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Determinants of Health and Disease Among Mexican Migrants to California

Narrative Final Report

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Overview and Background

Specific Aims

We conducted a pilot study to characterize changes in risk factors and associated disease among female Hispanic migrants to California, in order to discern the underlying causes for these changes. The focus was on major risk behaviors and health outcomes affecting this population. Primary outcomes assessed included behavioral risk factors, respiratory health, reproductive health, nutritional status and mental health. The effects of occupational exposures (e.g. agricultural work, pesticide exposure) were also considered. There is evidence that many of these health outcomes, or known risk factors for them, may become worse among Hispanics migrating to California. Specifically, prevalence rates of asthma, smoking-related respiratory symptoms, pre-term low birthweight pregnancies, obesity and diabetes are increased among Hispanic immigrants to California. Studies in rural Mexico have shown high rates of psychological distress, depressive symptomatology and *nervios*, but little is known about the prevalence of these disorders among migrants to the U.S. [1].

We conducted a cross-sectional survey of women in a Mexican sending state and a corresponding receiving community in California where large numbers of recent Hispanic migrants from the sending area reside. The goal was to conduct an investigation of behavior and illness profiles in the sending community that would allow us to separate the effects of "selective migration" from social-cultural changes associated with migration and living in a different environment [2]. For the present study, investigators in Mexico selected Chavinda, in the state of Michoacán as the sending community in Mexico, and Madera, California was selected as the receiving community in the U.S.

The specific aims of this pilot study were to:

1. Identify a sending community in the *Michoacán* state in Mexico and corresponding receiving community in California, and randomly select 100 women from both the sending and receiving communities for interviewing.

2. Conduct an interviewer-administered health survey on adult women aged 18-45 years in Madera, California and 18-49 years in Chavinda, Michoacán .

3. Compare adverse health risk factors in the two communities, both before and after adjustment for *a priori* known covariates such as age and marital status. Our primary hypothesis is that cigarette smoking will be greater in the U.S. than in Mexico, both before and after adjustment for covariates. Additional analyses will address other health behaviors.

4. Examine the relationship between immigration, acculturation measured by the ARMSA-II scale, and adverse health risk factors. Specifically, does the risk factor profile differ between Mexican residents and immigrants at different levels of acculturation?

In Chavinda, there were two additional specific aims:

1. To perform a population census in the identified community and randomly select 102 homes.

2. To perform screening tests for cervical cancer, diabetes and asthma for each of the participants.

Introduction

Migration and Acculturation

Migration is defined as the habitual change of residence by means of displacement from one geographical area to another [3]. The migration of people, and especially of groups, is a complex process than can cause deep changes within the individual and the societies to which they belong. The changes in behavior of immigrants are mainly influenced by the process of acculturation. Acculturation refers to the process of adjustment that a new culture requires, such as changes in lifestyle.

The immigrant, in an attempt to adapt to the differences in culture such as language, customs, dietary habits, climate and the norms of co-existence can develop physical and psychological problems, due to the stress associated with these changes and contact with the new society [4]. According to contemporary theories, the relation between acculturation and the state of both physical and mental health can be measured using such diverse variables as the nature of migration (i.e. forced migration), the acceptance of the receiving society, and the degree of similarity between the cultures [5-7]. The acculturation process has also been associated with the modification of risks related to health and disease, lifestyle, nutritional habits and work.

There are several reasons to focus on immigrants from Mexico. The first reason is the size of this group: the Immigration & Naturalization Services (INS) reported that from 1981 to 1996, Mexico ranked highest among countries of birth of immigrants to the U.S., representing over three million legal immigrants and 25% of all immigrants during the same time period [8]. In addition, the Mexican states of Guanajuato, Michoacán and Jalisco display the highest rates of migration to the U.S. Between 1990 and 1995, these three states contributed 11.4% of all immigrants from Mexico, with Michoacán as the second greatest contributor [8]. A Mexican census, compiled in 2000 by the National Institute of Statistical Geography and Computer Science (INEGI), reported that 3.3% of all the inhabitants of Michoacán emigrated to the U.S. This flow of migration is concentrated in only 30 of the 103 counties in Michoacán. This is noteworthy in the context of our study because Michoacán has nearly four million inhabitants, of whom 52% are women. In California, the Latino population represents 32% (11 million) of the total population, and of that, Mexican immigrants represent 25% (8.5 million).

The factors that influence the complex migratory process can be grouped into three large categories:

1. Factors affecting the movement of the work force, e.g. the insufficient dynamics of the Mexican national economy to absorb the excess workforce and the considerable wage differential between the economies.

2. Factors associated with the demand for and attraction of migrant manual labor, especially the demand for Mexican manual labor in the agricultural, industrial and service sectors of the U.S.

3. Numerous social factors that bond immigrants to their family, friends and communities of origin and those that bond them to their new destination.

The migration of Mexican women to the U.S. is a phenomenon which is partly explained by the displacement of spouses, parents or brothers. Diverse sources suggest that the number of immigrant women is increasing and that this is in response to new causes, including the intention to enter the labor market [9].

The Hispanic Epidemiological Paradox

The proposed analysis of bi-national data provides a unique approach to investigating the central hypotheses of the Hispanic epidemiological paradox from the perspective of the country of origin as well as the country of immigrant destination. The paradox was brought to wide scientific attention by Markides and Coreil [10], and may be stated as follows: immigrant women in the U.S., and specifically women of Mexican origin, have better birth outcomes than women in the country of origin, despite their higher risk profile [11-13].

It was in the context of immigrants from Mexico that the epidemiological paradox was first discussed. The critical epidemiologic comparison for understanding causes of the Hispanic paradox is between migrant women in the U.S. and the population from which they originate, yet little work has been done on this comparison. Thus, there are sparse data currently available to evaluate the two central competing hypotheses currently used to explain the epidemiological paradox. The first, the "healthy immigrant hypothesis," suggests that migrant women are a healthy sub-section of the population of origin, and therefore, immigrant women have better than expected birth outcomes because they have been positively selected by the migration process. The second hypothesis argues that the behavioral practices in the country of origin protect immigrant women in the U.S. from risks associated with disadvantaged socioeconomic status once in the U.S. [14]. Given the central role of the population of origin in explaining the paradox, a proper test of these hypotheses would involve a comparison of risk profiles between women living in Mexico and Mexican women who have migrated to the U.S. Of additional interest is the fact that previous reports on Hispanic immigrants from other countries in Central and South America did not show the elevated levels of low birth weight that have been observed among Mexican immigrants [14].

The protective behavioral practices of Mexican residents appear to be influenced by the process of acculturation after immigration to the U.S. The importance of examining acculturation lies in understanding potential cultural influences at work in modifying risk behaviors. On the behavioral level, acculturation influences language use, customs, dietary practices, and the behaviors one engages in. For example, acculturation has been associated with an increase of alcohol, cigarette and illicit drug use [15-26]. The degree of acculturation was found to be a major predictor of cigarette smoking among U.S. Hispanics in the HHANES [17]. Because acculturation has been shown to be significantly associated with observed changes in health-related behaviors and the development of associated diseases, it is critical to include this factor in our study of migration and subsequent changes in health.

