	Language use Ethnic social relations Media
Marin G	1996	24	Language use Linguistic proficiency Electronic media
Cuellar I	1995	18 each (for two scales)	Language use and preference Ethnic identity and classification Cultural heritage and ethnic behaviors Ethnic interaction

Yakima County, where Hispanics constitute 24% of the total population.[16] In the Yakima Valley, a region that includes many small agricultural communities, the percentage of Hispanics is estimated at over 50%.[17] This report is part of a larger community intervention study that measured acculturation to assess cancer prevention attitudes, beliefs, and screening practices.

Various characteristics of Mexican immigration to the Yakima Valley make it appropriate for research on acculturation. First, unlike areas of the southwestern United States, Mexican settlement in the Yakima Valley is a recent phenomenon. Large-scale Mexican immigration to the valley began during World War II, when the high demand for agricultural labor led to the enactment of the Bracero Program (1942–1964), which brought more than 35,000 Mexican laborers to Washington.[18] Since the Bracero Program ended in 1964, immigrants (predominantly from Mexico) have continued to come to the valley to find employment or to unite with family members and friends who settled in the area.

Identifying the Sample

Sample selection and survey procedures have been reported elsewhere.[19] Briefly, the study population included adults residing in any of the 20 communities of Yakima Valley. We identified Census blocks by using each community's geographic boundaries. Because we wished to survey enough Hispanics to make inferences to both Hispanic and non-Hispanic White populations, the design oversampled Hispanics. Census data (1990) were used to calculate the percentage of Hispanic residents within each Census block. The Census blocks were then arranged into three groups (tertiles) in order of the percentage of Hispanics. Approximately 160 households were drawn from each community; 50% of the sample came from the first tertile (blocks with the highest percentage of Hispanics), 33% of sample households came from the second tertile (blocks with the second-highest percentage of Hispanics), and 17% of sample households came from the third tertile (blocks with the lowest percentage of Hispanics). The percentage of Hispanics in each tertile varied by community: 0%–48% in the lowest percent-Hispanic group, 1%–79.4% for the middle group, and 24.6%–93.4% for the group with the highest proportion of Hispanic residents. Address lists were purchased from bulk mailing companies and overlaid on Census block maps to identify households. In areas where information was incomplete, project staff went to the community to clarify addresses.

In the six communities with fewer than 160 housing units, all households in the community were surveyed. Within each randomly selected household, one adult was interviewed. Eligibility criteria required respondents to be 18 years of age or older, have lived in the household for at least the past week, and be able to respond to questions. Where two or more eligible adults lived in the household, the first adult to have a birthday after December 31 was selected for the interview.

Survey Procedures

A number of steps were taken to prepare residents for the face-to-face interviews. English and Spanish advertisements were played on the two most popular radio stations in the valley. English and Spanish flyers were placed in high-profile areas in the 20 communities. Letters introducing the study were written in English and Spanish and delivered to each randomly selected household. Letters described the study and gave potential respondents the opportunity to telephone the project office if they had questions.

We used in-person interviewing because many households did not have telephones, education level of the population was low, and many respondents could not read well. Interviews were conducted by 22 bilingual interviewers, whose language proficiency was assessed by asking them to read aloud a section of the questionnaire in English and Spanish. Three training sessions of six hours each were conducted by bilingual project staff. Training addressed strategies for approaching households, methods for asking questions in a standard manner, methods of editing questionnaires, and rules for documenting household contacts and survey dispositions. All interviewers were tested, and only those with adequate language proficiency and demonstrated ability to select respondents and approach households were certified. Interviewing took place between October 1, 1998 and January 31, 1999. Respondents who gave verbal consent to participate were given a small incentive. Prior to survey implementation, the survey and study protocol were reviewed and approved by the institutional review board at the Fred Hutchinson Cancer Research Center (FHCRC).

Quality Control

To ensure the authenticity of survey data, completed surveys were reviewed by project staff. An additional 10% random sample of completed surveys was selected from each interviewer at regular intervals during the interview process. Participants from this group were recontacted and asked to verify that the interviewer had interviewed the respondent listed and that household rostering information was authentic. If information was incorrect and the contacted person reported living in the home when the survey was conducted, questionnaire data were assumed to be erroneous. If an interviewer was consistently found to have problematic survey data, all questionnaires and tracking sheets linked to him were verified, and the survey was readministered when necessary. Three interviewers had problematic data; 46 (2.6%) surveys were readministered.

Instrument

The interview instrument was a 100-item questionnaire that asked about

acculturation, healthcare access, smoking behavior, eating patterns, cancer screening behavior, demographics, and pesticide exposure. The interview generally took 45 minutes to complete and was administered during a single household visit. The acculturation questions are relevant for this study.

