

## Acculturation and Health Beliefs of Mexican Americans Regarding Tuberculosis Prevention

Dolores I. Rodríguez-Reimann,<sup>1,5</sup> Perry Nicassio,<sup>2</sup> Joachim O. F. Reimann,<sup>1</sup> Plácida I. Gallegos,<sup>3</sup> and Esteban L. Olmedo<sup>4</sup>

---

Mexican Americans are at particular risk of contracting tuberculosis. Yet too little is known about perceptions influencing their health. This study investigated gender and acculturation differences in TB-specific Health Belief Model (HBM) constructs, and the applicability of the HBM's traditional configuration to Mexican Americans. Acculturation and gender substantially influenced the findings. Traditional Mexican Americans reported higher perceived susceptibility and seriousness, more barriers, and greater attention to cues regarding TB prevention than Highly Integrated Biculturals. Women reported greater benefits, attention to cues, and intent to engage in TB prevention behaviors than men. Highly Integrated Bicultural men reported less attention to cues and less intent to engage in health behaviors than other groups. The traditional HBM configuration did not fit this sample. Reconfiguration did, however, result in adequate fit. Overall, higher perceived susceptibility, action benefits, attention to media cues, and female gender predicted greater intent to engage in TB health behaviors.

---

**KEY WORDS:** tuberculosis; acculturation; Mexican Americans; gender; health beliefs.

### INTRODUCTION

Tuberculosis (TB), once thought to be largely conquered, reemerged at significant rates in the mid-1980s (1, 2). From 1985 to 1992 alone, TB cases in the United States rose by 18% (3). While overall U.S. TB incidents again declined after 1993, they have only plateaued at around 7500 cases per year among foreign-born individuals (4).

These trends suggest TB rates are partially driven by immigration from developing countries such as

Mexico that have greater infection rates than found in the United States (5). The Centers for Disease Control and Prevention (CDC) reported that in 1999, Mexico was the country of origin for 23% of all foreign born persons with TB (6). Mexican Americans residing along the United States–Mexico border are at particular risk. The CDC indicates that three fourths of all reported TB cases among Mexican Americans occur in one of the four U.S. States bordering Mexico. Overall, Mexican Americans living in the border region experience higher TB rates than Latinos in other areas or the general population. In California's San Diego County, for example, 1999 TB rates (per 100,000 population) were estimated at 23.5 for Mexican Americans compared to 10.3 for the County's overall population and 12.9 for California's Latinos in general (6).

Disproportionately high Mexican American TB rates probably result from a combination of factors including substantial cross-border traffic, a presumed source of exposure (7) and frequently low socioeconomic status (8) which is assumed to increase

---

<sup>1</sup>Center for Behavioral & Community Health Studies, Graduate School of Public Health, San Diego State University, San Diego, California.

<sup>2</sup>Alliant International University, San Diego, California.

<sup>3</sup>Southwest Communication Resources, Inc., San Diego, California.

<sup>4</sup>Rowland Heights, California.

<sup>5</sup>Correspondence should be directed to Dolores I. Rodríguez-Reimann, Center for Behavioral & Community Health Studies, Graduate School of Public Health, San Diego State University, 9245 Sky Park Court, Suite 110, San Diego, California 92123; e-mail: dreimann@projects.sdsu.edu.

susceptibility. Even those who do not regularly commute between the United States and Mexico may be affected through contact with others in the Latino community who make such trips (9). Underidentification of TB cases also compounds the problem. Those lacking immigration documents are, for example, not screened on U.S. entry and may not seek health services for fear of deportation (6).

Tuberculosis is further increased and complicated by the emergence of drug-resistant bacteria that, at best, lengthen the disease's course (raising the likelihood of its exposure to others) and, at worst, render it untreatable (10). Mexican Americans are especially impacted by this circumstance as well. A disproportionately high incidence of drug resistant TB has been noted in U.S. regions bordering Mexico (11). In addition, foreign-born Latinos, and those with frequent cross-border contacts, are at particular risk of contracting such strains (12, 13).

Drug resistant bacteria are a natural consequence of evolution. But such evolution is hastened by incomplete medical treatment due to healthcare access barriers, errors in prescribing, and/or limitations in patient treatment follow-through. In part, unpleasant medication side effects and lengthy/complex regimens contribute to problems with TB care (14). Conflicting cultural expectations, language barriers, limited cross-border coordination, and some providers' lack of cultural competence further stifle healthcare effectiveness among culturally distinct groups including Mexican Americans (15–17, 6).

Current population trends make effective TB prevention and control increasingly essential. At almost 13%, Latinos constitute the largest and fastest growing ethnic group in many parts of the United States (18). If recent trends continue, much of this growth is likely to come through immigration (19, 20). With almost 60%, Mexican Americans comprise by far the largest U.S. Latino group (18).

To address TB prevention and care among Mexican Americans, we must understand factors coloring their perceptions about the illness. In this context, a simple awareness of ethnic group-level characteristics has limited utility because it provides an overly simplistic picture. Rather, our efforts must be grounded in understanding the groups' heterogeneity, variations that are often greater than the differences between ethnic groups (21). Among Mexican Americans, acculturation and gender serve as two dimensions through which such heterogeneity can be partially explored.

## Acculturation

Acculturation is a complex set of intercultural interactions through which persons 1) do or do not acquire the customs of another culture and 2) do or do not retain norms held by their culture of origin (22). Numerous elements including language use, generational status, pattern of associations, preferences for food and media sources, and SES have been used to assess acculturation (23). While language use is a particularly strong acculturation indicator for Mexican Americans, no single factor provides a complete picture of individuals within the group or predicts beliefs and practices across all situations (24).

The literature has linked acculturation with both negative and positive health factors among Latinos. Lower acculturation has, for example, been associated with better dietary practices (25), less heart disease (26), and less marijuana, cocaine, and alcohol use (27–29). Conversely, higher acculturation has been associated with more knowledge about Pap smears and greater utilization of cervical cancer screening services among Latino women (30). Overall, such results suggest that acculturation reduces barriers to healthcare information and access (31, 32) but also erodes some cultural attitudes and practices that facilitate positive health outcomes (33).

