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Psychological and behavioral acculturation in a social network of Mexican Americans in the United States and use of dental services

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Abstract – *Objectives:* We used data from the TalaSurvey study to examine associations between dental health experiences, social network characteristics, and levels of behavioral and psychological acculturation in one location in the American Midwest. *Methods:* Starting in parishes and community organizations, we identified adults of Mexican origin living in Indianapolis, who were 1st- or 2nd-generation immigrants from Tala, Mexico. Using a social networks methodology and following extensive formative research, we created an egocentric social network survey and administered it via face-to-face interviews. We identified the peers (alters) in interviewees' (egos) personal networks. We asked egos about multiple oral health and dental care variables for self and for alters. Acculturation (psychological and behavioral) was measured with a validated tool. Through logistic and negative binomial regression, we examined the effects of acculturation and network composition on ego's dental insurance status, dental office visits, and the reason for most recent dental office visit. *Results:* A total of 332 egos (mean age 36; 63% female) were interviewed: 90% were born in Mexico; 45% had completed elementary school or lower; and most had low income. Each ego named 3.9 (SD±1.9) alters in his/her personal network, for a total of 1299 alters (mean age 39; 61% female). Both behavioral acculturation and psychological acculturation were moderately associated with dental insurance coverage, and greater behavioral acculturation predicted more frequent dental care. More psychologically acculturated egos were more likely to seek preventive care. Further, egos with more highly educated networks sought care more frequently and for preventive purposes, net of ego's own education and acculturation. *Conclusions:* This study contextualizes acculturation of Mexican Americans within the personal networks in which oral health discussion takes place. The findings underscore the critical importance of acculturation and social network factors in shaping a subgroup of Latinos' orientation toward dental care.

Latino adults are disproportionately affected by adverse oral health outcomes[1,2]. In the case of Mexican Americans, the largest subgroup of Latinos in the United States, adults are at higher risk than other Americans for caries, gingivitis, and chronic periodontitis. Further, Latinos use oral health services at lower rates, including oral cancer screening and any dental care in the prior 12 months[1].

National data for 2011–2012 showed that Hispanic adults are more likely to age with more complete sets of teeth compared to other ethnic groups but are also more likely for those teeth to have untreated caries[2]. In this article, we examine the contribution of behavioral and psychological acculturation to oral health disparities in one subgroup of Latinos in the United States. In contrast to prior research described below, we adopt a social network perspective which situates Mexican American acculturation within the local social networks where oral health decision-making and social influence take place.

Acculturation and oral health

Latinos migrating to the United States arrive generally healthier than many other Americans and their second-generation Latino peers, despite often having lower socioeconomic status and enduring the stress of immigration[3]. However, Latino groups tend to become less healthy over time. It has been proposed that this is attributable to the simultaneous adoption of less healthful lifestyle factors (e.g., modern 'American' diet) and the erosion of traditional protective factors[4]. The immigrant health paradox is understudied in oral health research, but the mechanisms for this pattern, particularly with respect to dental caries, may be broadly posited as follows: When Latinos move to the United States, they develop a unique set of cultural norms that blend poor attention to preventive and clinical behaviors from premigration heritage[5] with American dietary norms[6]—specifically, often eating highly accessible, cariogenic foods and drinks. The problem is exacerbated by an increase in disposable income with which to purchase snack foods and sugary drinks. Although this hypothesized mechanism appears reasonable, a detailed examination of the influences of acculturation and assimilation is necessary.

Acculturation is the set of adaptations to living within a new sociocultural context, over time and across places; it has different dimensions[7]. Measurement is not an easy task, as there are no universal definitions of acculturation; the diversity of conceptualization and metrics of acculturation constructs is extensive[8]. Historically, most measures addressing the relationship of health status and gradients of acculturation in the specific case of Mexican Americans were limited to the individual person[7] and developed decades ago, before recent sociodemographic changes in migration[9]. Most measures rely on preferred use of language and self-definition of ethnic heritage, such as the

Hazuda[10] and Cuellar scales[11]. These are simple to obtain but they have limitations (see Appendix S1).

Several publications with an explicit research focus on acculturation and oral health have been undertaken on Latinos in the United States. The earliest one is an assessment of HHANES 1982–1984[12] that used Cuellar's scale, comprising scores for language use and ethnic self-classification. Another report using Cuellar's scale contrasted HHANES data for Mexican Americans, Puerto Ricans, and Cubans[13]. Again acculturation was considered to modify the use of dental care, but having dental insurance and higher levels of educational attainment were the most important variables. Another study teased out differences across convenience samples from Central America and Mexico[14]; its reliance on use of English and educational attainment made the role of acculturation fairly nonspecific. Other papers about the role of acculturation (for any minority group in the United States, including Latinos) on oral health have found some positive associations between language used at home and/or heritage, and dental sealants[15], pain[16], and visits[17] but others did not[18–21]. The one comprehensive review[22] concluded that there were positive, negative, and ambiguous associations published. On the whole, however, there was a positive effect of increased acculturation on immigrants' use of dental care services, noting two caveats: increased services may not necessarily lead to improved oral health status, and there is sparse research using multidimensional scales of acculturation.