We chose not to use an existing acculturation scale for various reasons. First, with the exception of the scales developed by Deyo et al and Marin et al, previous scales were too lengthy to be included in our instrument.[20,21] We chose not to use the scale developed by Deyo et al because it included only questions about language, and previous research has suggested that acculturation is multidimensional.[22] While questions in the scale developed by Marin et al addressed multiple dimensions, some questions were linked to socioeconomic status; eg, questions about language of television programs may assess the presence of cable television, rather than viewing preferences.[21] Second, existing scales would require adaptation to include response categories appropriate for respondents who belong to racial or ethnic groups other than Hispanic. Some scales, such as the Acculturation Rating Scale for Mexican Americans (ARSMA), were developed for self-administration and would have to be adapted for interviewer administration.[23] In a face-to-face interview, the interviewer can establish trust with the respondent, which enhances response rates.

In selecting acculturation questions for our survey, we reviewed previous acculturation scales. Of nine scales designed for Mexican-American adults, all included questions about language ability or preferred language use.[9,20–27] Five scales included questions about the ethnicity of one's peers (ethnic interaction),[9,21–23,25] five scales included questions about preferences for Mexican food, music, or television (cultural heritage).[21–23,26,27] Some scales included sociodemographic factors, such as place of birth, place of growing up, and generation level.[9,24,26]

Items in the acculturation section of our instrument were adapted from the Acculturation Rating Scale for Mexican Americans (ARSMA).[23] The original ARSMA contains 20 questions. The scale differentiates five types of Mexican Americans based on level of acculturation: very Mexican, Mexican-oriented bicultural, "true" biculturals, Anglo-oriented biculturals, and very Anglicized. The dimensions of the scale were language familiarity and usage ("What language do you prefer?"; "What language do you speak?"), ethnic identity and classification ("What ethnic identification does [did] your mother use?"; "What ethnic identification does [did] your father use?"; "How do you identify yourself?"; "Where were you born?"), cultural heritage and ethnic behaviors (In which language, English or Spanish, do you write better?"; "In which language, English or Spanish, do you read better?"; "Where were you raised?"), and ethnic interaction ("What was the ethnic origin of the friends and peers you had as a child from age 6–18?"; "What was the ethnic origin of the friends and peers you had as a child up to age 6?"). The scale was designed to provide reliable acculturation group assignments for both non-clinical and clinic populations (such as psychotics and schizophrenics).

We excluded questions that might be considered sensitive (eg, "Have you ever found it difficult to get a job or a promotion because you are of Mexican descent?").[5] Sensitive questions were thought to risk project acceptance and might have resulted in low survey response rates. Further, we excluded questions that we thought assessed general competence (ie, "Who is the current president of Mexico?"; "Can you identify this picture [Benito Juarez]?"[5]) or that referred to ability to read or write ("Which language do you read better?"; "Which language do you write better?"[5]) because previous studies in the valley indicated that the population is generally of low literacy.

The eight questions we selected made up the first two dimensions in the ARSMA (language familiarity and use and ethnic interaction). Specifically, the two questions asked about the respondent's language used most often: "What language would you say you speak most of the time?" (Spanish, English, other) and "What language do you mostly think in?" (mostly in Spanish, mostly in English, about the same in English and Spanish, mostly in another language, about the same in English and the other language). Three questions asked about ethnic identity of the respondent and his or her parents: "Of the following, how do you most identify yourself?"; "Of the following how does/did you mother identify?"; "Of the following, how does/did your father identify?" Response categories were Mexican, Chicano, Mexican American, Spanish American, Anglo American, American, and other. A final set of questions asked about birthplace: "Where were you born?"; "Where was your mother born?"; "Where was your father born?" Response categories for these questions were Mexico, the United States, and other. The questions we chose are the same as those used in the Hispanic Health and Nutrition Examination Survey (HHANES) to measure acculturation level.[28] Questions were adapted by project staff to allow response categories appropriate for non-Hispanic respondents. Thus, our analysis can be considered a validation for an abbreviated (and slightly modified) version of the original ARSMA scale.