To our knowledge, only one prior study has considered relationships between acculturation and TB control. An investigation of TB treatment adherence among Latino adolescents (34) found mixed results. While those with higher linguistic acculturation reported greater treatment-related self-efficacy, less acculturated respondents reported more support from parents. Ultimately, a high portion of those completing treatment described their parents as helping them remember to take TB medications. In short, familial support played a major role in successful treatment adherence.

One factor limiting past studies is that acculturation was often measured as a "linear" construct. Such an approach presumes that individuals automatically lose orientation toward their culture of origin as they acquire host culture skills and orientations (e.g., language, familiarity with common practices). Yet acculturation is not necessarily synonymous with assimilation (35). Rather, acculturation strategies include those in which individuals gain competence in the workings of another culture without negating identification with their ethnicity or culture of origin, as well as those in which individuals become alienated from both cultures (36). Methods and measures must

thus allow one to consider how various acculturation strategies, including biculturalism, impact health-related attitudes and behaviors.

### Gender

Positive relationships between social support and health behaviors have been frequently discussed in the literature (37). Social support includes the benefits of feeling valued (e.g., facilitating self-efficacy) as well as belonging to a network in which people have mutual obligations (thus, e.g., increasing access to tangible resources). Many authors report that, on average, Mexican Americans place particularly strong emphasis on attachments to family and gender roles (38–41).

Such roles can facilitate health behaviors. Women, for example, often assume caretaker and health liaison responsibilities for their family (42). Overall, Higgins and Learn (43) concluded that Latinas tend to be reasonably well-versed in the contemporary lay health literature and sometimes take better care of their families than of themselves. To our knowledge, no study has, however, investigated how such factors impact tuberculosis-specific prevention and treatment issues.

Research on the relationship between gender, family roles, and acculturation is also sparse. Sabogal *et al.* (44) reported that, while Latinos continue to espouse a strong identification with family throughout the acculturation process, willingness to shoulder family obligations tends to erode with acculturation. Other research suggests that gender roles become less traditional with acculturation (45). Again, how such factors may impact TB prevention is unknown.

### The Health Belief Model

The above discussion highlights our need to gain a clearer theoretical understanding of elements coloring perceptions about TB. One postulated approach is the Health Belief Model (HBM). Reflective of Hochbaum's early research (46) on sociobehavioral predictors of TB X-ray screening, originally presented by Rosenstock (47), and later modified by Becker and Maiman (48), the HBM provides a framework that attempts to explain health behaviors.

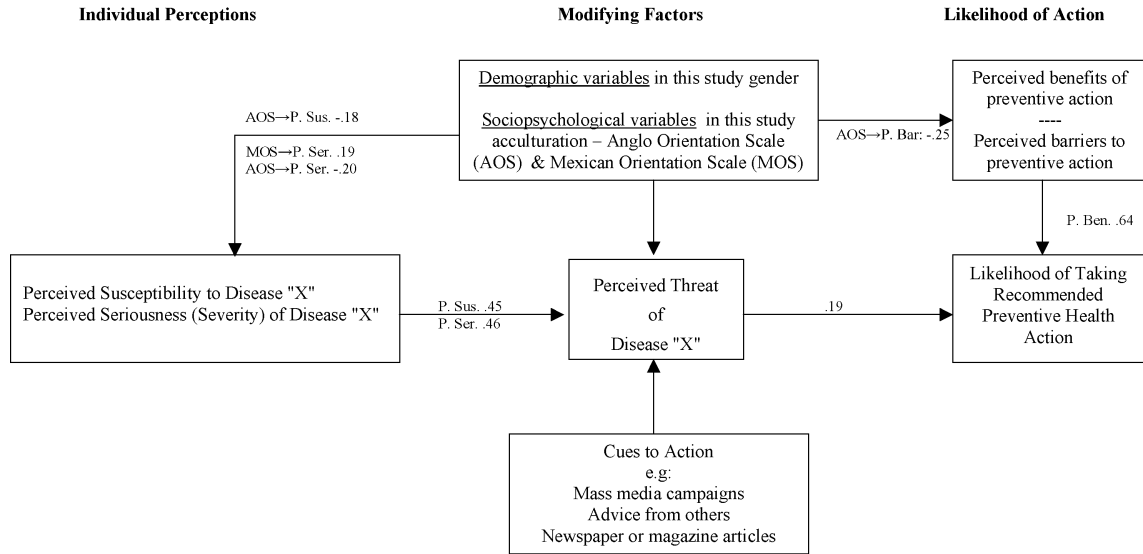
In 1956 Hochbaum (46) introduced the notion that three principal factors predict who participates in TB X-ray screening. The first was the individual's

personal conviction that he/she could really contract TB. Second was the person's conviction that he/she might have TB without being aware of it. The third factor was an individual's belief that early detection of tuberculosis would decrease problems and worries should he or she ever encounter the disease. Hochbaum found that these factors cut across socioeconomic classes, gender, and age categories. He further reported that people who scored higher on a belief that they might contract TB, those who did not rely solely on symptoms as a stimulus for seeking X-rays, and those who scored higher on perceived benefits of early detection were more likely to obtain X-rays voluntarily.

These basic premises are reflected in the HBM. Health behavior, or behavioral intent, is understood as resulting from the combination of attitudes related to five principal concepts: perceived susceptibility, perceived seriousness, perceived threat, perceived care benefits, and perceived care barriers. These concepts have been tested individually and in combination as predictors of health-related behaviors. Studies utilizing HBM dimensions have generally provided support for consistent although modest associations between included attitudes and treatment adherence (49).

In 1975 Becker and Maiman (48) expanded the HBM by adding several dimensions. The first is cues to action. This factor seeks to capture the attention to, and influence of environmental stimuli. It includes many social marketing elements (e.g., fliers, pamphlets, radio/television informational spots). Secondly, the impact of modifying factors such as social support and demographic variables (ethnicity, gender, and age) were added. Becker and Maiman also postulated the HBM as a complex set of direct and indirect relationships. Perceived seriousness of, and susceptibility to a disease are, for example, hypothesized to predict perceived threat. Perceived threat, in turn is assumed to predict likelihood of taking health action. Thus a set of independent variables is not simply assumed to predict one criterion variable. The full model is presented in Fig. 1.