A major gap in the oral health disparities literature remains because it is not fully understood when and how relevant norms are acquired, nor why immigrants fail to engage the dental care system in ways conducive to optimal oral health outcomes[23–25]. While acknowledging that structural barriers play a fundamental role in oral health disparities[26] within the larger dimension of immigration as a social determinant of health[27], the current body of knowledge has not sufficiently characterized the role of acculturation in Latino oral health disparities.

Social network perspective in oral health

We propose to add a network perspective to start addressing such gaps in the oral health outcomes and behaviors of Mexican Americans relative to Whites. We focus research on this subgroup to reduce variation associated with the diversity of national origins within Latinos. Social science

research submits that social network dynamics underlie the acculturation process. The acculturation career—or the timing, sequence, and combination of changes over time following immigration—is closely linked to social interaction with different individuals, groups, and institutions within the mainstream culture[28–30]. Recent immigrants interweave traditional norms and customs with those that are newly acquired through contact with mainstream American society and more established immigrants, or 'sponsors'[31]. Understanding how and why new oral health or dietary behaviors are adopted while other traditional behaviors are retained requires an understanding of changes in the norms, attitudes, and information flowing through social networks, and of the evolving composition of immigrant social ties.

The social network perspective starts with the premise that behaviors, beliefs, and values of individuals are shaped through contact and communication with others. A social network can be defined as a 'structure of relationships linking social actors'[32], or a 'set of individuals who are either directly or indirectly connected'[33]. This perspective is unique in that it embeds individuals and their decisions, outcomes, and life opportunities in the larger social context of relationships, group membership, and community[34,35]. Social network analysis focuses on a target individual and members of his or her personal community network, using characteristics of the network to predict wellbeing or other outcomes. Social network analysis is distinct from other relational approaches (e.g., social support research) in that it focuses on the quantifiable linkages between and among network ties, permitting an evaluation of the impact of one's position in a personal network. Network methods are critical for understanding oral health disparities because they shift the focus from individual risk factor epidemiological approaches to a broader social structural and cultural environment on which immigrant acculturation depends. This change in focus to personal community networks is consistent with calls in the oral health literature to address the role of informal sources of information and support[36].

This report adopts an egocentric network perspective to examine data from the TalaSurvey Study, an investigation into the nature and distribution of social network ties, oral health risk and protective behaviors, and use of dental care, in a community of urban-based Latinos of Mexican origin living in the United States. In the present report, we explored the relationship between acculturation, social network characteristics, and key experiences with dental care systems. These were as follows: having dental insurance, number of months since last dental office visit, and the principal reason for the last dental office visit.

Materials and methods

Participants and study procedure

Participants were urban-based Mexican American adults, first- or second-generation immigrants, who could read and write English or Spanish. They were recruited in the fall and winter of 2013 in a saturated sample of parishes or community organizations in greater Indianapolis. Project procedures were approved by an IRB at Indiana University (#1306011692). Participation included signing a letter of informed consent in Spanish or English after explanations in either language. Sessions lasted 20–45 min and were conducted in English or Spanish. A questionnaire was adapted from prior work[37] to include network name generator questions and oral health domains. After iterative refinement in focus groups, Spanish–English translation and back translation was undertaken.

Psychological–behavioral acculturation scale

We employed a Psychological–Behavioral Acculturation Scale (P-BAS) separately validated for Mexican Americans in the American Midwest[38]. The Psychological–Behavioral Acculturation Scale (P-BAS) is a self-administered questionnaire containing 66 items and has been used previously in oral health research[39]. It incorporates distinct behavioral and psychological acculturation domains[40–42]. While the former deals with the acquisition of adaptive behaviors to a new environment, the latter encompasses norms, ideologies, beliefs, and attitudes that resemble the mainstream culture[41,42].

Ego dental health variables and controls

We examined the relationship between acculturation and three dependent variables: having dental insurance coverage (1 = Yes, else 0), the count of months since ego's last dental office visit, and the 'main reason' for ego's last dental office visit (1 = checkup, examination, preventive, or other scheduled treatment ('preventive'), or 0 = emergency, or have never been ('emergency')). We also controlled for the influence of various ego characteristics: education level, sex, age, and percent of life

spent living in the United States. Descriptive statistics are in Table 1, further details are in Appendix S2.

Egocentric network research design

Egocentric network analysis acquires information about egos (the focal person being interviewed) and their relationships with alters (people that egos name within their network of peers). In the present report, we focused on alters solicited from egos using the Oral Health Matters (OHM) name generator in the questionnaire: *Looking back over the past 12 months, who are the people with whom you discussed issues about dental health, the people in your life that you feel you can really count on for help when you have dental health problems?*[32,35] We asked egos detailed follow-up questions about each named alter.

To examine network influences on oral health experiences, we calculated network variables based on aggregated characteristics of each ego's named alters. Network size was calculated as the count of OHM network alters listed by egos. Average education was calculated as the average level of education among alters, measured on a 9-point scale. There were two additional binary network variables: whether or not any alter had dental insurance (1 = Yes, else 0), and whether or not ego's network was composed entirely of kin (1 = Yes, else 0).