Analysis

Important response categories were identified for the eight variables used to determine acculturation. We excluded responses labeled "Don't know" and "Refused" or those which had any variation of "Other" ("Other," "Mostly in another language," "About the same in English and the other language") as part of the response. Of the eight variables we used to form an acculturation scale, the re-

sponse categories were ordered from low to high acculturation; responses of speaking and thinking in Spanish, identifying as Mexican, and being born in Mexico represented the lowest acculturation response. Principal component analysis (PCA) was used to assess the internal validity of our instrument. Principal component analysis forms linear combinations of the variables to partition the total variance in a set of variables into independent components. The first principal component is the combination of variables that accounts for the greatest amount of overall variation. The second principal component is the combination of variables that is uncorrelated with the first principal component and accounts for the second largest share of the total variance. Later principal components contribute less to the explanation of the total variance. The analysis has as many principal components as variables. To ensure equal weighting among principal components, variables are standardized so that those with a high number of response categories are given a weight proportionate to variables with few response categories.

Many previous studies have used factor analysis to identify items that explain portions of the variance in acculturation assignments.[9,21,23] One scale relied on PCA. We chose to use principal component methods because the low number of questions included in our instrument would render the assessment of factors difficult. Nevertheless, PCA is typically the first step in factor analysis. When factor analysis is performed, the eigenvectors generated during the PCA step are rotated to achieve factor scores. If only one dimension exists, no rotation is required. Hence, our PCA may be considered as a factor analysis if there is a single eigenvector that accounts for most of the variance in the data. We keep only the principal components that have an eigenvalue $\geq$1.00, which means that each principal component retained must account for at least as much variance as any one single variable in the set of acculturation questions. We did not consider using structural equation modeling since no previous acculturation scale known to these authors relied on structural equation modeling, and our analyses had a low number of variables.

We conducted three tests of internal validity with principal components. First, we examined the proportion of total variance explained by the retained principal components. A dominant first principal component that accounts for most of the variance in the set of acculturation questions indicates high internal validity. Second, we examined the eigenvectors. Eigenvector values indicate the relative importance of each item to the total variance. Finally, we examined the correlation of the first principal component for various subsets of the acculturation measures with the first principal component for the entire set of measures. These correlations indicate redundancy among the set of acculturation questions, as well as internal validity. In order to determine the contribution of specific acculturation items to the overall model, we calculated Pearson correlation coefficients comparing the PCA value of individual questions or sets of questions to the PCA value for the full eight-item scale.

Principal component values are only indirectly useful for assigning acculturation levels. A range of principal component scores may represent Hispanics who have the same broad acculturation level. That is, Hispanics of any specific acculturation level may have principal component scores following an acculturation level specific mean and variance. We used normal distribution finite mixture models to determine the number of levels of acculturation and to assign individuals into broad acculturation levels.[29] The finite mixture model finds level-specific means and variances that maximize the likelihood for the observed distribution of first principal component scores.

For 38 observations, one or more acculturation questions were marked on the questionnaire as "other" or "missing." In order to assign an acculturation level for these observations, values for missing variables were assigned the most common value among Mexican Americans with the matching responses to non-"missing" and non-"other" acculturation questions.

To assess the external validity of our instrument, the first principal components from the four- and eight-item analyses were assigned as acculturation scores. We then calculated Pearson correlation coefficients for the acculturation scores with individual demographic characteristics. The characteristics included gender (male, female), number of years of education completed (no school completed, 4th grade or less, 5th–8th grade, 9th grade, 10th grade, 11th grade, 12th grade no diploma, high school graduation or GED, some college but no degree, Associate's degree in college, Bachelor's degree, Master's degree, Doctoral degree [MD, PhD, JD]), annual household income ($\leq$\$5000, \$5001–\$10,000, \$10,001–\$15,000, \$15,001–\$25,000, \$25,001–\$35,000, \$35,001–\$50,000, $>$\$50,000), and years of residence in the Yakima Valley. In addition to the raw correlations of each variable with the acculturation scores, correlations were calculated partialling other demographic characteristics.

In order to assess differences among individuals in the high and low acculturation groups using the four-item scale, frequencies of demographic characteristics were calculated. The characteristics included age (18–24, 25–34, 35–49, 50+), education, household income, gender, years of residence in the Yakima Valley, occupation (unemployed; agricultural, warehouse; service, technical, retail; administration, management; professional; retired; student), marital status (married, living as married; widowed; divorced, separated; never married), and whether the respondent lives year round in the Yakima Valley (yes, no).