To date, few studies have reported the HBM's applicability to culturally distinct populations including Mexican Americans. In their review of the literature, Austin *et al.* (50) concluded that, on average, breast and cervical cancer screening is predicted by Latino women's fear of cancer (leading them to avoid the issues), disbelief in their susceptibility (e.g., belief that screening is not needed), fatalism (e.g., belief that cancer is not curable), and limited English speaking



**Fig. 1.** The health belief model as specified by Becker and Maiman. [ $\chi^2$  Goodness of fit index (18 df) = 375,  $p < 0.0001$ ; AGFI = 0.05]. Numeral on path =  $\beta$ ; only  $p < 0.05$  paths identified (all others nonsignificant). Original HBM configuration adapted and printed with permission from: "Sociobehavioral determinants of compliance with health and medical care recommendations" by MH Becker and LA Maiman, 1975, *Medical Care*, 13,12. Copyright by Lippincott, Williams & Wilkins.

ability. This study is, however, substantially restricted in that it does not consider institutional barriers to care.

Another study investigating structural HBM paths among Mexican Americans, African Americans, and non-Latino Whites supported the viability of some HBM constructs across populations (51). But they also indicated that such constructs interrelate differently for men and women.

Several methodological and theoretical problems with the HBM have consistently appeared. They include operational definitions that vary greatly from one study to another (49), questionable measure reliability and validity, and a lack of statistical analyses that evaluate the entire model structure (52). Another criticism is that, although the expanded model proposed by Becker and Maiman includes modifying factors, it still fails to adequately take the central role of personal, family, community, and other environmental situations into account (53). Finally, rational belief models such as the HBM are criticized for focusing exclusively on conscious decisions, while ignoring many of the automatic and unconscious behaviors that people engage in (54).

While such criticisms have led some to dismiss the HBM as obsolete, it has yet to undergo adequate empirical evaluation warranting a conclusive decision about its value. Even if the HBM fails to consider all relevant variables, it probably pinpoints factors that are important to consider in understanding health-

related decisions. In addition, modifications made by Becker and Mairnan (48) have not been adequately investigated (49). Finally, current studies have not yet provided clear evidence establishing the HBM's level of applicability across different ethnic groups and illnesses. A comprehensive structural evaluation of the HBM with Mexican Americans thus appears important.

This study investigated relationship between gender, acculturation, and HBM dimensions as applicable to TB prevention among high-risk Mexican Americans. It centered on adult family members of persons who have had a positive TB skin test. Tuberculosis' spread through frequent and prolonged contact makes preventative efforts on the part of these individuals especially important (55). Specific research aims were to 1) investigate gender and acculturation differences in the how strongly persons endorse HBM components (e.g., agree that TB is a serious disease) and 2) empirically test Becker and Maiman's proposed HBM configuration (48), with gender and acculturation as modifying factors.

## METHODS

### Participants and Procedures

Present findings are based on a cross-sectional survey of 166 adult Mexican Americans residing in greater San Diego, California's South Bay region, an

area directly adjacent to the United States–Mexico border. Participants were identified in conjunction with initial phases of a community clinic-based TB control project. A total of 402 families with Spanish given and/or surnames and with one member whose skin test (provided by the TB control project) had been positive were identified. In most circumstances it was not yet known whether results implied latent or active TB. Invitational fliers asked one adult relative residing with the family, who identified as of Mexican birth or descent, who had no prior TB history, and who had not had a skin test in the last year, to participate. No other inclusion or exclusion criteria were applied.

Subsequently 166 (41%) adults volunteered. They completed a pencil-and-paper tuberculosis health belief questionnaire, an acculturation scale, and a set of demographic questions in one session. Participants had the choice to complete all measures in English or Spanish. A fully bilingual and bicultural investigator was available to read/clarify items, answer questions, and generally facilitate the process.

## Measures

The cross-sectional self-report protocol included elements measuring acculturation, TB-specific HBM components (perceived TB seriousness, susceptibility, etc.), and intent to engage in TB preventative behaviors. In addition, it asked demographic questions including age, gender, ethnicity, education, marital status, number of persons living in household, and personal TB history (skin test, prior or current TB diagnosis, and/or treatment). HBM and acculturation measures were as follows:

### *Tuberculosis Health Belief Questionnaire*

Given that no TB-specific instrument assessing HBM components among Mexican Americans existed at the time of this effort, the investigators developed such a measure. Some items were adapted from Champion's questionnaire (52). Five Latino experts in behavioral sciences and tuberculosis wrote additional items and reviewed the entire measure for content validity and cultural acceptability.

The resulting instrument consisted of subscales assessing TB-specific perceived susceptibility, seriousness, threat, benefits of taking action, barriers to such action, attention to action cues, and intent to engage

in TB prevention/control behaviors. Examples of specific subscale items are: "My chances of contracting tuberculosis are great"—susceptibility; "If I get tuberculosis I might die"—seriousness; "If I had tuberculosis, my whole life would change for the worse"—threat; "Having a skin test for tuberculosis would prevent future problems for me"—benefits; "It costs too much money for me to get health care services"—barriers; "I would read a brochure on tuberculosis"—action cues; and "I intend to get a medical check-up within the next 6 months"—intent to engage in prevention/control behaviors. All items were presented in a Likert scale format ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

We then determined if items fit intended subscales through two experts who had not been involved in other aspects of instrument development. These experts matched survey items to provided HBM component definitions. Cohen's kappa assessing interrater agreement was 0.81. Items on which no clear agreement could be reached were dropped or rewritten.

Finally, a Spanish-language version was developed using standard backtranslation techniques (39). A pilot convenience sample of 58 Mexican American adults recruited through a local clinic (55%) and the community phone directory (45%) then completed the questionnaire in one proctored session and was given the opportunity to comment on its content and clarity. Twenty-eight (48%) chose to take the survey in Spanish while 30 (52%) chose the English version. Internal consistency was calculated for each subscale. Cronbach's alpha levels ranged from .92 (perceived barriers) to .72 (perceived benefits). Separate alpha levels, calculated for each scale in the English and Spanish versions, indicated that they were comparable.

### *The Acculturation Scale for Mexican Americans-II (ARSMA-II)*

The ARSMA-II (36) assessed acculturation strategies through orthogonal "Mexican Orientation" (MOS) and "Anglo Orientation" (AOS) scales. These scales measured language, ethnic identification, and ethnic interaction or distance through 13 AOS and 17 MOS items. Respondents could answer items in English or Spanish. MOS and AOS total scores were treated independently for one, and used to classify respondents into "highly integrated bicultural," "traditional," "low integrated bicultural," and "assimilated" categories for another subsequent set of

analyses (see Cuéllar (36) for specific typing criteria and procedures).