Analysis summary and missing data procedures

We assessed the relationship between ego level of acculturation, network composition, and dental health experiences with logistic regressions for two binary outcome variables and a negative binomial regression for the count outcome. Analyses were conducted on a sample of 301 ego respondents for whom complete data was available. Full methodological details including sample selection are in Appendix S2.

Results

Among 301 Latinos (egos) retained for analysis, the mean age was 36 years (range 18–70) and 65% were female (Table 1). All egos indicated their parents were born in Mexico, and 90% reported being born in Mexico. 40% of egos had completed high school or more. Only 39% of egos had dental insurance, but 45% had a dental visit in the prior 12 months. Egos named an average of 3.9 (SD±0.1) alters in any personal network, for a total of 1,299 alters (mean age 39; 61% female). The average number of alters in egos' OHM networks was 2.7 (SD±1.9, range 1–9).

Results from logistic regression predicting whether or not ego has dental insurance coverage are presented in Table 2. In model (1), increasing psychological acculturation by 1 point (7-point scale) increases the odds of having dental insurance by a factor of 1.3 ($P < 0.001$). Behavioral acculturation, however, is not related to dental insurance coverage. Model (2) introduces controls for ego characteristics. In this model, both greater behavioral acculturation and psychological

Table 1. Descriptive statistics for dependent and independent variables

	Mean (%)	SD	Min	Max
Dependent variables				
Ego has dental insurance (1 = Yes)	(0.4)		0	1
Ego's months since last dental office visit[1]	72.1	89.5	0	420
Ego's last visit was for planned or preventive care (1 = Yes)	(0.4)		0	1
Independent variables				
Ego characteristics				
Behavioral acculturation	2.4	0.9	1	5
Psychological acculturation	−1.5	1.4	−4.2	3.2
High school graduate or more (1 = Yes)	(0.4)		0	1
Female (1 = Yes)	(0.6)		0	1
Age (years)	36.6	12.2	18	70
Percent life in United States	51.0	28.0	0	100
Oral Health Matters network characteristics				
Size	2.7	1.9	0	9
Any member has dental insurance (1 = Yes)	(0.5)		0	1
Kin-only (1 = Yes)	(0.4)		0	1
Average education	4.5	1.9	1	9

301 observations.
[1]284 observations for this variable.

Table 2. Logistic regression predicting that ego has dental insurance (1) relative to ego is uninsured (0)

	(1) Odds ratio (Lower, Upper)	(2) Odds ratio (Lower, Upper)	(3) Odds ratio (Lower, Upper)
Ego characteristics			
Behavioral acculturation	1.05 (0.93,1.18)	1.31[†] (0.96,1.79)	1.40[†] (0.99,1.98)
Psychological acculturation	1.32*** (1.13,1.55)	1.19[†] (0.99,1.42)	1.21[†] (0.99,1.47)
High school graduate		2.39** (1.39,4.09)	2.21* (1.21,4.04)
Female		1.60[†] (0.95,1.11)	1.01 (0.90,1.12)
Percent life in United States		0.99 (0.90,1.11)	1.01 (0.90,1.13)
Age (logged)		0.64*** (0.52,0.79)	0.70* (0.52,0.93)
OHM network characteristics			
Size			0.83* (0.70,0.98)
Any member has dental insurance			3.55*** (1.93,6.55)
Kin-only			0.47* (0.25,0.88)
Average education			0.92 (0.78,1.08)

301 observations. Exponentiated coefficients (ORs), 95% confidence intervals in parentheses.
[†]$P < 0.10$, *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. Crude estimates are available upon request.

acculturation predict a modest increase in odds of having dental insurance (both $P < 0.10$). Egos who are high school graduates (or have greater educational attainment) have about twice the odds to have dental insurance (OR = 2.4, $P < 0.01$), and females are marginally more likely to have insurance than males (OR = 1.6, $P < 0.10$). Older egos have significantly lower odds of having dental insurance (OR = 0.6, $P < 0.001$), and percent of life spent in the United States has no effect on coverage. Model (3) introduces control variables based on the composition of egos' OHM networks. Egos with a larger network and egos with a network composed entirely of kin have significantly lower odds to have dental insurance coverage (OR = 0.8, $P < 0.05$, and OR = 0.5, $P < 0.05$, respectively). However, if any member of an ego's OHM network has dental insurance coverage, then ego's odds to be insured more than triple (OR = 3.6, $P < 0.001$). Average education level in the network has no effect, and the effects of other variables, including the acculturation scales, are consistent with model (2).