Table 2. Eigenvector values for eight-item acculturation scale

Acculturation Items	Eigenvector
Question 1: Language spoken	0.35
Question 2: Language thought	0.36
Question 3: Ethnic identity (self)	0.33
Question 4: Ethnic identity (mother)	0.35
Question 5: Ethnic identity (father)	0.34
Question 6: Birthplace (self)	0.38
Question 7: Birthplace (mother)	0.37
Question 8: Birthplace (father)	0.35

RESULTS

From a sample of 2,862 addresses, 2,345 households were approached for the study. The remaining addresses were vacant buildings (190), organizations (eg, schools, churches, fire stations) (162), nonexistent dwellings (109), and businesses (56). Interviews were completed by 1,795 individuals. There was no answer after five or more visits in 186 households, which yielded a conservative response rate of 76.5. The response rate of the known eligible households (N=2,159) was 83.1%. Of the respondents, 735 (41%) were Hispanic. Other respondents identified themselves as non-Hispanic White (N=954), African American (N=6), Asian American / Pacific Islander (N=9), American Indian (N=79), other (N=5), or values were missing (N=7). Data from 735 Mexican Americans, constituting 40.4% of the total sample, were used in these analyses.

Of Mexican-American respondents, 66.5% completed the interview in Spanish. A large percentage of Mexican-American respondents reported Mexico as their birthplace (63.8%). An additional 18.5% of Mexican Americans reported being born in the United States and having at least one parent born in Mexico. The mean age of the Mexican-American respondents was 39 years, whereas the mean age of the non-Mexican-American White respondents was 52 years. Fifty-four percent of Mexican-American respondents had completed 8 or fewer years of education; 74% of non-Mexican-American Whites had completed 12 or more years of education. Eighty percent of Mexican Americans earned a household income $<$\$25,000; 54% of non-Mexican-American Whites earned $\geq$\$25,000.

The eigenvalues for complete eight-item scale show that a high proportion of the variance is accounted for by the first principal component (data not shown). Component 1 accounts for 66% of the variance in the total model and has an eigenvalue of 5.24. Component 2 accounts for 10% of the variance, but has an eigenvalue $<$1.00. Only the first component is therefore considered meaningful.

Each question in the scale explains an approximately equal proportion of the variance in the first principal component (Table 2). The value of the Cronbach's alpha for the eight items is 0.92 and does not increase with the removal of any item, which indicates that a single scale is being measured. Squared eigenvector values are interpretable as the percent of the variation in the principal component that is attributable to each item. Overall, items range from explaining 11% of the variance (ethnic identity [self]) to 14% of the variance (birthplace [self]).

Correlations of individual and combined acculturation items to the full model showed a trend of higher correlation for combinations of greater numbers of items (Table 3).Language spoken most of the time, by itself, explained 62.4% of the variance of the full model, whereas birthplace, by itself, accounted for 74% of the variance. Only slight increases in correlation values were observed beyond a four-item model that included language spoken most of the time, language thought, respondent's ethnic identity, and respondent's birthplace. From this analysis, a scale containing four items (Q1: language spoken, Q2: language thought, Q3: ethnic identity [self], and Q6: birthplace [self]), accounted for only slightly lower amount of variability than the full model (0.94 vs 1.00).

Table 3. Correlation of individual items and sets of items with full 8-item scale

Acculturation Items	*R**
Q1: Language spoken	0.79
Q6: Birthplace (self)	0.86
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self)	0.92
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self), Q6: Birthplace (self)	0.94
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self), Q4: Ethnic identity (mother), Q5: Ethnic identity (father)	0.97
Q1: Language spoken, Q2: Language thought, Q6: Birthplace (self), Q7: Birthplace (mother), Q8: Birthplace (father)	0.96
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self), Q6: Birthplace (self), Q4: Ethnic identity (mother), Q5: Ethnic identity (father)	0.99
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self), Q6: Birthplace (self), Q7: Birthplace (mother), Q8: Birthplace (father)	0.98
Q1: Language spoken, Q2: Language thought, Q3: Ethnic identity (self), Q6: Birthplace (self), Q4: Ethnic identity (mother), Q5: Ethnic identity (father), Q7: Birthplace (mother), Q8: Birthplace (father)	1.00

Q = question.
* Pearson correlation coefficient.

Table 4. Correlation of acculturation level group assignments using the four-item and eight-time scales*

	Eight-Item Scale			
Four-Item Scale	**Level 1 (low)** ***N*** **(%)**	**Level 2** ***N*** **(%)**	**Level 3** ***N*** **(%)**	**Level 4 (high)** ***N*** **(%)**
Level 1 (low)	391 (53.20)	4 (0.54)	2 (0.27)	0
Level 2	0	55 (7.48)	2 (0.27)	1 (0.14)
Level 3	0	6 (0.82)	50 (6.80)	17 (2.31)
Level 4 (high)	0	0	20 (2.72)	187 (25.44)

* Kappa = .89; weighted kappa = .95.