Prior research has demonstrated the ARSMA-II's validity in relation to generational status as well as cultural lifestyle and identity measures (36, 56). These studies also support MOS and AOS test-retest reliability (0.94 to 0.96) and internal consistency (with alphas ranging from 0.83 to 0.88). The present sample yielded alphas of 0.90 for the MOS and 0.92 for the AOS.

### Statistical Analyses

The first set of analyses focused on data preparation and measure reliability. In this process data accuracy and distributional checks were conducted. The ARSMA-II's and TB Health Belief Questionnaire's reliability were also assessed by calculating Cronbach's alphas. In preparation for subsequent analyses, we then grouped respondents into the ARSMA-II's "Traditional Mexican," "Highly Integrated Bicultural," "Assimilated," and "Low Integrated Bicultural" typology. Only the first two categories yielded adequate samples for further analyses.

Descriptive statistics, using parametric and nonparametric techniques as appropriate, subsequently provided a basic response overview. To identify variables that, left uncontrolled, could confound later analyses, we also checked 1) gender and acculturation groups for demographic equivalence and 2) correlations between demographics (age, education, marital status, and number of persons living in household) and HBM components. Demographics that were both significantly unequal across gender and/or acculturation groups and correlated to one or more HBM components were labeled potential confounds.

Two sets of primary analyses were then conducted. The first investigated gender and acculturation differences in how strongly respondents endorsed HBM components. A factorial MANCOVA first assessed gender/acculturation main and interaction effects using Wilks's Lambda, an omnibus statistic. A set of univariate *F* tests then checked for specific gender and acculturation group differences on individual HBM constructs. Education was the covariate in MANCOVA-related analyses because it had been identified as a potential confound through the previously described sequence of checks. All of the above statistics were calculated using SPSS software.

The second set of analyses, using LISREL 8 software, conducted structural modeling (path anal-

ysis) to test the HBM as specified by Becker and Maiman (48). Since we included Mexican and Anglo Orientation Scales as independent scores, the entire sample of 166 was used in these analyses. Modeling 1) tested direct and indirect predictive relationships between Anglo Orientation, Mexican Orientation, gender, and HBM components through a set of regression equations and 2) examined overall model fit. Structural modeling often employs multiple observed indicators to calculate latent constructs. But it is also advantageous when single indicators from multiple-item scales with reasonable internal consistency, as was the case here, are used. This method facilitated simultaneous analysis of specified relationships among all variables, thus evaluating overall model appropriateness (57).

Model fit was primarily checked using the chi-square ( $\chi^2$ ) goodness of fit test. Somewhat misnamed, chi-square actually tests "badness of fit" since it assesses magnitude of discrepancy between the sample and a fitted covariance matrix. Unlike most conventional statistics, nonsignificant results ( $p > 0.05$ ) thus indicate model adequacy. Since the  $\chi^2$  test is susceptible to sample size and model complexity, the Adjusted Goodness of Fit Index (AGFI) provided a supplemental fit statistic that controlled for these factors. AGFI values of 0.90 or higher indicate an acceptable fit (58, 59). Individual regression equations embedded in the model yielded overall (e.g.,  $R^2$ ) and specific variable (e.g.,  $\beta$ ) estimates by which they could be evaluated.

Initial results guided model revision. Jöreskog and Sörbom (57) note that such an approach is generally more fruitful than one that strictly accepts or rejects an initially specified pattern of relationships. We followed their recommendations that model revision include evaluation of 1) regression estimates to identify nonsignificant values 2) modification indices that suggest fit improvement, and 3) "real-world" plausibility of the reconfigured relationships.

## RESULTS

The study's sample of 166 Mexican Americans ranged in age from 18 to 65 years ( $M = 30.4$ ). Seventy-eight (47%) were men and 88 (53%) were women. A majority of the respondents (56%) described themselves as first generation immigrants. Of the remaining 44%, the generational spread was: 24.1% second generation, 7.8% third generation, 8.4% fourth generation, and 3.6% fifth generation U.S. born individuals.

The total number of persons living in participants' households ranged from 2 to 9 with a mean of 4. A great majority (72%) reported an annual income of under \$20,000. In addition, 26% indicated they had completed 9th grade or less, while only 4% were college graduates. Forty-seven% said they had been primarily educated in Mexico. Among respondents, 92 (55%) elected to complete measures in Spanish while 74 (45%) completed them in English.

The sample's classification into ARSMA-II's multidimensional typology yielded the following results. A total of 49% (42 men and 39 women) were classified as "Traditional Mexican," and 29% (23 men and 25 women) were classified as "Highly Integrated Biculturals." Only 4% could be classified as "assimilated" and the remaining 18% were undifferentiated and could not be classified using Cuéllar's system. No individual in the sample fell into the "low integrated bicultural" (Marginal) category.

Given these sample limits, a factorial MANCOVA ( $N = 129$ ) investigated if men, women, "Traditional Mexicans," and "Highly Integrated Biculturals" endorsed HBM constructs to different degrees. Education was controlled as the covariate because Kruskal-Wallis Analysis by Ranks revealed that Highly Integrated Biculturals tended to be significantly more educated than Traditional Mexicans

[ $H(2, N = 129) = 23.53, p < 0.001$ ] and significant Spearman rank order correlations between education and perceived seriousness ( $\rho = -0.21, p = 0.006$ ), threat ( $\rho = -0.19, p = 0.01$ ), and barriers ( $\rho = -0.23, p = 0.002$ ) were noted. The overall MANCOVA was significant for acculturation main effects [ $\lambda = 0.81$ , equivalent  $F(7, 118) = 3.95, p = 0.001$ ], gender main effects [ $\lambda = 0.76$ , equivalent  $F(7, 118) = 5.35, p < 0.0001$ ], and the interaction between acculturation and gender [ $\lambda = 0.86$ , equivalent  $F(7, 118) = 2.66, p = 0.013$ ].

Results from subsequent univariate  $F$  tests checking specific differences between groups on HBM constructs are presented in Table I. Those classified as having a traditional Mexican orientation tended to perceive themselves as more susceptible to TB [ $F(1, 124) = 6.73, p = 0.01$ ], reported it as a more serious disease [ $F(1, 124) = 7.15, p = 0.009$ ], perceived greater barriers to taking health care actions [ $F(1, 124) = 8.90, p = 0.003$ ], and said they would attend more to action cues than those classified as highly integrated bicultural [ $F(1, 124) = 7.17, p = 0.008$ ].