To further delineate the relationship between acculturation and oral health experiences, we use negative binomial regression to predict the count of months since ego's last dental office visit. For 17 egos, this information is not available and cannot be inferred based on other variables; these cases are thus omitted from this portion of the analysis. Model (1) includes the acculturation scales, Model (2) adds ego characteristics including dental insurance coverage, and Model (3) adds additional OHM network variables; the results are consistent across all models. Looking at Model (3),

psychological acculturation has no significant effect, but increasing behavioral acculturation predicts significantly fewer months since ego's last dental office visit (IRR = 0.76, $P < 0.05$). To facilitate interpretation, each one-point increase in behavioral acculturation (4-point scale) decreases the expected count of months since last dental office visit by about 25%. As a point of comparison, having dental insurance reduces the expected count of months by about 43%, relative to the uninsured (IRR = 0.57, $P < 0.01$). At the network level, increased average education among alters predicts fewer months since last visit (IRR = 0.88, $P < 0.05$). In contrast, egos who have spent a larger percentage of their life in the United States have significantly more months since their last visit, net of ego's age (IRR = 1.10, $P < 0.05$). Other variables in the model are nonsignificant.

Table 4 contains logistic regression results predicting the main reason for ego's last dental office visit: whether a checkup, prevention, or planned treatment ('preventive'), as opposed to a dental emergency or having never been ('emergency') (reference). In Model (1), increasing behavioral acculturation by 1 point (4-point scale) increases odds of ego having been for preventive care by a factor of 1.2 ($P < 0.05$); a 1-point increase in psychological acculturation increases odds of a preventive visit by a factor of 1.4 ($P < 0.001$). The acculturation effects are consistent in Model (2), which introduces control variables, including dental insurance coverage. Egos with insurance have more than 3 times the odds of having sought preventive care rather than seeking care for an emergency (OR = 3.4, $P < 0.001$). Older egos have lower

odds of having been for preventive care (OR = 0.7, $P < 0.001$); education, sex, and percent of life in the United States have no significant effect on ego's reason for last dental visit. Model (3) introduces OHM network variables. After controlling for ego and network characteristics, greater psychological acculturation predicts significantly greater odds of having sought preventive care (OR = 1.2, $P < 0.05$), but behavioral acculturation is nonsignificant. Among the network variables, increased average alter education predicts significantly greater odds of ego having sought preventive care (OR = 1.2, $P < 0.05$). Network size, presence of members with dental insurance, and kin-only makeup of OHM are nonsignificant; other variables are consistent with model (2).

Discussion

Drawing on a network science perspective and measures of acculturation in one subgroup of Latinos, the present study began to shed light on three key dental health experiences that underlie oral health disparities. Our findings suggest that having better-educated oral health discussants in personal networks is associated with better experiences, controlling for one's own level of education (Tables 3 and 4). It is possible that higher levels of education are associated with having more knowledge or information about dental services or oral hygiene practices, which are transmitted to egos

through discussion[43]. Similarly, more educated alters may shape oral health experiences through normative influence or diffusion of oral health behaviors. In turn, ascribing greater importance to good oral health may become the norm in personal social networks with higher mean levels of education. Moreover, we have shown that having any network member with dental insurance increases egos own odds of being insured (Table 2). This suggests an indirect effect of social networks on ego's oral health behaviors including seeking more frequent (Table 3) and preventive-oriented dental care (Table 4).

With respect to acculturation, we found that both behavioral acculturation and psychological acculturation predict oral health outcomes, albeit through different mechanisms. Both types of acculturation are modestly associated with dental insurance coverage (Table 2). However, behavioral acculturation is associated with more recent use of professional services (Table 3), whereas psychological acculturation predicts use of dental care for services generally considered to be associated with better long-term outcomes, such as planned and preventive care (Table 4). Notably, the findings in Tables 3–4 persist even when controlling for ego's dental insurance status. Furthermore, supplemental analyses using interaction terms provided no evidence to suggest that the effect of acculturation on the outcome variables is significantly different depending upon dental insurance status. These findings suggest that the observed effects of

Table 3. Negative binomial regression predicting number of months since ego's last dental office visit

	(1) Incidence rate ratio (Lower, Upper)	(2) Incidence rate ratio (Lower, Upper)	(3) Incidence rate ratio (Lower, Upper)
Ego characteristics			
Behavioral acculturation	0.69*** (0.58,0.28)	0.76* (0.60,0.97)	0.76* (0.59,0.97)
Psychological acculturation	0.93 (0.83,1.03)	0.93 (0.84,1.03)	0.95 (0.85,1.07)
Has dental insurance		0.55*** (0.40,0.76)	0.57** (0.41,0.80)
High school graduate		0.67* (0.48,0.95)	0.79 (0.55,1.13)
Female		0.86 (0.63,1.18)	0.91 (0.67,1.25)
Percent life in United States		1.10* (1.01,1.20)	1.10* (1.01,1.20)
Age (logged)		1.63 (0.91,2.93)	1.65 (0.90,3.04)
OHM network characteristics			
Size			1.02 (0.92,1.13)
Any member has dental insurance			0.89 (0.61,1.30)
Kin-only			0.90 (0.63,1.29)
Average education			0.88* (0.80,0.98)
Alpha (lower, upper)	1.71 (1.48,1.97)	1.60 (1.38,1.84)	1.56 (1.35,1.80)

284 observations. Exponentiated coefficients (IRRs), 95% confidence intervals in parentheses.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. Crude estimates are available upon request.