When we examined individual acculturation level group assignments by using the four- and eight-item scales, we found a high correlation between the full and reduced scale (Kappa=.89) (Table 4). Using a mixture distribution analysis of the first principal component, we identified four levels of acculturation.[29] A total of 391 study participants were assigned the lowest level of acculturation when the eight- and four-item scales were used. Similarly, both the full and reduced scale classified 187 participants in the highest level of acculturation. Fifty-five participants were classified as the second level of acculturation on both the four- and eight-item scales; 50 were assigned the third level of acculturation using both scales. The remaining 52 participants were assigned differing acculturation levels by using the four- and eight-item scales.

Pearson correlation coefficients for the relationship between individual acculturation scores and demographic characteristics varied by characteristic (Table 5). Among the demographic characteristics tested, the highest coefficient was reported for years of school completed, and the coefficient remained high after adjustment for gender, annual household income, and length of residence in the Yakima Valley. A substantial reduction in the correlation coefficient was noted for annual household income after adjustment for gender, years of school completed, and length of residence in the Yakima Valley. Coefficients were similar for the four-item scale as for the eight-item scale.

When we grouped individuals who were assigned the two lowest levels of acculturation and those that were assigned the two highest levels of acculturation, we observed notable differences in demographic characteristics between the two combined groups (data not shown). Specifically, we found that Mexican Americans assigned a low level of acculturation were younger, had completed fewer years of education, had a lower annual household income, and were more likely to report working in agriculture or in a warehouse than Mexican Americans assigned to a high level of acculturation.

DISCUSSION

The findings of our study suggest that the abbreviated four-item scale has nearly as high an internal validity as the original eight items. Internal validity of our four-item scale was demonstrated by a dominant first principal component that was found to account for 66% of the model variance, the relative equal importance of each scale item to the total model variance, and by the high correlation of the principal components for subsets of acculturation measures to the principal component of the entire set of measures. External validity was demonstrated by high Pearson correlation coefficients for demographic characteristics.

The distribution of acculturation level group assignments using the four- and eight-item scales suggests that acculturation measures that assess language used for speaking, language used for thinking, ethnic identification (of self), and birthplace (of self) produce similar group assignments as acculturation scales that also assess self-identification (of parents) and birthplace (of

Table 5. Pearson correlation coefficients of acculturation with demographic characteristics

	Four-Item Scale		Eight-Item Scale	
Characteristic	***R***	**Adjusted *R***	***R***	**Adjusted *R***
Gender*	0.11	0.15	0.12	0.17
Years of school completed†	0.62	0.56	0.59	0.53
Annual household income‡	0.28	0.05	0.28	0.07
Length of residence in Yakima Valley (years)§	0.39	0.38	0.35	0.33

* Adjusted for years of school completed (no school completed, 4th grade or less, 5th–8th grade, 9th grade, 10th grade, 11th grade, 12th grade no diploma, high school graduation or GED, some college but no degree, Associate's degree in college, Bachelor's degree, Master's degree, Doctoral degree [MD, PhD, JD]), annual household income (≤$5000, $5001–$10,000, $10,001–$15,000, $15,001–$25,000, $25,001–$35,000, $35,001–$50,000, >$50,000), and length of residence in the Yakima Valley (number of years).

† Adjusted for gender, annual household income, and length of residence in the Yakima Valley.

‡ Adjusted for gender, years of school completed, and length of residence in the Yakima Valley.

§ Adjusted for gender, years of school completed, and annual household income.

parents). The strong correlation between acculturation level assignments based on the four-item scale and those based on the original eight items is further supported by the high kappa value (.89).

Factor analysis performed on the original ARSMA scale showed that four factors accounted for total model variance.[23] The first factor, "language familiarity and usage," accounted for 64.6% of the total variance in acculturation scores, "ethnic identity and generation" accounted for 18.9%, "cultural heritage" accounted for 11.4%, and "ethnic interaction" accounted for 5.2%. We found a similar distribution of variance in our study sample. Thus, factors that accounted for the largest share of the variance in the original ARSMA were included in our short scale.

The portion of the variance that is explained by each of our scale questions was consistent with that reported by Cuellar et al.[23] While the language factor accounted for nearly 65% of the overall difference in acculturation scores (the model variance) in the ARSMA scale, it accounted for 45% of the model variance in analysis performed by Montgomery and Orozco on the original ARSMA scale. Deyo et al reported that 90% of second-generation Mexican Americans had a working knowledge of English, whereas only 40% of first-generation Mexican Americans had this knowledge.[20] Language preference and use was found to account for 74% of the larger factor labeled Ethnic Loyalty in a study conducted by Padilla et al.[5] Marin et al reported that the language-based factor accounted for about 55% of the total variance in their scale.[21] Olmedo et al found that language accounted for 40% of the total model variance.[24] Similarly, we found that language spoken most of the time was the first principal component and accounted for >62% of the overall variance.