Previous Studies

Recent analyses of U.S. vital statistics find a continued disparity for birth outcomes and infant mortality between Mexican-Americans and non-Hispanic Whites in the U.S. [27-30]. Schenker and colleagues have recently analyzed the baseline data from the Study of

Hispanic Acculturation, Reproduction and Environment (SHARE), a study of 1121 Latina women receiving prenatal care in Stockton, California from 1999-2001. Stockton has a large Mexican immigrant population, and these data captured a broad range of female immigrants from Mexico as well as U.S.-born Latinas. For instance, 295 (26%) of the Latinas surveyed were born in the U.S. and 826 (74%) were foreign-born, of whom 98% were born in Mexico. In addition, 27% of the participants chose English as their preferred language and 73% chose Spanish.

In the SHARE study, we investigated a broad range of demographic factors and risk behaviors for adverse health in this population, and found dramatic differences between U.S.-born and Mexican-born Latinas (Table 1). The mean education levels of the native and immigrant women were 11.1 years and 7.95 years respectively ($p<0.001$) [26]. Approximately 22% of the U.S. born participants had a family income over $20,000 annually, compared to 12% of foreign-born participants ($p=0.002$). U.S.-born Latinas engaged in risky health behaviors at markedly higher rates than their less acculturated Mexican-born counterparts. They were about five times more likely to have smoked cigarettes, three times more likely to have used alcohol, and thirty times more likely to have experimented with drugs [26]. They tended to have first intercourse at an early age and were three times more likely to have had multiple sexual partners, and were twice as likely to have a history of sexually transmitted diseases. This preliminary work in the SHARE study found dramatic changes in health behaviors related to risk profiles, and the results suggest that the process of acculturation appears to be closely linked to these observed changes.

By studying the process of acculturation, and particularly the determinants of health and illness in a displaced population, we hope to gain a better understanding of the impact of cultural influences that can modify the risks posed to these immigrants. The current study was undertaken with the purpose of formulating new strategies oriented towards the prevention and protection of this vulnerable group.

Table 1. Risk factors among U.S. and Mexican-born Latinas in Stockton, California.

	U.S.- Born (n=295)	Mexican-Born (n=826)
DEMOGRAPHICS		
Average Age*	22.3	26.1
Average Years In U.S.	--	6.3
Average Years of Education	11.1	7.9
Some College*	13.2%	3.5%
Ave. Persons In Household	4.6	4.8
> 6	14.3%	19.3%
Ave. Prior Pregnancies	1.99	1.84
0-1	58%	50%
2-3	25%	35%
> 3	17%	15%
WIC Participant*	70%	86%
OCCUPATIONAL RISKS		
History of Farm Work*	18%	32%
BEHAVIORAL RISKS		
History Of Smoking*	42%	10%
Current*	58%	90%
Former*	14%	5.5%
Never*	28%	4.5%
Regular Exposure To Secondhand Smoke*	91%	76%
History Of Alcohol Use*	77%	30%
History Of Drug Use*	39%	2.1%
Average Age At First Intercourse*	15.9 yrs	18.9 yrs
< 14 Yrs	27%	8%
15-18 Yrs	64%	46%
Number Of Sexual Partners*		
0-1	28%	72%
2-5	53%	27%
6-10	13%	0.7%
> 10	6%	0.3%
STD Diagnosis In Past Year	9.7%	4.8%
NUTRITION		
≥5 Servings Fruits/Day	19%	26%
≥5 Servings Veggies/Day	11%	30%
≥5 Servings Beans/Day	24%	37%
≥5 Days/Week Tortillas	46%	81%
≥3 Days/Week Fast Food	30%	7%
PSYCHOLOGICAL / OTHER RISKS		
History Of Hypertension*	3.1%	1.2%
Can't Deal With Problems In Last Month	34%	22%
Can't Rely On Family*	25%	37%
Worried About Pregnancy*	47%	33%

*p-value < 0.01

Methods

Study Organization

The study organization included two principal investigators, Marc Schenker directing efforts in California and Fernando Meneses directing study activities in Mexico. Eligibility criteria for participants were agreed upon by study personnel in both locations, and there was a coordinated effort in the development of the study instruments. Regular communication between both groups was maintained through conference calls and e-mail exchanges. The recruitment and interviewing of participants was conducted by study personnel in each location, and there were some differences in procedures used in California and Mexico.

UC Davis and INSP submitted protocols to their Institutional Review Boards according to guidelines at each institution. At UC Davis, a human subjects' protocol, including a description of the study, questionnaires and consent forms in both English and Spanish, was submitted to the UC Davis Office of Human Research Protection (OHRP) and received approval on December 29, 2003. A renewal to the protocol was submitted in 2004 and received approval from the Office of Human Research Protection. In addition, all study personnel in contact with participants completed educational courses required by the OHRP. At INSP, the study protocol was approved by the Committee of Ethics of the National Institute of Public Health and all women signed consent forms (Appendix).

Community Identification

Joint discussion by Dr. Schenker with Dr. Meneses and his team in Mexico decided that conducting study activities in Chavinda, would best serve the purposes of the study (Figure 1). In the U.S., discussions with Rick Mines and colleagues at the California Institute for Rural Studies identified Madera and Berkeley in California as receiving communities for people from Chavinda. One of the study objectives was to look at agricultural work, and since Berkeley consisted primarily of service industry work, Madera was chosen as the study site in California (Figure 2).

Figure 1. Detailed map of Chavinda, Michoacán.

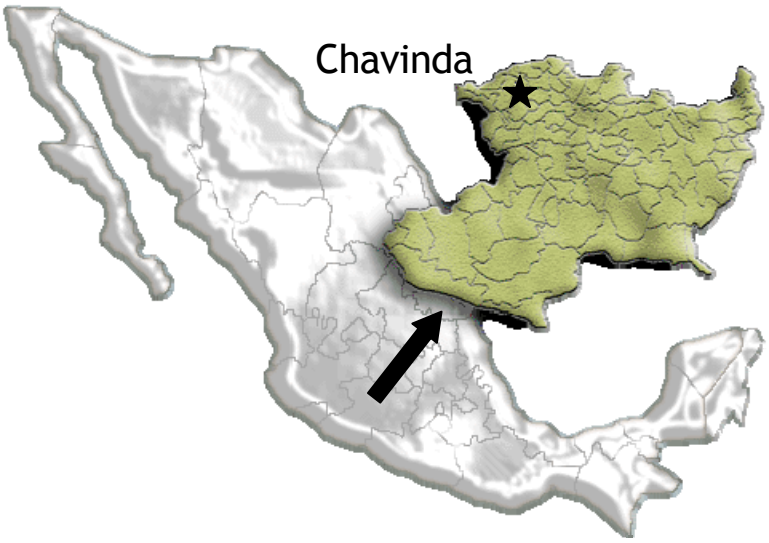
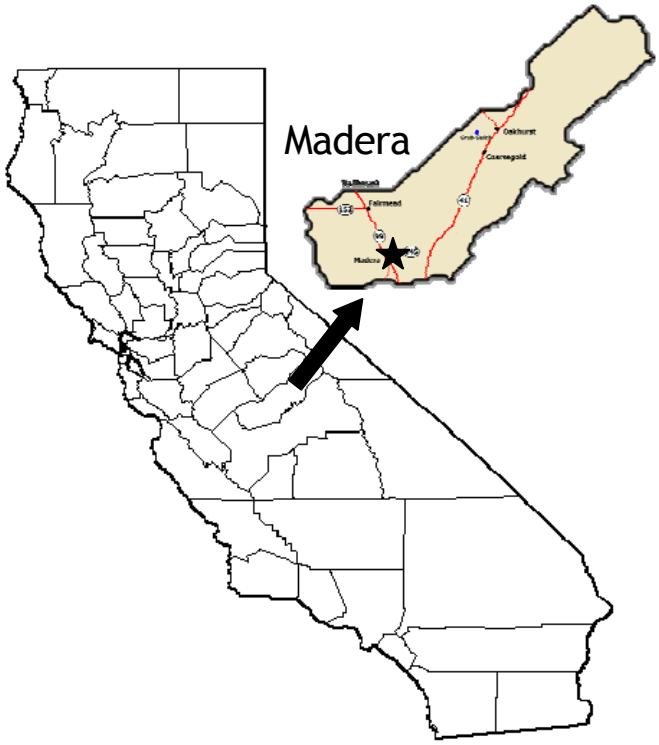