On average, women reported perceiving more benefits to health care actions [ $F(1, 124) = 8.76, p = 0.004$ ], a greater willingness to attend to TB-related cues (such as newspaper articles and radio and TV spots) [ $F(1, 124) = 13.42, p < 0.001$ ] and greater

**Table I.** Differences Across Acculturation and Gender on HBM Components

HBM component	Acculturation	Gender	Gender × acculturation
Perceived susceptibility	Lower acculturation = Higher perceived susceptibility*	(ns)	(ns)
Perceived seriousness	Lower acculturation = Higher perceived seriousness**	(ns)	(ns)
Perceived threat	(ns)	(ns)	(ns)
Perceived benefits	(ns)	Women perceive greater benefits than men**	(ns)
Perceived barriers	Lower acculturation = Greater perceived barriers**	(ns)	(ns)
Cues to action	Lower acculturation = Greater attention to cues**	Women attend more to Cues than men***	Highly acculturated men attend least to Cues*
Intent to engage in TB prevention and control behavior	(ns)	Women more intent than men***	Highly acculturated men report least intent***

Note.  $N = 129$ .

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

intent to engage in health care actions than men [ $F(1, 124) = 30.57, p < 0.0001$ ]. Finally, Highly Integrated Bicultural men reported the lowest attention to action cues [ $F(1, 124) = 4.45, p = 0.03$ ] as well as the lowest intent to engage in TB health behaviors [ $F(1, 124) = 13.37, p < 0.0001$ ] among all groups.

Structural equation analysis subsequently revealed that the HBM, as configured by Becker and Maiman (48) did not adequately fit this sample [ $\chi^2(18 \text{ df}) = 375.57, p < 0.00001$ ; AGFI = 0.05]. A detailed review of predictive relationships between HBM components showed that some did, however, match Becker and Maiman arrangement. For example the more respondents agreed that TB was a serious illness ( $\beta = 0.48, t = 3.8, p < 0.0001$ ) and that they were susceptible to it ( $\beta = 0.49, t = 3.8, p < 0.0001$ ), the more they reported it as a personal threat. All such significant paths are identified in Fig. 1. These observations formed a core around which the model was reconfigured. Modification resulted in adequate overall model fit [ $\chi^2(24 \text{ df}) = 28, p = 0.26$ ; AGFI = 0.93] and identified significant predictive relationships between HBM components, gender, Anglo orientation, and Mexican orientation. Results are presented in Table II and Fig. 2.

In summary, greater perceived seriousness ( $\beta = 0.25, t = 3.8, p < 0.0001$ ) health care barriers ( $\beta = 0.45, t = 6.9, p < 0.0001$ ), and more cues to action ( $\beta = 0.25, t = 4.3, p < 0.0001$ ) predicted significantly higher perceived susceptibility. Gre-

ater perceived barriers ( $\beta = 0.47, t = 7.2, p < 0.0001$ ) and a stronger Mexican orientation ( $\beta = 0.23, t = 3.6, p < 0.0001$ ) predicted greater perceived seriousness. Higher perceived susceptibility ( $\beta = 0.34, t = 5.3, p < 0.0001$ ), seriousness ( $\beta = 0.39, t = 6.6, p < 0.0001$ ), and health care barriers ( $\beta = 0.21, t = 3.3, p = 0.001$ ) predicted significantly greater perceived threat. More attention to action cues ( $\beta = 0.54, t = 9.5, p < 0.0001$ ), greater perceived susceptibility ( $\beta = 0.36, t = 6.3, p < 0.0001$ ), and a stronger Anglo orientation ( $\beta = 0.18, t = 3.2, p = 0.001$ ) predicted significantly greater perceived benefits to action. A stronger Anglo orientation ( $\beta = -0.26, t = -3.5, p = 0.001$ ) predicted less perceived barriers. Being female predicted greater ( $\beta = 0.24, t = 3.3, p = 0.001$ ), and an Anglo orientation predicted less attention ( $\beta = -0.21, t = -2.8, p = 0.006$ ) to action cues. Finally, greater perceived susceptibility to TB ( $\beta = 0.21, t = 4.0, p < 0.0001$ ), perceived benefits ( $\beta = 0.28, t = 4.3, p < 0.0001$ ), attention to action cues ( $\beta = 0.43, t = 7.2, p < 0.0001$ ), and being female ( $\beta = 0.15, t = 3.3, p = 0.001$ ) predicted a greater intent to engage in health care actions.

**DISCUSSION AND CONCLUSIONS**

Overall results support HBM components' value in understanding relationships between health related

**Table II.** Regression Equations in the Modified HBM

Criterion variables	Predictor variables	$\beta$	$t$ values	$SE$	$R^2$ (overall equation)
Perceived susceptibility	Perceived seriousness	0.25	3.80***		
	Perceived barriers	0.45	6.93***		
	Action cues	0.25	4.31***	0.53	0.48***
Perceived seriousness	Perceived barriers	0.47	7.25***		
	Mexican orientation	0.23	3.57***	0.80	0.31***
Perceived threat	Perceived susceptibility	0.34	5.33***		
	Perceived seriousness	0.39	6.65***		
	Perceived barriers	0.21	3.30***	0.47	0.62***
Perceived benefits	Perceived susceptibility	0.36	6.28***		
	Cues to action	0.54	9.77***		
	Anglo orientation	0.18	3.19**	0.53	0.52***
Perceived barriers	Anglo orientation	-0.26	-3.47***	0.77	0.06*
	Gender	0.24	3.26**		
Cues to action	Anglo orientation	-0.21	-2.76*	1.25	0.09*
	Perceived susceptibility	0.21	4.01***		
Intent to engage in TB prevention and control behaviors	Perceived benefits	0.28	4.29***		
	Cues to action	0.43	7.24***		
	Gender	0.15	3.30**	0.48	0.66***

Note. Fit of total model: [ $\chi^2(24) = 28, p = 0.26$ ], AGFI = 0.93.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .



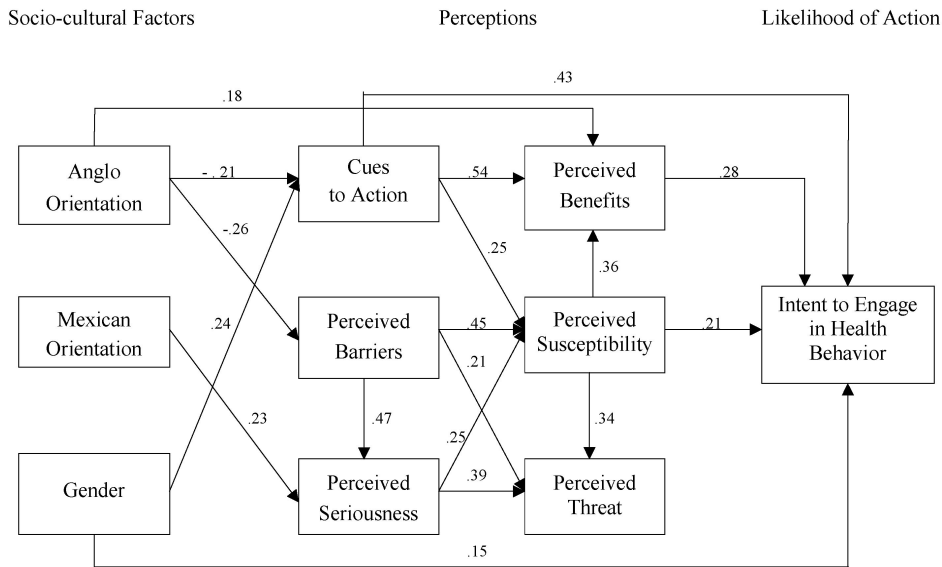


Fig. 2. The modified Tuberculosis HBM for Mexican Americans. [ $\chi^2$  Goodness of Fit Index (24 df) = 28,  $p = 0.26$ ; AGFI = 0.93]. Numeral on path =  $\beta$ .

attitudes and perceptions. Like previous findings (49), elements identified as directly predicting peoples’ intent to engage in health behavior included a belief that they are susceptible to TB, and anticipation that there are benefits to taking preventative actions. Significant relationships between gender, acculturation, and HBM components further highlight that Becker and Maiman’s addition (48) of modifying sociopsychological and demographic factors is highly relevant. Differences between the model specified by Becker and Maiman and the present study point out how health-related perceptions may interact in dissimilar ways across culturally distinct populations.

On the other hand, results indicating that gender and cues to act directly predicted intent to engage in a health behavior as well as through HBM components, supports frequent criticism that the HBM fails to consider elements not directly related to perceptions around a disease (53). Present findings thus do not support the HBM as a complete mediational model.

“Traditional” Mexican Americans’ perception of TB as particularly serious contradict assumptions that lower acculturation is associated with ignorance regarding the dangers posed by the illness. Therefore, any differences in understanding TB between traditional Mexican and U.S. cultures (60) can not be translated into conclusions that the severity of diseases will be underestimated. Rather, adoption of a United States mainstream orientation was associated

with lower perceptions that TB is a serious and personally threatening disease.

One possible explanation for this finding is as follows. Highly acculturated persons may be more familiar with TB treatment outcomes in the United States, and thus more aware that the disease is routinely cured. They may consequently perceive it as less serious than those who are not as aware of such facts.

Findings that barriers did not directly predict intent to engage in health actions are somewhat inconsistent with the previous literature (52). These results were probably obtained because behavioral intent rather than behavior was measured. As such they point out that, while barriers may limit health behaviors, they do not inhibit the basic willingness to act. Health care providers should thus not assume that patients’ lack of treatment adherence automatically denotes an unwillingness to follow prescribed regimens. Such assumptions constitute wrong and stereotypical views about Mexican Americans that “blame the victims” (61).

Results linked greater barriers with greater perceptions of susceptibility. Susceptibility, in turn, was associated with an increased rather than decreased intent to engage in TB control behaviors. In short, barriers indirectly heighten the realization that such action is necessary. One can, however, assume that they also limit beliefs that such behavior is possible. Outreach efforts are thus likely to be most effective if

they do not simply inform Mexican Americans about TB dangers, but also give clear indications that health care is accessible to them. Findings regarding cues to action warrant special notice in this context. Attention to such cues was a significant direct predictor of perceived susceptibility, benefits, and intent to engage in TB control behaviors. Social marketing thus appears potentially valuable in facilitating TB control efforts among Mexican Americans.

In addition, results supporting the idea that women perceive more benefits to taking health-related actions, report greater attention to TB-related cues to act, and indicate a greater intent to engage in preventative health behavior than men, serve to further support the notion that Mexican American women may often take on the role of caretakers and health liaisons for their family (42).

That perceived threat did not predict behavioral intent in our model was one of its greatest departures from Becker and Maiman's configuration. We operationalized "threat" as TB-related fears including those about negative impact on career and interpersonal relationships. It may be that psychological defenses such as fear avoidance (e.g., "If it's that bad, I'd rather not know") serve to counteract any motivations threat contributes toward behavioral intent. If true, this scenario supports rational belief model critiques that health decisions are not simply made in a mechanistic and cerebral cost-benefit analysis (54).

Finally, it is interesting that almost all of the people in the sample fell either into the traditional Mexican or highly integrated bicultural (28.9%) acculturation categories. This distribution raises questions about the degree to which similar patterns hold true for the more general Mexican American population and/or the degree to which such trends are more specifically representative of the population segment that has had at least some indirect contact with community health clinics near the United States–Mexico border. Highly assimilated individuals may, for example, choose to obtain health services from providers that are not closely linked with the Latino community. Overall, it does appear that, contrary to the traditional linear view, the acculturation strategy that allows persons to gain Anglo orientations without necessarily giving up their Mexican orientation is not just plausible but fairly common.

This study has a number of limitations. Its investigation of a particularly high-risk subgroup restricts generalizability to other Latinos who do not live near the United States–Mexico border, who are not of Mexican birth or descent, and who do not have

family members with a positive TB skin test. It also remains unclear if our TB-specific results are applicable to other health issues. Future research should thus focus on other illnesses and Latino groups to identify similarities and differences. Secondly, our assessment did not include a direct measure of TB knowledge. We thus do not know what specific information or ideas respondents' perceptions about "seriousness," "susceptibility," etc. are based on.