Table 4. Logistic regression predicting last dental office visit was for planned or preventive care (1) rather than an emergency or never been (0)

	(1) Odds ratio (Lower, Upper)	(2) Odds ratio (Lower, Upper)	(3) Odds ratio (Lower, Upper)
Ego characteristics			
Behavioral acculturation	1.15* (1.01,1.30)	1.39* (1.00,1.92)	1.33 (0.93,1.89)
Psychological acculturation	1.41*** (1.20,1.66)	1.23** (1.02,1.48)	1.21* (1.00,1.47)
Has dental insurance		3.41*** (2.01,5.80)	3.28*** (1.88,5.73)
High school graduate		1.56 (0.89,2.72)	1.24 (0.68,2.27)
Female		0.98 (0.58,1.66)	0.98 (0.57,1.69)
Percent life in United States		0.97 (0.87,1.08)	0.96 (0.86,1.08)
Age (logged)		0.69*** (0.58,0.85)	0.58*** (0.43,0.78)
OHM network characteristics			
Size			0.91 (0.78,1.07)
Any member has dental insurance			1.29 (0.71,2.37)
Kin-only			1.31 (0.72,2.40)
Average education			1.20* (1.02,1.42)

301 observations. Exponentiated coefficients (ORs), 95% confidence intervals in parentheses.
[†]$P < 0.10$, *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. Crude estimates are available upon request.

acculturation are not solely attributable to differences in access to care over the acculturation career.

These results offer an interesting contrast to other findings on acculturation and oral health. A study of Vietnamese migrants in Australia demonstrated complex relationships between behavioral and psychological acculturation and oral health attitudes and behaviors[40]. Specifically, strong acculturation in one domain often coexisted with superficial acculturation in the other[44], with a mixed pattern of association with various changes in oral health knowledge and patterns of dental visits[39]. In the present study, higher behavioral acculturation was only moderately associated with how recently a dental office visit had taken place; but psychological acculturation predicted patterns of regular dental visits, therefore resembling those findings in Australia. This may be because behavioral acculturation is sometimes theorized to precede psychological acculturation, for example, in classic models of immigrant 'assimilation'[43]. Thus, use of planned and preventive dental visits may be associated with changes in oral health norms and values that are developed only at more advanced stages of acculturation. This is consistent with other findings presented here on the effects of percent of life spent in the United States, suggesting that utilization of dental services for nonemergencies may be more likely to occur at an advanced stage in the acculturation career. Changes in the frequency of dental visits may be due to a reduction in the likelihood of oral health problems at the individual level when that person has spent a larger proportion of his/her life in the United States.

Future research would be necessary to characterize the exact effects of larger percentage of life in United States.

The present study is novel, but has important limitations. We used a nonrandom sample, most of whom attended Catholic churches. Although findings are generalizable only to the American Midwest and to one subgroup of Latinos, some extrapolations may be warranted if limited to urban locations. Our conclusions may not extend to other, dissimilar groups such as agricultural workers, rural communities, or indigenous aboriginals from Mexico. Finally, we use an individual acculturation framework as one factor in oral health disparities, but acknowledge that this strategy omits an investigation of important structural influences (e.g., health systems, public policies)[7,27].

Despite these limitations, this study makes important contributions to our understanding of the interconnected role of social networks and acculturation in oral health. Latinos tend to have densely knit, female-centered networks of kin and fictive kin that reside in close proximity[45]. Family obligations, kinship support, and use of family as referents are key aspects of the social organization of Mexican American life[46]. Informal networks play a critical role in facilitating Mexican American migration and providing expedient access to material and social resources upon arrival, including health services. For example, English-speaking surrogates have been shown to seek general health information on behalf of monolinguistic Latinos in their networks, helping them overcome structural and individual access barriers[47].

Cultural 'brokering' is essential for recent immigrants, who typically have limited access to formal health care in the United States. However, informal network involvement may also impede use of formal services, particularly because cultural norms around oral health in Mexican culture prescribe a more reactive orientation to dental care[48]. Larger, more supportive networks may decrease the use of formal and preventive healthcare services in Latino communities and delay entry into the health sector[49]. Consistent with this idea, in the present study we found that having larger and more kincentered networks reduces the odds of ego having dental insurance (Table 2).

In conclusion, our results suggest that social network effects on health behaviors may present interesting contradictions wherein networks can be both beneficial and constraining, and this may change across the acculturation career. Indeed, our findings suggest that more acculturated egos have qualitatively different dental care experiences when compared to their less acculturated peers, perhaps because they rely less intensely on in-group advice and support about oral health. We call for additional longitudinal research to further illuminate the multiple and dynamic roles of social networks and acculturation in promoting oral health[50].

Acknowledgements

Conflict of interest

The authors declare they have no conflict of interests.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Potential limitations of commonly used scales to measure acculturation level of people of Mexican origin in the U.S.

Appendix S2. Detailed Description of Materials and Methods.

Online Appendix

Appendix S1. Potential limitations of commonly used scales to measure acculturation level of people of Mexican origin in the U.S.