The importance of language in acculturation instruments is likely related to two factors. The first is that changes in language appear to occur more quickly than changes in other acculturation components. Hazuda et al reported that a greater percentage of Mexican Americans were highly acculturated on adult language dimensions than on dimensions involving attitudes or values. Various other studies have reported[21,25] that language change can occur independently of changes in values, attitudes, and beliefs. The second factor is that language proficiency is likely to be positively correlated with demographic factors that may allow greater contact with mainstream society, such as education, income, and occupation. Thus, the ability to speak English may result in greater opportunities for employment and access to health and social services.

Because of the importance of language in acculturation, Deyo et al suggested that a language-based acculturation scale may be useful in studying clinical phenomena, such as doctor-patient interactions and patient compliance.[20] Other authors, however, have discouraged the use of language preference as a proxy for acculturation status in assessing cancer screening behavior because of the strong association of language use and ability with healthcare access or because it measures access to care, rather than changes in cultural values.[30] Hispanics who speak English are reported to have greater access to healthcare services and will score high on language-only acculturation scales. Thus, the strong association between healthcare access and acculturation may obscure the independent effects of these factors on a given health outcome.

Acculturation assignments based on the four-item scale were correlated with certain sociodemographic characteristics, which is consistent with previous studies. Various studies have assessed the relationship between acculturation and level of education. All of the studies have reported higher acculturation scores for greater number of years of education completed.[20,24] Deyo et al, for example, reported a trend of increasing mean years of education with increasing language score category, beginning with an average of 3.7 years associated with the lowest language score up to 13.3 years for the highest language score (of four ordered scores).[20] Olmedo and Padilla also reported an increasing level of education associated with increasing quartile of acculturation.[24]

Previous studies have also reported a high correlation of acculturation with annual household income. Deyo et al reported an increasing trend for higher levels of income associated with higher language scores, beginning with a mean of US$7,800 for those in the group with the lowest language score and US$12,500 for the group with the highest language score.[20] We found that correlation diminished when other demographic factors were adjusted. This result is likely because of the high correlation between years of school completed and annual household income, and the greater precision with which education was recorded (greater number of available response categories). Further, a greater percentage of respondents reported their level of education than household income. Despite difficulties inherent in documenting education among immigrant populations (whose members may have completed years of education in other countries), education is nevertheless likely to be more accurately reported than income.

Because of the strong correlation of acculturation level with years of education completed and with annual household income, some authors have suggested that for certain health behaviors, it is important to distinguish socioeconomic status and education level from acculturation level.[30–32] The rationale is that many previous scales have relied heavily on language use alone as a surrogate measure for acculturation, which may simply measure the effects of education and socioeconomic status on associated behaviors.[30] Nevertheless, education by itself, may not distinguish cer-

tain subgroups, since contact with mainstream culture can occur in occupational or other settings.

The relationship between gender and level of acculturation also has been examined in a limited number of previous studies. Burnam et al and Szapocznick et al reported a higher mean acculturation score for men than for women and suggested that the difference may be a result of greater employment and educational opportunities available for males.[9] Marin et al found no significant differences in acculturation scores between males and females.[21] This finding was consistent with the work of Montgomery and Orozco.[33] Our observation of slightly higher acculturation score for females is inconsistent with previous findings and may be related to the high number of unmarried foreign-born males who are drawn to the valley to find work in agriculture, which suggests more generally that the findings may depend on specific characteristics of the Hispanic population.

Our scale minimizes important limitations of previously developed scales. Most previous instruments are lengthy and produce high respondent burden. Five of the acculturation scales reviewed contain 20 or more questions. [9,23–26] The extra burden may be particularly problematic in studies that require long questionnaires to assess other complex constructs or many variables. Shorter adaptations of these scales have been used widely in health research among Hispanics.[12,28] Typically, however, the psychometric qualities of these versions are unknown. Some previous scales require psychological judgments or include questions that are potentially threatening.

Other studies, with the exception of scales developed by Padilla,[5] Deyo[20] (language-only scale), and Burnam,[9] have relied on study participants who are college or university students or are convenience sampled. College and university students may display limited ranges of acculturation dimensions; most speak English as a requirement of admissions, and may represent the upper range of socioeconomic status. Convenience sampling may exclude participants who are less acculturated (as they may be less familiar with research studies and may more likely be illiterate). Testing the reliability of a scale is important in populations that vary in age, socioeconomic status, education, and cultural experiences. This study sample largely comprised Hispanics who originated from Mexico and were from the same Hispanic population subgroup. Further, data were collected by using random sampling techniques at the population level.