In addition, the study could have benefited from an increased sample size. Power calculations for both the MANCOVA and HBM structural test guided our data collection. The initial model test, for example, met Bentler and Chau's recommendations (62) for a 10:1 (sample size to free parameters) ratio if normality of distribution cannot be presumed beforehand. The revised model, however, included a greater number of free parameters. Fortunately, continuous variables were normally distributed. In this case the minimum adequate ration can be dropped to 5:1 (62). The substantial number of significant results in all analyses reduces concern that the study was insensitive to important relationships between variables.

Finally, the sample's nonrandom nature also limits generalizability. In such cases it is expedient to assess the extent to which groupings accounted for variance in responses (63). We believe that our primary focus on such groupings served to reduce problems associated with availability samples.

Despite its limitations, this study helps us understand the ways in which a culturally distinct group negotiates health perceptions. It supports other research highlighting positive aspects of adherence to traditional views and norms. While, as previously described, our focus on behavioral intent served to dispel some stereotypes, future studies should assess preventative behaviors *per se*, as well as their outcomes. We suspect that, ultimately, HBM components fit into a much larger ecological model of health that predicts positive outcomes in the context of familial, social, and community support.

## ACKNOWLEDGMENTS

This study was partially supported through Grant # 118-2034-56 from the Social Science Research Council and Inter-University Program for Latino Research. Earlier portions served as Dr. Rodríguez-Reimann's 1996 doctoral dissertation at the California School of Professional Psychology—San Diego (CSPP) (now Alliant International University). Data collection activities and analyses

were approved by CSPP's Institutional Review Board.

## REFERENCES

- Cauthen GM, Pio HG, Ten Dam HG: Annual risk of tuberculosis infection. World Health Organization TB Publication 1988; 88:154
- Bloom BR, Murray CJL: Tuberculosis: Commentary on a re-emergent killer. *Science* 1992; 257:1055-1064
- Centers for Disease Control and Prevention: Tuberculosis morbidity—United States, 1995. *Morb Mortal Wkly Rep* 1996; 45:365-370
- Centers for Disease Control and Prevention: NCHSTP Program Briefing, 2001, The National Tuberculosis (TB) Surveillance System 2001. Available on-line (accessed November 2001) at: <http://www.cdc.gov/nchstp/tb/surv/surv2001/default.htm>
- Zuber PL, McKenna MT, Binkin NJ, Onorato IM, Castro KG: Long-term risk of tuberculosis among foreign-born persons in the United States. *JAMA* 1997; 278:304-307
- Centers for Disease Control and Prevention: Preventing and controlling tuberculosis along the U.S.-Mexico border: Work group report. *Morb and Mortal Wkly Rep* 2001; 50(No. RR1):1-27
- Banerji S, Bellomy AL, Yu ES, Waterman S, Haas EA, Moser KE: Tuberculosis in San Diego County: A border community perspective. *Public Health Rep* 1996; 111:431-436
- Therrien M, Ramirez RR: The Hispanic population in the United States: March 2000. *Current Population Reports*. Washington DC: U.S. Census Bureau; 2000; P20-P535
- Watchi R, Kahlstrom E, Vachon LA, Barnes PF: Pediatric tuberculosis: Clinical presentation and contact investigation at an urban medical center. *Respiration* 1998; 65:192-194
- Villarino ME, Geiter L, Simone PM: The multi-drug resistant tuberculosis challenge to public health efforts to control tuberculosis. *Public Health Rep* 1992; 107:616-625
- Taylor JP, Bergmire-Sweat D, Suarez L: Epidemiology of drug resistant tuberculosis in Texas. *Am J Epidemiol* 1999; 149:359-365
- Taylor JP, Suarez L: Prevalence and risk factors of drug resistant tuberculosis along the Mexico-Texas border. *Am J Public Health* 2000; 90:271-273
- Kenyon TA, Driver C, Haas E, Valway SE, Moser KS, Onorato IM: Immigration and tuberculosis among children on the United States-Mexico border, County of San Diego, California. *Pediatrics* 1999; 104:e8
- Morisky DE, Malotte CK, Choi P, Davidson P, Rigler S, Sugland B, Langer M: A patient education program to improve adherence rates with anti-tuberculosis drug regimens. *Health Educ Q* 1990; 17:253-267
- Sumartojo E: When tuberculosis treatment fails, a social behavioral account of patient adherence. *Am Rev Respir Dis* 1993; 147:1311-1320
- Holland L, Courtney R: Increasing cultural competence with the Latino community. *J Community Health Nurs* 1998; 15:45-53
- Cabrera DM, Morisky DE, Chin S: Development of a tuberculosis education booklet for Latino immigrant patients. *Patient Educ Couns* 2002; 46:117-124
- Guzman B: The Hispanic Population: Census 2000 brief (C2KBR/OI-3). Washington DC: U.S. Department of Commerce, U.S. Census Bureau; 2001
- Day JC: Population Projections of the United States by age, sex, race, and Hispanic origin: 1995-2050. *Current Population Reports No. 25-1130*. Washington, DC: US Bureau of the Census; 1996
- Byrd WM, Clayton LA: Understanding and eliminating racial and ethnic disparities in healthcare: In: Institute of Medicine, ed. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington DC: National Academy Press; 2002:248-303
- Zuckerman M: Some dubious premises in research and theory on racial differences. *Am Psychol* 1990; 45:1297-1303
- Mendoza RH: Acculturation and sociocultural variability: In: Martinez JL, Mendoza, RH, eds. *Chicano Psychology*, 2nd edn. Orlando Florida: Academic Press; 1984:61-76
- Cuellar I, Harris L, Jasso R: An acculturation scale for Mexican American normal and clinical populations. *Hispanic J Behav Sci* 1980; 2:199-217
- Olmedo, EL: Acculturation: A psychometric perspective. *Am Psychol* 1978; 34:1061-1070
- Mack TM: Cancer in Hispanics in Los Angeles county. *NCI Monograph* 1989; 69:99-104
- Hayes-Bautista DE: Latino health indicators and the underclass model: From paradox to new policy models: In: Furino E, ed. *Health Policy and the Hispanic*. Boulder, CO: Westview; 1992:32-47.
- Markides KS, Krause N, Mendes de Leon CF: Acculturation and alcohol consumption among Mexican Americans: A three-generation study. *Am J Public Health* 1988; 78:1178-1181
- Amaro H, Whitaker R, Coffman G, Heeven T: Acculturation and marijuana and cocaine use: Findings from HHANES 1982-84. *Am J Public Health* 1990; 80(suppl):54-60
- Otero-Sabogal R, Sabogal F, Pérez-Stable EJ, Hiatt RA: Dietary practices, alcohol consumption, and smoking behavior: Ethnic, sex, and acculturation differences. *J Nat Cancer Inst Monogr* 1995; 18:73-82
- Harmon NIP, Castro FG, Coe K: Acculturation and cervical cancer: Knowledge, beliefs, and behaviors of Hispanic women. *Women Health* 1996; 24:37-57
- De la Torre A, Friis R, Hunter HR, Garcia L: The health insurance status of US Latino women: A profile from the 1982-1984 HHANES. *Am J Public Health* 1996; 86:533-537
- Vitullo MW, Taylor AK: Latino adults' health insurance coverage: An examination of Mexican and Puerto Rican subgroup differences. *J Health Care Poor Underserved* 2002; 13:504-525
- Carter-Pokras O, Zambrana RE: Latino health status: In: Aguirre-Molina M, Molina CW, Zambrana RE, eds. *Health Issues in the Latino Community*. San Francisco, CA: Jossey-Bass; 2001:23-54
- Salabarria-Pena Y, Trout PT, Gill JK, Morisky DE, Muralles AA, Ebin VJ: Effects of acculturation and psychosocial factors in Latino adolescents' TB-related behaviors. *Ethn Discourse* 2001; 11:661-675
- Domino G: Acculturation of Hispanics: In: Knouse SB, Rosenfeld P, Culbertson AL, eds. *Hispanics in the Workplace*. Newberry Park, CA: Sage; 1992:57-75
- 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; 17:275-304
- Feuerstein M, Labbé E, Kuczmierczyk A: *Health Psychology: A Psychobiological Perspective*. New York: Plenum; 1986
- Davenport DS, Yurich JM: Multicultural gender issues. *J Couns Dev* 1991; 70:64-71
- Marín G, Marín B: *Research With Hispanic Populations*. Newbury Park, CA: Sage; 1991
- Marín G: Influences of acculturation on familialism and self-identification among Hispanics: In: Bernal ME, Knight GP, eds. *Ethnic Identity: Formation and Transmission Among Hispanics and Other Minorities*. Albany, NY: State University of New York Press; 1993:181-196
- Casas JM, Wagenheim BR, Banchemo R, Mendoza-Romero J: Hispanic masculinity: Myth or psychological schema meriting clinical consideration. *Hispanic J Behav Sci* 1994; 16:315-331