Most measures rely on preferred use of language and self-definition of ethnic heritage, such as the Hazuda[1] and Cuellar scales[2]. These are simple to obtain but they have limitations. Language used in family or work life is influenced by recency of immigration, educational background, type of occupation, and length of time spent in the U.S. overall[3]. Relying on language use may ignore nuances moderating acculturation derived from different waves of Mexican migrants in the past 30 years. Self-identification of heritage may be affected by similar factors[4]. That is, Latino profiles have been assumed to be homogeneous, while in fact social and cultural variables may fluctuate in moveable association with other demographic and social characteristics, such as SES[5]. Such consideration is important vis-à-vis the increased 'Westernization' of the urbanites of modern Mexico, particularly the middle and lower-middle classes who have increasingly supplied migrants in recent times[6]. If we were to contrast observing Mexican traditions (e.g., *Day of the Dead)* among rural dwellers (often of lower SES), we would find that the size of the location of origin or SES would likely interact with the wave of immigration that brought that person to the U.S.[3,7]; and also, with where in the American society such rural dweller would be more likely to insert[6]. Language and heritage would be differently viewed across poorly educated vs. college-educated Mexican Americans.

Appendix S2. Detailed Description of Materials and Methods

Participants and Study Procedure. Participants were recruited through announcements made in churches, through community organizations, and through flyers and posters. Participants received monetary compensation. The TalaSurvey Study had additional protection through a U.S. Federal government Certificate of Confidentiality to allay fears by potential participants who may have been concerned about disclosing personal information. In this way we minimized self-selection of participants toward a biased group of Mexican Americans with legal residence status in the U.S.

Dental Health Network Instrument. Egocentric network analysis acquires information about egos (the focal person being interviewed) and their relationships with alters (people that egos name

within their network of peers), without necessarily contacting alters directly[8]. In the present report we use the Oral Health Matters (OHM) name generator to elicit a set of alters from each ego: *Looking back over the past 12 months, who are the people with whom you discussed issues about dental health, the people in your life that you feel you can really count on for help when you have dental health problems?* This is an oral health-specific extension of the well-known Important Matters (IM) name generator question, which was also included in the TalaSurvey study[9]. A similar adapted version of the IM name generator has been developed and applied to health issues more broadly, including mental health; such functionally-specific name generator questions have been shown to more strongly predict health outcomes than functionally non-specific name generators[10,11]. The Dental Health Network instrument is adapted from the PhenX Social Networks Battery. The PhenX Toolkit provides high quality, standard measures for inclusion in health and human genetics research. It was developed by a panel of researchers, and was supported by Award Number U01HG004597 from the National Human Genome Research Institute. The PhenX Social Networks Battery has been well validated and used extensively in social science research[10,11].

We asked egos detailed follow-up questions about each OHM alter, and used egos' responses to construct variables for network characteristics.

Detailed Description of Variables. We examined the relationship between acculturation and three dependent variables. First, having any form of dental insurance coverage (1=Yes, else 0). Second, the count of months since ego's last dental office visit. If an ego had never been to a dental office, then their value for this variable was the count of months that they had lived in the U.S. Models predicting this variable omit 17 cases due to missing data, because time elapsed since their last dental office visit was not known and could not be imputed based on other information. Third, the "main reason" for ego's last dental office visit (1=check-up, examination, cleaning, or other scheduled treatment; 0=emergency, or have never been). We combine "emergency" and "have never been" in the reference category for several reasons. First, in a population group with substantial barriers in access to care (most of them financial), it appears reasonable to consider similar those delaying care because of cost, and not being able to purchase care. Consider that 72% of respondents felt dental care costs were never or only sometimes reasonable, or out of their budget; 76% felt they were never or only sometimes able to pay for dental care; and only 3% of respondents who had not sought dental care indicated they never had

dental problems. Given that only 11 respondents (out of 332) had no natural teeth, edentulousness is not a mediating factor. Second, alternative models which distinguish between these categories show only a small difference in the results, and that difference appears to be due to a loss of sample size as opposed to substantive changes. These results are available on request. Perhaps a more ideal approach for this outcome variable would be to estimate a multinomial model with 3 response categories, but we would not trust results from such complex models in a relatively small sample.

In our multivariate models we control for various ego characteristics: the P-BAS acculturation scales, with separate behavioral acculturation (BA) and psychological acculturation (PA) scores; sex (1=female, else 0); ego's age in years; highest completed level of formal schooling in either the U.S. or Mexico (1=High school degree or higher, else 0); and percent of life lived in U.S. The latter variable was constructed by dividing ego's reported number of months lived in the U.S. since immigration by ego's age. If an ego did not immigrate (i.e., they were born in the U.S.), then percent of life lived in the U.S. is 100%. A previous version of this manuscript used U.S. citizenship status as an alternative control variable. We have removed this variable from the current draft because of the sample size limitations that it imposes; this information was not available for approximately 9% of respondents. Furthermore, 90% of the sample was born in Mexico and over 70% remained Mexican citizens. The percent life in U.S. variable helps to delineate between the participants in a more nuanced way. For the interested reader, we report citizenship descriptive statistics below (Table A).