Some limitations of this study also should be considered. The relatively low number of survey questions related to acculturation limited our ability to compare our questions with previous scales or to evaluate certain acculturation constructs. Constructs that assess adherence to traditional Mexican family values, for example, were omitted from our scale, even though they have been documented in previous research as important in predicting use of cancer screening services.[30] Questions chosen for our study, by and large, arguably fail to assess factors related to one's interest or willingness to adopt mainstream customs. Padilla argues that the freedom of choice in acculturation is often overlooked in acculturation research.[5] Factors such as personal preference for one cultural orientation over the other (ethnic loyalty), as demonstrated by the choice of ethnic identification and the ethnic identity of friends and cultural awareness, may better tap the individual motivation to adopt customs and values.

Another limitation is the inability of our instrument to assess acculturation in subgroups of Hispanics other than Mexican Americans. In particular, our question about ethnic identity is tailored specifically to the Mexican-American population. Further, the use of different terminology in different geographic regions to define "Hispanics" may limit assessments of Hispanics in other areas.

Understanding and characterizing the process of cultural change is essential to the conduct of culturally relevant health intervention in the Hispanic community.

Another potential limitation of our study is that the two-culture matrix model cannot be evaluated with our data. Such a model has been developed and tested by Cuellar et al and was published in 1995.[22] It measures Mexican and Anglo orientation by using two independent axes and assesses four modes of acculturation: integration, assimilation, separation, and marginalization. The model defines biculturals who score high on orientation toward Hispanic culture and toward mainstream culture. Similarly, the model defines persons who score low on orientation toward each culture. Thus, the model is based on the assumption that gaining and losing traits from one culture is unrelated to gaining or losing traits from another culture. Some authors, however, argue that this assessment method is confounded by general competency and social involvement. Others argue that the scale is lengthy and produces a high respondent burden and that there are statistical limitations to using four categories to define acculturation level. Thus, in order to describe the general process of acculturation in a population, the matrix model offers various advantages. However, when only a crude assessment of acculturation is needed, complex statistical analysis of other variables that may be related to acculturation is required, or where instrument length may reduce response rates, a shorter scale, such as ours, may be advantageous.

CONCLUSION

Various studies have shown that cultural factors play an important role in health decisions. Understanding and characterizing the process of cultural change is essential to the conduct of culturally relevant health intervention in the Hispanic community. Knowledge of the differences between groups is thought to be important for the design and implementation of health interventions in this population.[31,34] Future studies should compare this scale with other multidimensional scales and should evaluate this scale on populations in other geographic areas.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Coronado, Thompson, McLerran, Koepsell
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Acquisition of funding: Thompson
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REFERENCES