Figure 2. Detailed map of Madera, California.



Participant Recruitment

For this cross-sectional pilot study, the goal was to recruit and interview 100 women in both Chavinda and Madera. The participants were limited to women because of the funding available. The criteria for inclusion differed slightly in each of the locations. In discussions between investigators and staff at UC Davis and at INSP, the participant eligibility criteria for participants in Michoacán were defined as women between the ages of 18-49 years, born in Chavinda, Michoacán, and who had never previously emigrated. In California, the criteria were defined as women between the ages of 18-45 years, born in Chavinda or lived at least 10 years in Chavinda, lived in the U.S. for at least six months, and currently residing in Madera, California at the time of the interview.

In Chavinda, the universe was the population of 5,558 inhabitants (1538 homes), 102 non-immigrant women between the ages of 18 to 49 were randomly selected from the population census made between April and May 2004.

We initially planned to use a household enumeration procedure for recruitment of participants living in Madera, but because we were interested in women just from Chavinda, we decided that using a network sampling scheme would be more efficient. Initial contacts were made in the community through the Darin M. Camarena Health Clinic's "Concilio de Campesinos," other local health service organizations and migrant housing programs. These contacts led to a network of women connected within the community who linked the field team with potential participants for the study.

In Madera, potential participants were contacted by telephone and the project was explained to them. During this phone conversation, the field coordinator would set up a time to obtain consent and conduct the interview. The field coordinator and interviewers would then meet with the participant at their home, explain the project in detail and go over the consent forms and answer any questions. After consent was obtained, the questionnaire was administered. In some cases, consent was obtained and the interview was scheduled for a later date/time at the participant's convenience.

Data Collection Instruments

Questionnaire assessment

All data collection was conducted in Chavinda and Madera by local field teams and consisted of an interviewer-administered questionnaire. All questions were in Spanish and the questionnaire was administered by trained interviewers fluent in Spanish. The questionnaire collected information on demographic characteristics; household composition; acculturation; occupational history; women's health and reproductive issues; tobacco, alcohol and drug use; dietary patterns; physical activity; use of medical/dental services; and respiratory and mental health outcomes.

Screening tests (Chavinda only)

After the interview, each of the women was given an appointment card for their scheduled screening tests. They were each tested for cervical cancer, diabetes and asthma.

Pap smear

A trained nurse following standard techniques collected endo- and exo-cervical specimens from each woman. The samples were fixed, stained and evaluated by two cytopathologists, one from the local hospital and one from the National Institute of Cancer in Mexico City. The histological findings were classified according to the Bethesda System. The results of both pathological evaluations were totally concordant.

Test of glycosylated hemoglobin

A blood sample of each participant was taken to determine the average level of glucose in the blood in the last six to eight weeks. The determination of the hemoglobin A1C was done using disposable equipment (AcNOW). Values higher than 8.0 mg/dl were considered abnormal.

Spirometry test

A trained physician conducted the spirometric tests for each participant and followed standard techniques for the test's application. The spirometer used was previously calibrated and the registered data were obtained by means of the computer program EASY WARE™ (Germany). For the analysis of results, we considered a value equal to or higher than 80% of the FEV1 value as normal.

Participants with an abnormal value in any screening tests were informed and referred to the health center for diagnosis and treatment.

Results

Characteristics of Chavinda, Michoacán Participants

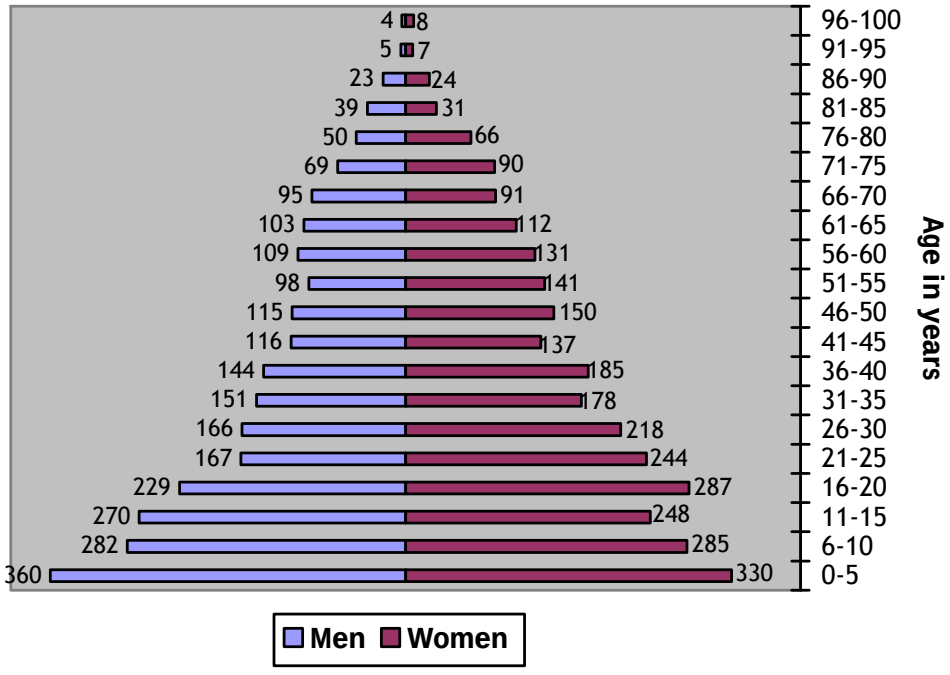
Following the methodology of the Mexican National Census for the year 2000, a Poverty Index was constructed in which the following socioeconomic variables were combined: overcrowding, sex, schooling and age of the head of household, number of children in the home, sanitary service, number of floors in the house, stationary gas, refrigerator, washing machine, number of vehicles and region. The results were grouped into three categories: below the poverty line, near the poverty line, and above the poverty line.