Table A. Ego Citizenship Status (N=332)	%
Mexican Citizen	71.7
U.S. Citizen, Naturalized	8.4
U.S. Citizen, Birth	2.4
Dual U.S./MX Citizen	3.6
U.S. Permanent Resident	5.4
Missing	8.4
Total	100.0

To examine network effects on ego's oral health experiences, we calculated several network-level variables based on the aggregated characteristics of each ego's set of OHM alters. These aggregated network measures were calculated using all available data from egos' alters, so

if only one alter was missing data then that alter was ignored in the calculation of the aggregate variable. Network size refers to the count of OHM alters listed by egos. Average education was calculated as the average level of education among alters, measured on a 9-point scale. Alternatively, average education at the network level could be calculated as the proportion of network members with a high school degree; however, the irregular distribution of that variable made interpretation suspect. So we measured education at the network level using the average OHM alter value on the original education scale, which ranged from "No Formal Education" (1) to "Graduate Degree" (9). There were two additional binary network variables: whether or not any named OHM alter had dental insurance (1=Yes, else 0), and whether or not ego's network was composed entirely of kin (1=Yes, else 0).

Analysis Summary and Missing Data Procedures. We examined the relationship between ego level of acculturation, OHM network composition, and dental health experiences using logistic regressions for the two binary outcome variables and a negative binomial regression for the count outcome variable. For the purposes of this analyses we collapsed the original multilevel data into 332 ego-level observations. In the unaltered TalaSurvey data egos and alters represent empirically and conceptually distinct levels of analysis; other projects based on this data employ multilevel modeling with alters nested in egos. However, such modeling strategies are only appropriate to examine alter- or relationship-level dependent variables. The focus of the present study is to examine outcomes at the ego-level (ego's dental insurance, dental office visits, and reason for last visit). Because of the nature of our research interests in the present paper, we believe that it is most appropriate to collapse the data to the ego-level. We nevertheless believe that alter characteristics can have important influences on ego-level outcomes, which is why we created network variables based on aggregated alter characteristics. The analytic approach that we use here is arguably adequate for the collapsed sample of egos and their aggregated networks, which together compose only one level of analysis. That being said, the present analysis does assume that the egos are independent of one another; this assumption could be unjustified if egos in the Tala community know and interact with one another on a regular basis. Consequently, potential latent relationships among the egos could be considered a limitation of this study.

Our final sample for analysis was reached following listwise deletion of cases for which there was missing data on any variable (9.7% of cases deleted). We tested for significant differences between the retained cases (N=301) and the cases excluded due to missing data

(N=31). Egos omitted due to missing data had significantly smaller OHM networks (Welch's two sample T-test, two-tailed $p<0.05$), and significantly less likely to have dental insurance (Pearson's chi-squared test, $p<0.05$), but did not differ with respect to other demographic variables.

Model Fit Diagnostics and Robustness Checks. Model diagnostics for logistic regression are less straightforward than for OLS; we assessed model (3) from Tables 2 and 4 by following several steps. First, we conducted a linktest[12,13] to assess misspecification as a result of omitted variables. For both Table 2 and Table 4, the linktest produced a significant "_hat" parameter and non-significant "_hatsq" parameter, which indicates that the models were correctly specified. Second, we conducted a Hosmer–Lemeshow goodness of fit test, which is an extension of Pearson's chi-squared goodness of fit test[14]. Once again, for model (3) in both Table 2 and Table 4, the test statistic was not significant; therefore, the models fit the data reasonably well. Third, we examined residuals plots for problematic cases (e.g, Figure A). Two cases fall above a standardized residual of 3.0, which could indicate unacceptable leverage. However, examination of these cases did not reveal coding errors or other obvious issues (i.e., these may be "true" outliers). Finally, we calculated McKelvey and Zavoina's pseudo-R^2, which has been shown to be the most comparable logistic regression-appropriate alternative to the R^2 frequently used in OLS[12,13]. For Table 2 model (3), the R^2 is 0.24; for Table 4 model (3) the R^2 is 0.26. While much of the variation in the outcome remains unexplained, we believe that these diagnostics show that our models meet acceptable standards for applied research.