1. US Census Bureau. *Differences in Population by Race and Hispanic or Latino Origin, for the United States: 1990 to 2000.* (Table 4). Washington, DC: Bureau of the Census; 2000.
2. US Census Bureau. *Population by Race and Hispanic or Latino Origin, for All Ages and for 18 Years and Over, for the United States: 2000.* Table 1. Washington, DC: Bureau of the Census; 2000.
3. US Census Bureau. *Coming from the Americas: A Profile of the Nation's Latino American Foreign Born (2000 update).* Washington, DC: Bureau of the Census; 2000.
4. Suárez-Orozco MM. Introduction: crossings: Mexican immigration in interdisciplinary perspective. In: Suárez-Orozco MM, ed. *Crossings: Mexican Immigration in Interdisciplinary Perspective.* Cambridge, Mass: Harvard University Press; 1998:3–50.
5. Padilla AM, ed. *Acculturation, Theory, Models, and Some New Findings.* Boulder, Colo: Westview Press for the American Association for the Advancement of Science; 1980.
6. Menck H, Henderson B, Pike M, et al. Cancer incidence in the Mexican American. *J Natl Cancer Inst.* 1975;55(3):531–536.
7. Crespo CJ, Smit E, Carter-Pokras O, et al. Acculturation and leisure-time physical inactivity in Mexican-American adults: results from NHANES III, 1988–1994. *Am J Public Health.* 2001;91(8):1254–1257.
8. Arcia E, Skinner M, Bailey D, et al. Models of acculturation and health behaviors among Latino immigrants to the US. *Soc Sci Med.* 2001;53(1):41–53.
9. Burnam MA, Telles CA, Hough RL, et al. Measurement of acculturation in a community population of Mexican Americans. *Hisp J Behav Sci.* 1987;9(2):105–130.
10. Otero-Sabogal R, Sabogal F, Perez-Stable EJ. Psychosocial correlates of smoking among immigrant Latina adolescents. *J Natl Cancer Inst Monogr.* 1995;18:65–71.
11. Solis JM, Marks G, Garcia M, et al. Acculturation, access to care, and use of preventive services by Hispanics: findings from HHANES 1982–84. *Am J Public Health.* 1990; 80(suppl):11–19.
12. Harmon MP, Castro FG, Coe K. Acculturation and cervical cancer: knowledge, beliefs, and behaviors of Hispanic women. *Women Health.* 1996;24(3):37–57.
13. Mendoza R. Acculturation and socio-cultural variability. In: Mendoza R, Martinez JL, eds. *Chicano Psychology.* New York, NY: Academic Press; 1984:61–75.
14. Garza RT, Gallegos PI. Environmental influences and personal choice: a humanistic perspective on acculturation. In: Padilla A, ed. *Hispanic Psychology: Critical Issues in Theory and Research.* Thousand Oaks, Calif. Sage Publications, Inc; 1995:3–14.
15. Suarez L, Lloyd L, Weiss N, et al. Effect of social networks on cancer-screening behavior of older Mexican-American women. *J Natl Cancer Inst.* 1994;86(10):775–779.
16. US Department of Commerce. *1990 Census of Population and Housing, Yakima, Washington, USA.* Washington, DC: Bureau of the Census; 1995.
17. US Bureau of the Census. *Detailed Tables: Yakima County, Washington.* Washington, DC: US Census Bureau, American Fact Finder; 2002.
18. Gamboa E. *Mexican Labor and World War II: Braceros in the Pacific Northwest, 1942–1947.* 1st ed. Austin, Tex: University of Texas Press; 1990.
19. Thompson B, Coronado GD, Solomon CC, et al. Cancer prevention behaviors and socioeconomic status among Hispanics and non-Hispanic Whites in a rural population in the United States. *Cancer Causes Control.* 2002; 13(8):719–728.
20. Deyo RA, Diehl AK, Hazuda H, et al. A simple language-based acculturation scale for Mexican Americans: validation and application to healthcare research. *Am J Public Health.* 1985;75(1):51–55.
21. Marin G, Sabogal F, Marin BV, et al. Development of a short acculturation scale for Hispanics. *Hispanic J Behav Sci.* 1987;9(2):183–205.
22. Cuellar I, Arnold B, Maldonado R. Acculturation Rating Scale for Mexican Americans-II: a revision of the original ARSMA scale. *Hispanic J Behav Sci.* 1995;17(3):275–304.
23. Cuellar I, Harris LC, Jazzo R. An acculturation scale for Mexican-American normal and clinical populations. *Hispanic J Behav Sci.* 1980;2(3):199–217.
24. Olmedo EL, Padilla AM. Empirical and construct validation of a measure of acculturation for Mexican Americans. *J Soc Psychol.* 1978; 105:179–187.
25. Hazuda HP, Stern MP, Haffner SM. Acculturation and assimilation among Mexican Americans: scales and population-based data. *Soc Sci Q.* 1988;69:687–706.
26. Ramirez MI. Assessing and understanding biculturalism-multiculturalism in Mexican-American adults. In: Mendoza R, Martinez JL, eds. *Chicano Psychology.* New York, NY: Academic Press; 1984:77–94.
27. Marin G, Gamba RJ. A new measurement of acculturation for Hispanics: The Bi-dimensional Acculturation Scale for Hispanics (BAS). *Hispanic J Behav Sci.* 1996;18(3):297–316.
28. Delgado JL, Johnson CL, Roy I, et al. Hispanic Health and Nutrition Examination Survey: methodological considerations. *Am J Public Health.* 1990;80(suppl):6–10.
29. Qu P, Qu Y. A Bayesian approach to finite mixture models in bioassay via data augmentation and Gibbs sampling and its application to insecticide resistance. *Biometrics.* 2000; 56(4):1249–1255.
30. Suarez L, Pulley L. Comparing acculturation scales and their relationship to cancer screening among older Mexican-American women. *J Natl Cancer Inst Monogr.* 1995;18:41–47.
31. Negy C, Woods DJ. The importance of acculturation in understanding research with Hispanic Americans. *Hispanic J Behav Sci.* 1992;14(2):224–247.
32. Negy C, Woods DJ. A note of the relationship between acculturation and socioeconomic status. *Hispanic J Behav Sci.* 1992;14(2): 248–251.
33. Montgomery G, Orozco S. Validation of a measure of acculturation for Mexican Americans. *Hispanic J Behav Sci.* 1984;6:53–63.
34. Flores ET, Castro FG, Fernandez-Esquer ME. Social theory, social action, and intervention research: implications for cancer prevention among Latinos. *J Natl Cancer Inst Monogr.* 1995;18:101–108.