In the descriptive analysis, averages, standard deviation and proportions were included. In addition to the general description of the participants, stratification by age was proposed in the analysis. Two categories were chosen: young adult women (18-34 years) and adult women (35-49 years). T-tests were used to compare the differences in age between the women who reported an immigrant husband and those that reported another immigrant relative. Chi-square and exact tests of Fisher were used to compare the proportions.

Census

In agreement with the census, Chavinda has 5,558 inhabitants (average age: 31.5 years), grouped into 1,538 homes. We calculated an index of 3.6 inhabitants per home. The population was 53.3% women and 46.7% men. The total population of women 18-49 years of age in Chavinda was 1,242 (Figure 3). Of that group 14% (174) had migrated previously and 86% (1,068) had not. The study population was selected from the group of non-immigrants.

Figure 3. Structure of the population by age and sex, Chavinda, Michoacán 2004



Sociodemographic characteristics

Table 2 shows the sociodemographic characteristics of the participants in Chavinda, Michoacán. The average age was 31.8 years (SD ± 9.1 years). 74.5% of the women were married. 64.7% had completed at least a primary education and 4.9% had no formal education. When we compared women in the younger and older age groups, older women were more likely to have had no formal education. There were no other differences by age for other demographic characteristics.

Table 2. Demographic characteristics of Chavinda, Michoacán participants

		Age group (years)		
Variable	**Total (N=102)**	**18-34 (n=60)**	**35-49 (n=42)**	**p-value***
Age in years - average (SD)	31.8 (9.1)	25.4 (4.9)	41.1 (4.3)	N/A
Marital status				
Single (includes widowed)	25.5 (26)	30.0 (18)	19.1 (8)	
Married (includes living together)	74.5 (76)	70.0 (42)	80.9 (34)	0.154 [b]
Education level				
No education	4.9 (5)	0	11.9 (5)	
Primary	64.7 (66)	63.3 (38)	66.7 (28)	
Greater than primary	30.4 (31)	36.7 (22)	21.4 (9)	0.0107 [a]
Migrant relatives				
Yes	31.4 (32)	20.0 (12)	47.6 (20)	0.118 [a]
Relation with migrant	(n=32)			
Spouse or partner	34.4 (11)	33.3 (4)	35.0 (7)	
Other	65.6 (21)	66.7 (8)	65.0 (13)	0.617 [b]
Number of migrant relatives				
1 – 3	24.5 (25)	15.0 (9)	38.1 (16)	
4 or more	6.9 (7)	5.0 (3)	9.5 (4)	0.535 [b]
Socioeconomic index				
Below poverty line	11.8 (12)	13.3 (8)	9.5 (4)	
Near poverty line	12.7 (13)	15.0 (9)	9.5 (4)	
Above poverty line	75.5 (77)	71.7 (43)	81.0 (34)	0.558 [a]
Work outside the home				
Yes	20.6 (21)	23.3 (14)	16.7 (7)	0.727 [a]

[a] p-value from evaluating association by means of Chi-square test
[b] p-value from evaluating association by means of Fisher's exact test

In agreement with the established poverty index, 11.8% of the women were classified as living below the poverty line and 12.7% near the poverty line. 31.4% of the women reported having migrant relatives, and 21.6% of these women had received economic remittances from the relatives. Among migrant relatives, 90.6% had migrated to California. 93.1% of the women reported having indoor plumbing. 51% had between four and six electric household appliances and 96.1% cooked on a gas stove. 20.6% of the women reported working outside of the home and of this group, 2.0% had worked in agriculture.

Health history and screening tests

In relation to the use of health services, 60.8% of the women had sought medical attention in the last two years. Of this group, 16.1% used the Secretary of Health (SSA). When investigating antecedents of chronic diseases, 12.7% reported hypertension (high blood pressure), of these 46% take medication to control their hypertension and 69.2% have medical check-ups. None of the participants reported diabetes. However, 65 women

underwent a screening test for diabetes and we detected one woman (1.5%) with a glycosylated hemoglobin level greater than 8.0 mg/dl (Table 3).

Of the total number of participants, 51% reported never having a pap smear. Of the women who had a previous pap smear, 21.6% had not done it in the last 12 months (Table 3). Forty-four women underwent the cervical cancer screening test, and a low-grade intraepithelial lesion (LGSIL) was detected in one woman. None of the women reported a prior history of asthma and 62 women underwent a spirometry test as part of the study. Of those, one woman had abnormal values. In general, the different age groups did not show any significant differences when comparing illness characteristics.

Table 3. Distribution of variables related to chronic illness (Chavinda population)

		Age group (years)		
Variable	**Total (N=102)**	**18-34 (n=60)**	**35-49 (n=42)**	**p-value***
History of diabetes				
No	100.0 (102)	100.0 (60)	100.0 (42)	N/A
Glycosylated hemoglobin screening	(n=65)			
Normal results	98.5 (64)	100.0 (38)	96.3 (26)	
Abnormal results	1.5 (1)	0	3.7 (1)	0.415 [b]
History of hypertension				
Yes	12.7 (13)	8.3 (5)	19.1 (8)	0.321 [a]
Monitored by doctor	69.2 (9)	60.0 (3)	75.0 (6)	0.289 [a]
Currently taking medication	46.6 (6)	60.0 (3)	37.5 (3)	0.255 [a]
History of asthma				
No	100.0 (102)	100.0 (60)	100.0 (42)	N/A
Spirometry screening	(n=62)			
Normal results	98.4 (61)	97.4 (37)	100.0 (24)	
Abnormal results	1.6 (1)	2.6 (1)	0	0.613 [b]
Previous pap smear				
Never	51.0 (52)	58.3 (35)	40.5 (17)	
Yes, but not within last 12 months	21.6 (22)	20.0 (12)	23.8 (10)	
Yes, within last 12 months	27.4 (28)	21.7 (13)	35.7 (15)	0.175 [a]
Pap smear screening	(n=44)			
Normal results	97.7 (43)	100.0 (21)	95.7 (22)	
Abnormal results	2.3 (1)	0	4.3 (1)	0.523 [b]

[a] p-value from evaluating association by means of Chi-square test
[b] p-value from evaluating association by means of Fisher's exact test

Health knowledge

To determine the general level of health knowledge of participants, some basic questions relating to reproductive health and cancer (particularly cervical and breast cancer) were included in the questionnaire. Based on the number of correct answers, three levels of knowledge were derived: low (one correct answer), medium (two to three correct answers), and high (more than three correct answers). In general, 71.6% of the participants demonstrated a high knowledge of reproductive health and 58.8% a high knowledge of cancer. There were no significant differences when comparing younger and older women (Table 4).

Table 4. Distribution of knowledge about reproductive health and cancer (Chavinda population)

		Age group (years)		
General knowledge	Total (N=102)	18-34 (n=60)	35-49 (n=42)	p-value [a]
Reproductive health				
Low	7.8 (8)	6.7 (4)	9.5 (4)	
Medium	20.6 (21)	18.3 (11)	23.8 (10)	
High	71.6 (73)	75.0 (45)	66.7 (28)	0.652
Cancer				
Low	21.6 (22)	25.0 (15)	16.7 (7)	
Medium	19.6 (20)	18.3 (11)	21.4 (9)	
High	58.8 (60)	56.7 (34)	61.9 (26)	0.597

[a] p-value from evaluating association by means of Chi-square test

Health and behavioral risks

In relation to behavioral risk factors, 4.9% of the women reported prior and present use of tobacco and 8.8% reported prior alcohol consumption. Women in the older age group were more likely to have smoked and report prior alcohol use, however, the differences were not statistically significant. There was no report of illicit drug use (Table 5). With respect to prior use of contraceptives, 43.2% of the women reported using the same method, Bilateral Tubal Occlusion (BTO).