42. Vasquez-Nuttall E, Romero-Garcia I, DeLeon R: Sex roles and perceptions of femininity and masculinity of Hispanic women: A review of the literature. *Psychol Women Q* 1987; 11:409–425
43. Higgins PG, Learn CD: Health practices of adult Hispanic women. *J Adv Nurs* 1999; 29:1105–1112
44. Sabogal F, Marin G, Otero-Sabogal R, Marin BV, Pérez-Stable R: Hispanic familism and acculturation: What changes and what doesn't? *Hispanic J Behav Sci* 1987; 9:397–412
45. Sabogal F, Faigues B, Catania JA: Data from the AIDS Behavioral Surveys. II: Multiple sexual partners among Hispanics in high-risk cities. *Fam Plann Perspect* 1993; 6:257–262
46. Hochbaum GM: Why people seek diagnostic X-rays. *Public Health Rep* 1956; 71:377–380
47. Rosenstock IM: Why people use health services. *Milbank Memorial Fund Q* 1966; 44:94.
48. Becker MH, Maiman LA: Sociobehavioral determinants of compliance with health and medical care recommendations. *Med Care* 1975; 13:10–24
49. Harrison JA, Mullen PD, Green LW: A meta-analysis of studies of the Health Belief Model with adults. *Health Educ Res* 1992; 7:107–116
50. Austin LT, Ahmad F, McNally MJ, Stewart DE: Breast and cervical cancer screening in Hispanic women: A literature review using the health belief model. *Women's Health Issues* 2002; 12:122–128
51. Neff JA, Crawford SL: The Health Belief Model and HIV risk behaviors: A causal model analysis among Anglos, African-Americans and Mexican-Americans. *Ethn Health* 1998; 3:283–299
52. Champion VL: Instrument development for Health Belief Model constructs. *Adv Nurs Sci* 1984; 6:73–85
53. Airhihenbuwa CO: *Health and Culture: Beyond the Western Paradigm*. Thousand Oaks, CA: Sage; 1995
54. Leventhal H, Cameron L: Behavioral theories and the problem of compliance. *Patient Educ Couns* 1987; 10:117–118
55. American Lung Association: *Tuberculosis Fact Sheet*. 2002. Available online (accessed January 2003) at: <http://www.lungusa.org/diseases/tbfac.html>
56. Lessenger LH: Use of Acculturation Rating Scale for Mexican Americans-II with substance abuse patients. *Hispanic J Behav Sci* 1997; 19:387–398
57. Jöreskog K, Sörbom D: *LISREL 8: Structural Equation Modeling With the SIMPLIS Command Language*. Hillsdale, NJ: Earlbaum; 1993
58. Hu L, Bentler PM: Evaluating model fit: In: Hoyle RH, ed. *Structural Equation Modeling: Concepts, Issues and Applications*. Thousand Oaks, CA: Sage; 1995:76–99
59. Hoyle RH: The structural equation modeling approach: Basic concepts and fundamental issues: In: Hoyle RH, ed. *Structural Equation Modeling: Concepts, Issues, and Applications*. Thousand Oaks, CA: Sage; 1995:158–176
60. Clark M: *A Community Health Study in the Mexican American Culture*. Berkeley, CA: University of California Press; 1973
61. Farmer P: Social scientists and the new tuberculosis. *Soc Sci Med* 1997; 44:347–358
62. Bentler PM, Chou CP: Practical issues in structural modeling. *Sociol Methods Res* 1987; 16:78–117
63. Matheson DW, Bruce RL, Beauchamp KL: *Experimental Psychology: Research Design and Analysis*, 3rd edn Fort Worth, TX: Holt, Rinehart, & Winston; 1978