Fig A. Logistic Regression Residuals Plot

Note: Model (3), Table 2.
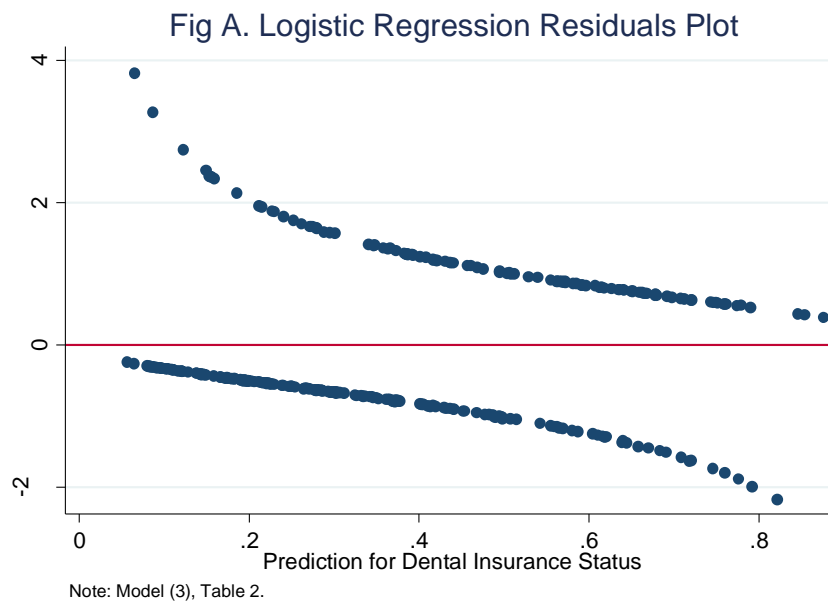
Assessing model fit for negative binomial regression is likewise less straightforward than in OLS. We assessed our negative binomial regressions presented in Table 3 by following several steps. First, the significant alpha parameters reported in Table 3 indicate that a Poisson regression would not be appropriate due to over-dispersion in the count outcome (e.g., model (3), $\alpha = 1.56$, 95% CI: 1.35-1.80). Second, we examined the Cox and Snell pseudo-R^2, which is calculated as a ratio of the likelihood for a model including only an intercept over the likelihood for the full model[12,13]. The R^2 of 0.17 for model (3) indicates that the full model is a much better fit for the data. Third, we examined the Anscombe residuals (Figure B). In this case, we see that there is some bias toward under prediction, and several cases that could be considered outliers. Even so, we think that these diagnostic steps overall support the validity of our methods.

Fig B. Negative Binomial Anscombe Residuals Plot

Note: Model (3), Table 4.
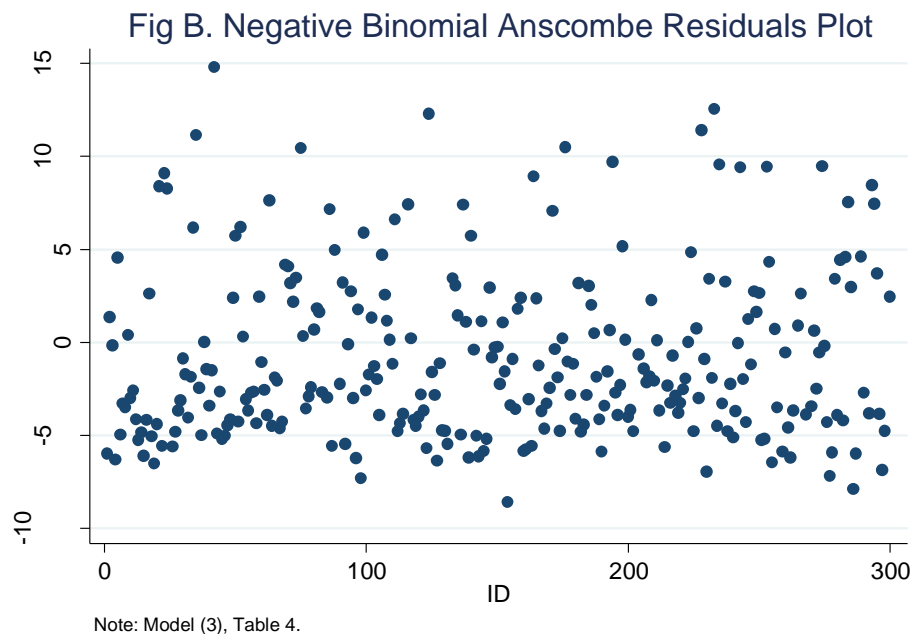
We checked the sensitivity of our results through a variety of robustness checks and alternative multivariate model specifications. Most of these analyses are available on request, but we will describe one important example here: interaction tests for the effects of acculturation. We estimated supplemental models to check for significant interactions between acculturation (both behavioral and psychological) and ego's age and gender, respectively, for each outcome variable. The interaction term was only statistically significant in one instance among 12 investigated models: behavioral acculturation*ego age predicting dental insurance status (OR=1.02, LR chi square = 7.23 (1), p=0.007). Considering that the effect size is relatively small, however, we do not think that this one significant interaction is substantively important enough to include in the main text. In other words, the bulk of the evidence suggests that the effect of acculturation on the outcome variables is not conditional on either ego's age or gender. As pointed out during peer review, there is an important question of access underlying the acculturation results. One way to assess this is to split the results by dental insurance status, but doing so would not allow us to test for significant differences between the coefficients in the separate models. As an alternative, we estimated supplemental models including all control variables and an additional interaction term between acculturation (both behavioral and psychological, respectively) and dental insurance status. No interaction term was statistically significant for either acculturation scale, whether predicting months since last dental office visit

or reason for last visit (all p>0.05). In other words, there was no evidence to suggest that the effect of acculturation on the outcome variables is significantly different depending upon dental insurance status.

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