The average age of first sexual relation was 21 years of age, the average number of children per woman was 1.4 and the average number of sexual partners was 1.1. Among sexually active women, only 2.8% reported having had a sexually transmitted disease (Table 5).

Table 5. Distribution of health risk characteristics of Chavinda, Michoacán participants

		Age group (years)		
Variable	Total (N=102)	18-34 (n=60)	35-49 (n=42)	p-value [b]
Ever smoked [a]				
No	95.1 (97)	98.3 (59)	90.5 (38)	
Yes	4.9 (5)	1.7 (1)	9.5 (4)	0.091
Current smoker				
No	95.1 (97)	98.3 (59)	90.5 (38)	
Yes	4.9 (5)	1.7 (1)	9.5 (4)	0.091
Prior alcohol use [c]				
No	91.2 (93)	95.0 (57)	85.7 (36)	
Yes	8.8 (9)	5.0 (3)	14.3 (6)	0.103
Prior illegal drug use				
No	100.0 (102)	100.0 (60)	100.0 (42)	N/A
Prior use of contraceptives	(n=81)	(n=44)	(n=37)	
No	56.8 (46)	52.8 (23)	62.2 (23)	
Yes	43.2 (35)	47.7 (21)	37.8 (14)	0.252
History of STD's	(n=81)	(n=44)	(n=37)	
No	97.2 (69)	100.0 (37)	94.1 (32)	
Yes	2.8 (2)	0	5.9 (2)	0.226

[a] Ever smoked was defined as having smoked at least 100 cigarettes in lifetime.
[b] p-value from evaluating association by means of Fisher's exact test.
[c] Prior alcohol use was defined as having consumed at least 12 alcoholic beverages in lifetime.

Comparisons among women reporting immigrant relatives

To determine whether internal differences existed among participants who reported immigrant relatives (n=32), two groups were chosen for comparison: those who reported that their husband (or partner) is migrant (34.4%) and those who reported that the migrant is another member of the family (65.6%). Table 6 summarizes the main findings. In general, there were no significant differences between groups. The exception is in the percentage of women who work outside of the home; in the group in which the husband or partner is the migrant, there are no women who reported working, while in the group in which another family member is the migrant, 14.3% of the women reported working. This information suggests an economic dependence on the migrant spouse.

Table 6. Distribution of risk factors according to migrant relative relationship

		Migrant family member		
Variable	**Total (N=32)**	**Spouse (n=11)**	**Other (n=21)**	**p-value**
Age in years - average (SD)	34.7 (10.1)	34.1 (7.5)	34.6 (11.5)	0.882 [c]
Education level (primary)	71.9 (23)	72.7 (8)	71.4 (15)	0.890 [a]
Socioeconomic index				
Below poverty line	12.5 (4)	18.2 (2)	9.5 (2)	
Near poverty line	9.4 (3)	0	14.3 (3)	
Above poverty line	78.1 (25)	81.8 (9)	76.2 (16)	0.362 [a]
Previously worked	15.6 (5)	0	23.8 (5)	
Ever smoked [a]				
No	87.5 (28)	90.9 (10)	85.7 (18)	
Yes	12.5 (4)	9.1 (1)	14.3 (3)	0.573 [b]
Prior alcohol use [c]				
No	90.6 (29)	90.9 (10)	90.5 (19)	
Yes	9.4 (3)	9.1 (1)	9.5 (2)	0. 734 [b]
Prior illegal drug use				
No	100.0 (32)	100.0 (11)	100.0 (21)	N/A
History of asthma				
No	100.0 (32)	100.0 (11)	100.0 (21)	N/A
History of diabetes				
No	100.0 (32)	100.0 (11)	100.0 (21)	N/A
History of hypertension				
No	87.5 (28)	100.0 (11)	81.0 (17)	
Yes	12.5 (4)	0	19.0 (4)	0.166 [b]
Previous pap smear				
No	59.4 (19)	45.5 (5)	66.7 (14)	
Yes	40.6 (13)	54.5 (6)	33.3 (7)	0.217 [b]
History of STD's				
No	96.8 (31)	91.0 (10)	100.0 (21)	
Yes	3.2 (1)	9.0 (1)	0	0.344 [b]

[a] p-value from evaluating association by means of Chi-square test
[b] p-value from evaluating association by means of Fisher's exact test
[c] p-value from evaluation association by means of t-test

Characteristics of Madera, California Participants

Sociodemographic characteristics

Ninety-three women were interviewed in Madera, California. The average of age participants was 32 years. Almost 84% were married. Ninety-nine percent were born in Mexico, and 18% had attended school in the U.S. Women in the younger age group were more likely to have attended school in the U.S. and were more likely to be married. Most of the participants had less than a high school education level (Table 7).

Table 7. Demographic characteristics of Madera, California participants

		Age group (years)		
Variable	**Total (N=93)**	**18-34 (n=56)**	**35-45 (n=37)**	**p-value[a]**
Age				
18 – 34 years	60.2 (56)	N/A	N/A	N/A
35 – 45 years	39.8 (37)			
Marital status				
Single (includes widowed)	16.1 (15)	10.7 (6)	24.3 (9)	
Married (includes living together)	83.9 (78)	89.3 (50)	75.7 (28)	0.081
Country of birth				
Mexico	98.9 (92)	98.2 (55)	100.0 (37)	
Other	1.1 (1)	1.8 (1)	0	0.414
Attended school in the U.S.				
Yes	18.3 (17)	25.0 (14)	8.1 (3)	
No	81.7 (76)	75.0 (42)	91.9 (34)	0.039
Education level				
Less than high school graduate	75.3 (70)	71.4 (40)	81.1 (30)	
High school graduate or higher	24.7 (23)	28.6 (16)	18.9 (7)	0.291
Acculturation level (missing = 7)				
Low	83.9 (71)	84.6 (44)	82.9 (29)	
Medium/high	16.1 (14)	15.4 (8)	17.1 (6)	0.827
Family living in Mexico				
Yes	8.6 (8)	7.1 (4)	10.8 (4)	
No	91.4 (85)	92.9 (52)	89.2 (33)	0.537

[a]p-value indicates significance of differences by age group

Work characteristics

The majority of the women (67.7%) had worked outside of the home for at least 20 hours per week at some time in their lives, and 48.4% had worked outside of the home in the last 12 months. For women who had worked in the last 12 months, the mean salary was an average of $1,022 per month, with a standard deviation of $721. The median reported salary was $880 per month. Additionally, all women were also asked if they had ever worked in agriculture outside of the home, either with or without pay. Of those who had worked in agriculture (55.9%), 37.4% reported that they had been exposed to pesticides and women in the older age group were more likely to report exposure to pesticides (Table 8).

Table 8. Work characteristics of the Madera, California participants

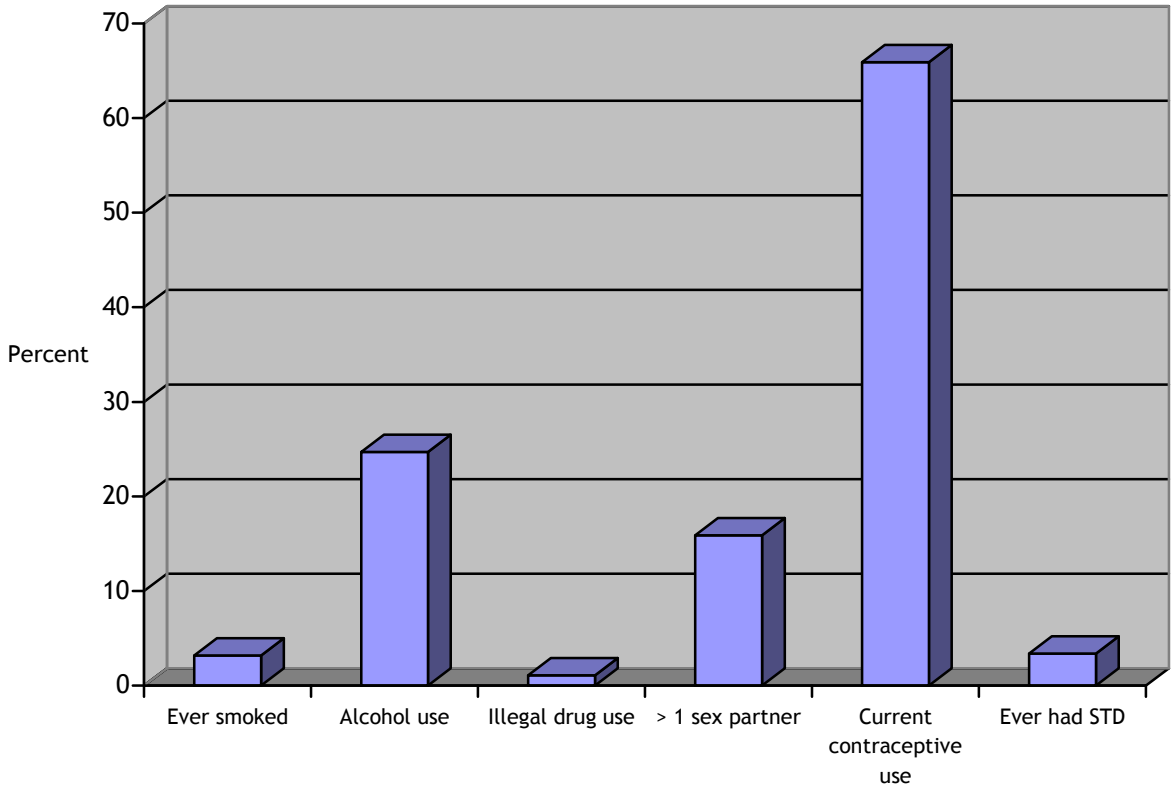
		Age group (years)		
Variable	**Total (N=93)**	**18-34 (n=56)**	**35-45 (n=37)**	**p-value[a]**
Ever worked				
Yes	67.7 (63)	66.1 (37)	70.2 (26)	
No	32.3 (30)	33.9 (19)	29.7 (11)	0.6716
Ever worked in agriculture				
Yes	55.9 (52)	53.6 (30)	59.5 (22)	
No	44.1 (41)	46.4 (26)	40.5 (15)	0.5756
Exposed to pesticides				
Yes	37.7 (20)	26.7 (8)	52.2 (12)	
No/don't know	62.3 (33)	73.3 (22)	47.8 (11)	0.0649
Monthly salary				
< $1000 per month	55.8 (24)	55.6 (15)	56.3 (9)	
≥ $1000 per month	44.2 (19)	44.4 (12)	43.7 (7)	0.9646

[a]p-value indicates significance of differences by age group

Health and behavioral risks

The prevalence of high risk health behaviors was relatively low in this population (Figure 4). Only 3.2% of participants reported having smoked at least 100 cigarettes in their lifetime ("Ever smoked") and there were very few illegal drug users, 1.1%, ("Drug use"). Less than one quarter of the participants reported that they had consumed at least 12 alcoholic beverages in their lives ("Alcohol use"). Of persons who reported sexual activity (n=88), only 16% reported having more than one sexual partner.

Figure 4. Health risk characteristics of the Madera, California participants



Acculturation

Acculturation scores were calculated only for the Madera participants and were determined using a 12-item version of the Acculturation Rating Scale for Mexican Americans-II (ARSMA-II) developed by Cuéllar and colleagues [31, 32]. The ARSMA-II instrument measures language use and preference, ethnic identity, ethnic behaviors and ethnic interaction through the use of a Mexican-oriented scale (MOS) and an Anglo-oriented scale (AOS). Responses to each question range from "not at all" (response score = 1) to "extremely often or almost always" (response score = 5). The MOS questions and AOS questions were summed separately and a mean calculated for each orientation scale. A raw acculturation score was calculated for each participant by subtracting the MOS mean from the AOS mean; scores ranged from -4 to +1.33. Criteria for determining levels of acculturation were based on mean and standard deviation scores from the ARSMA-II validation study [31, 33]. The ARSMA-II identified five acculturation levels and their corresponding scores as seen in Table 9.

Table 9. Scores for determining acculturation level using ARSMA-II

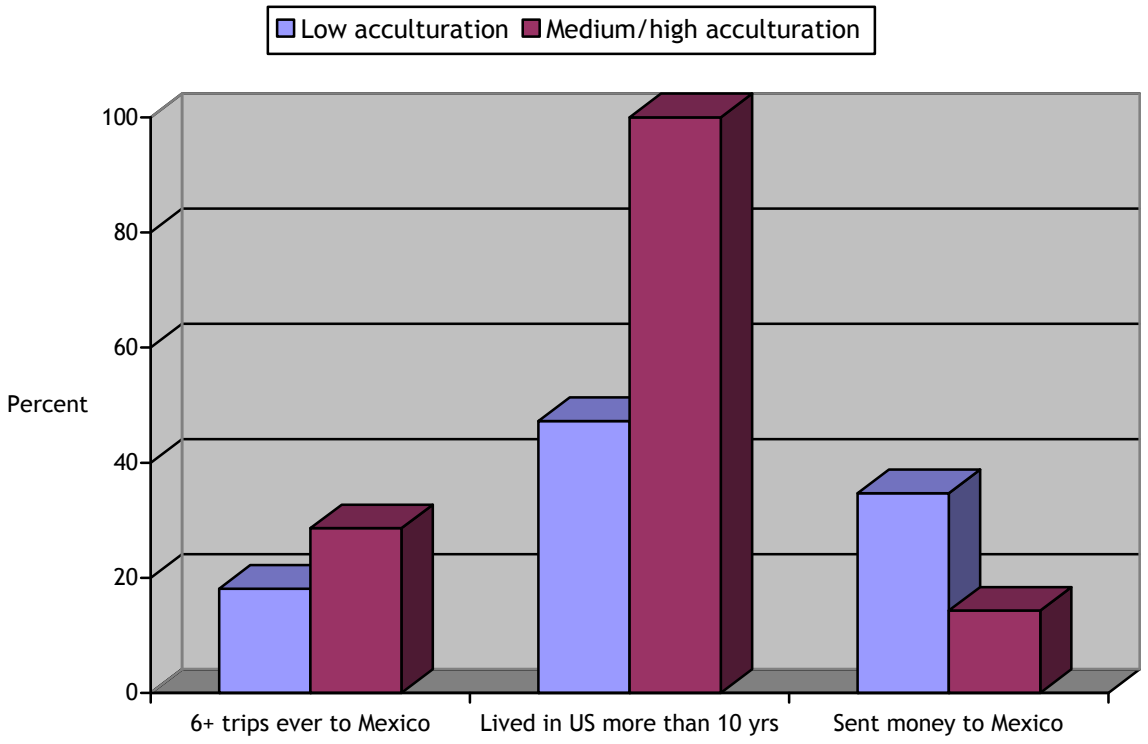
Acculturation level	Description	ARSMA-II acculturation score
Level I	Very Mexican oriented	< -1.33
Level II	Mexican oriented to approximately balanced bicultural	≥ -1.33 and ≤ -0.07
Level III	Slightly Anglo oriented bicultural	> 0.07 and < 1.19
Level IV	Strongly Anglo oriented	≥ 1.19 and < 2.45
Level V	Very assimilated; Anglicized	> 2.45

We were unable to calculate acculturation scores for seven women due to missing data. There were 71 women in the Level I category, six women at Level II, eight women at Level III and one woman at Level IV. There were no women in the Level V category. Because there were relatively few women in levels II through V, we collapsed levels II and III to create a "medium acculturation" category and levels IV and V to a "high acculturation" category. Based on these categories 83% of women were considered "low" acculturated, 16% "medium" acculturated and one percent (n=1) was classified as "high" acculturated. Because of the small sample size at the high acculturation level, the medium and high categories were collapsed into one for the purpose of analysis.

Participants were asked about the number of times they had visited Mexico since moving to the U.S.; persons at the higher acculturation levels were more likely to have made more than six trips back to Mexico, although the difference was not statistically significant (Figure 5). The mean number of trips to Mexico among low acculturated women was 3.2 trips (SD ± 4.2), with a median of 1.5 trips. Women at the medium/high acculturation level had a mean number of 4.2 trips to Mexico (SD ± 3.2), with a median of four trips.

Participants reported that they had lived in the U.S. an average of 12.8 years. Women at medium/high acculturation levels were statistically more likely to have lived in the U.S. for more than ten years (p=0.0006). Among women at the low acculturation level who had sent money to Mexico in the last 12 months (n=25), the mean amount was $568 (SD ± $507) and the median amount was $300. For women at the medium/high acculturation level who sent money in the last 12 months (n=2), the mean amount was $450 (SD ± $71). While 57% reported that they had traveled to Mexico in the last year, only 33% said that they sent money back to Mexico.

Figure 5. Acculturative characteristics of the Madera, California participants

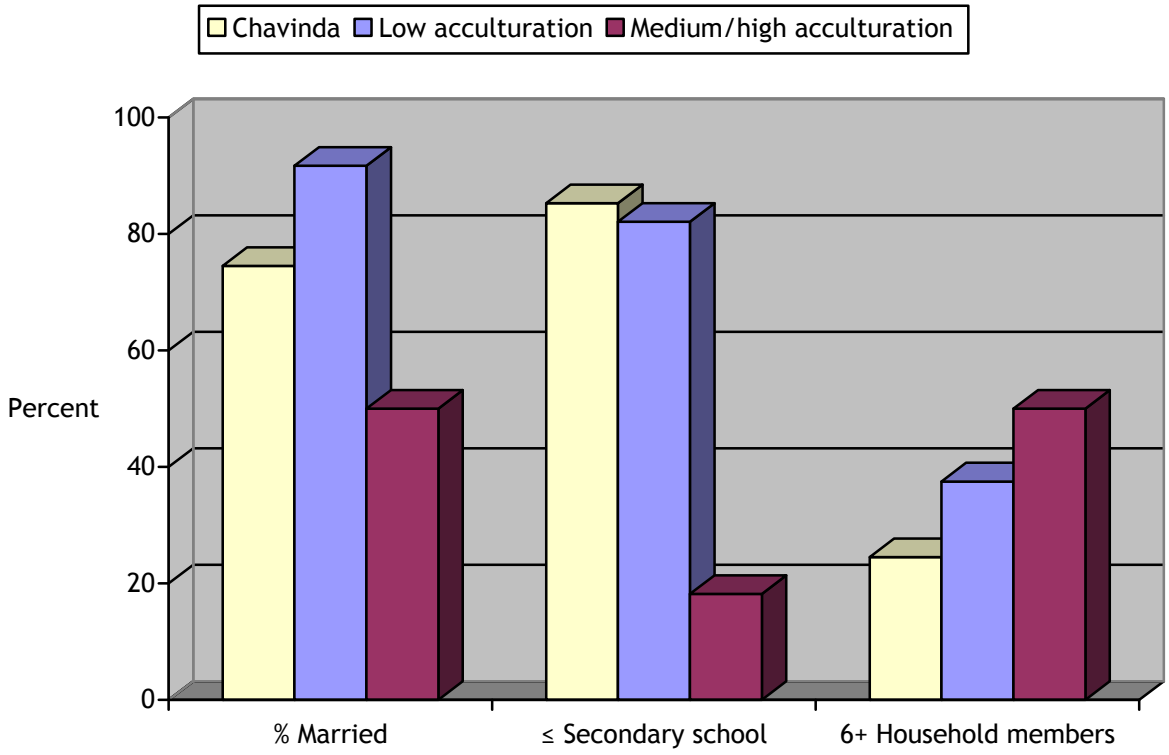


Bi-national Comparisons -- Chavinda and Madera Participants

Sociodemographic characteristics

In Chavinda, 102 women were interviewed and were included in these bi-national comparisons. For these comparisons, women in the U.S. were stratified on acculturation (low acculturation and medium/high acculturation). The mean ages of women living in Chavinda and low acculturated women living in the U.S. was 32 years and for medium/high acculturated women living in the U.S. the mean age was 31 years. Medium/high acculturated women living in the U.S. were more likely to be single (includes widowed) and have higher education levels than less acculturated U.S. women or women from Chavinda (Figure 6).

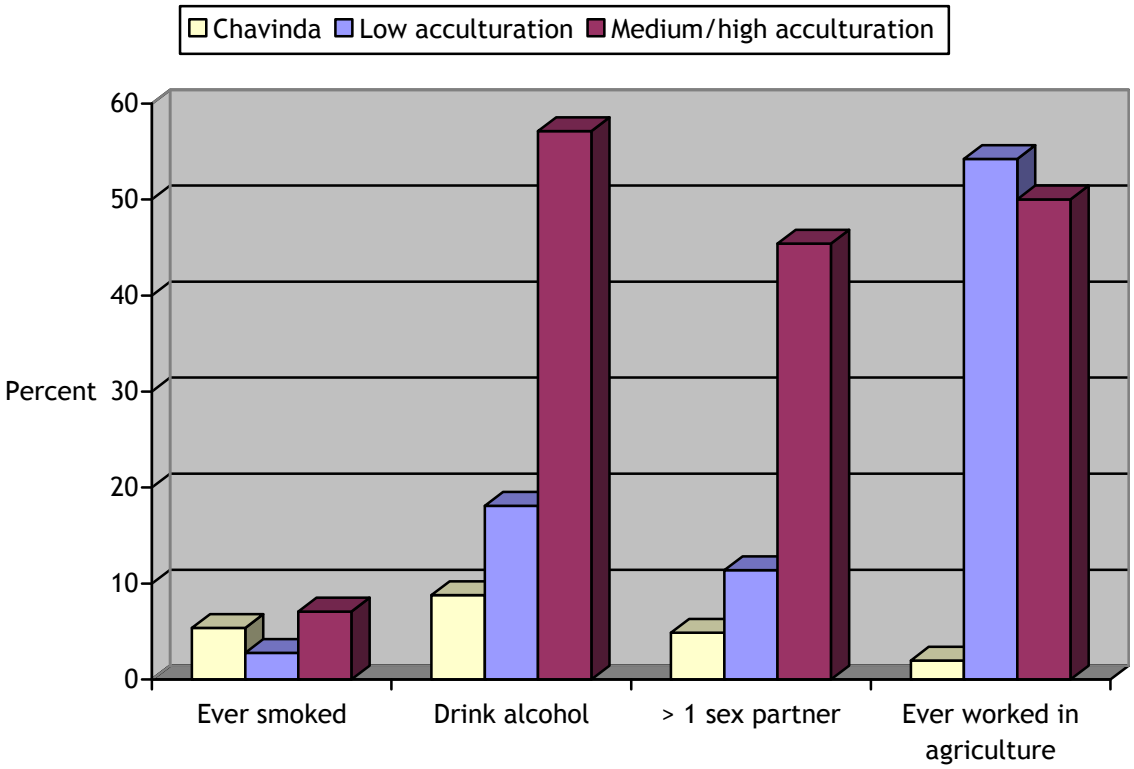
Figure 6. Bi-national comparisons of demographic characteristics



Health and behavioral risks

Participants were compared on risk behaviors that may influence health outcomes (Figure 7). Medium/high acculturated women living in the U.S. were more likely to have reported drinking at least 12 alcoholic beverages in their lifetime and to have had more than one sexual partner (among women reporting sexual activity) compared to both low acculturated women in the U.S. and women living in Chavinda. Women living in the U.S., regardless of acculturation level, were more likely than women from Chavinda to have worked in agriculture at some time in their lives.

Figure 7. Bi-national comparisons of risk behaviors



Discussion and Conclusions

This study provided a unique opportunity to conduct a bi-national study and collect data from women living in Chavinda who have never traveled to the U.S., as well as from women who have migrated to the U.S. from Chavinda, to investigate factors related to theories of selective migration versus acculturation. This bi-national approach has not previously been done, and it was our intent to better understand the Hispanic epidemiological paradox and account for differences seen in health outcomes among Latina women. In Chavinda, Michoacán we interviewed 102 women, and 93 women in Madera, California participated in the study and were interviewed.

Sociodemographic characteristics

In terms of sociodemographic characteristics, there were similarities between the Chavinda and Madera samples. We attempted to recruit women in similar age ranges and approximately 60% of the women in each location were in the younger age group (between the ages of 18 and 34), and 40% in each location were in the older age group (between the ages of 35 and 45 in Madera and 35 and 49 in Chavinda). Among women in Chavinda, only education showed a difference by age, with older women more likely to have had no formal education. Among the Madera participants, there were several factors that differed by age. Younger women were more likely to have attended school in the U.S. and slightly more likely to be married. We found that where there were differences on demographic characteristics, women in Chavinda and low acculturated women in Madera were likely to be similar to each other but these groups differed from more highly acculturated women living in Madera. This trend was found for marital status, education and number of members in the household. For example, women in Chavinda and "low acculturated" women in Madera were statistically more likely to be married than their medium/high acculturated counterparts.

Among the women living in Madera, age and acculturation level were strongly associated with the number of years living in the U.S. Age was also strongly associated with number of years living in the U.S. Therefore, it is difficult to determine which of these factors more heavily account for the differences seen among women living in the U.S.

Work characteristics

Women currently living in Madera were much more likely to have worked in agriculture than women in Chavinda, regardless of age group or acculturation status. This result is plausible given the understanding that most of the women who immigrate to the U.S. do so in order to find a better life. Agricultural work has historically been the primary entry-level occupation for these immigrant women, especially among those coming to California.

Health behaviors

Most of the women in Chavinda had an acceptable level of general knowledge in reproductive health and cancer. Several chronic health conditions were evaluated, and overall, women in the Chavinda population had a low prevalence of these conditions. In the U.S., "low acculturated" women tend to have similar health risk behavior profiles as women living in Chavinda. The risk profiles of medium/high acculturated women differed from that of the other two groups because as women became more educated, they tended to engage in high-risk behaviors with increasing levels of acculturation. This trend was seen most consistently with alcohol consumption and sexual practices and less with smoking in this sample.

Our preliminary pilot data suggests that process of acculturation has a more powerful impact on the observed changes in health status and health behavior when people migrate to the U.S., and the theory of selective migration seems less likely to account for these differences. This explanation is further strengthened by the results showing similar prevalences in health risk behaviors among low acculturated U.S. women and women living in Chavinda and increasing prevalences among the high acculturated U.S. women.

When women immigrate to the U.S., acculturation is a normal process. However, this study does not allow us to make any definitive statements about the trajectory or speed of this process. Nevertheless, our findings can suggest directions for successful prevention programs that would target women at greatest risk for adopting unhealthy behaviors.

Funding and proposals resulting from pilot project

We have obtained additional funding to support a larger study to build upon the research we did in this pilot study.

- PI: Marc B. Schenker, $300,000 National Institute for Occupational Safety and Health, Agricultural and Environmental Health for California's Hired Farm Workers, Project period: October 1, 2004 – September 30, 2006.

- PI: Marc B. Schenker, $552,000 The California Endowment, Mexican Immigration to California: Agricultural Safety and Acculturation (MICASA), Project period: March 2005 – March 2007.

We have also prepared and submitted the following proposal to obtain additional funding to support efforts in the area of Mexican migration and health.

- PI: Marc B. Schenker, Acculturation, Smoking and California's Mexican Immigrants, Submitted to the Tobacco-Related Diseases Research Program for $510,000 over a three year period.

Publications and presentations

The following presentations related to the project have been done.

- Tamara E. Hennessy, *Agricultural Work, Acculturation and Migration In Female Mexican Migrants*, Western Regional Agricultural Safety and Health Conference "Cultivating a Sustainable Agricultural Workplace," September 12-14, 2004, Troutdale, Oregon.

- Marc B. Schenker, *Determinants of Health and Disease Among Mexican Migrants to California,* Instituto Nacional de Salud Pública - XI Congreso de Investigación en Salud Pública "Salud Y Protección Social," March 2-4, 2005, Cuernavaca, Mexico.

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