HHS Public Access

Author manuscript

Womens Health Issues. Author manuscript; available in PMC 2016 February 03.

Published in final edited form as:

Womens Health Issues. 2015 ; 25(5): 494–500. doi:10.1016/j.whi.2015.05.011.

Acculturation, Behavioral Factors, and Family History of Breast Cancer among Mexican and Mexican-American Women

Jesse N. Nodora, DrPH[a,*], **Renee Cooper, MPH**[b], **Gregory A. Talavera, MD, MPH**[b], **Linda Gallo, PhD**[c], **María Mercedes Meza Montenegro, PhD**[d], **Ian Komenaka, MD**[e], **Loki Natarajan, PhD**[a], **Luis Enrique Gutierrez Millán, PhD**[f], **Adrian Daneri-Navarro, PhD**[g], **Melissa Bondy, PhD**[h], **Abenaa Brewster, MD**[i], **Patricia Thompson, PhD**[j], and **María Elena Martinez, PhD**[a]

[a]Moores Cancer Center, University of California, San Diego, La Jolla, California

[b]Graduate School of Public Health, San Diego State University, Graduate School of Public Health, San Diego, California

[c]Department of Psychology, San Diego State University, Graduate School of Public Health, San Diego, California

[d]Ambiente y Salud, Instituto Tecnologico de Sonora, Ciudad Obregon, Mexico

[e]Department of Surgery, Maricopa Medical Center, Phoenix, Arizona

[f]Departamento de Investigaciones Científicas y Tecnologicas, University of Sonora, Hermosillo, Mexico

[g]Centro Universitario de Ciencias de la Salud, University of Guadalajara, Guadalajara, Mexico

[h]Department of Pediatrics, Dan L. Duncan Cancer Center, Baylor College of Medicine, Houston, Texas

[i]University of Texas M.D. Anderson Cancer Center, Houston, Texas

[j]Arizona Cancer Center, University of Arizona, Tucson, Arizona

Abstract

Background—Incidence rates for breast cancer are higher among Mexican-American (MA) women in the United States than women living in Mexico. Studies have shown higher prevalence of breast cancer risk factors in more acculturated than less acculturated Hispanic/Latinas in the United States. We compared the prevalence of behavioral risk factors and family history of breast cancer by level of acculturation and country of residence in women of Mexican descent.

Methods—Data were collected from 1,201 newly diagnosed breast cancer patients living in Mexico (n = 581) and MAs in the United States (n = 620). MA participants were categorized into three acculturation groups (Spanish dominant, bilingual, and English dominant); women living in Mexico were used as the referent group. The prevalence of behavioral risk factors and family

[*]Correspondence to: Jesse N. Nodora, DrPH, Moores UCSD Cancer Center, 3855 Health Sciences Drive, #0901, La Jolla, CA 92093-0901. Phone: 858 822-3686; fax: 858 822-2399. jnodora@ucsd.edu (J.N. Nodora).

The authors have no conflicts to disclose.

history of breast cancer were assessed according to acculturation level, adjusting for age at diagnosis and education.

Results—In the adjusted models, bilingual and English-dominant MAs were significantly more likely to have a body mass index of 30 kg/m^2 or greater, consume more than one alcoholic beverage a week, and report having a family history of breast cancer than women living in Mexico. All three U.S. acculturation groups were significantly more likely to have lower total energy expenditure (≤533 kcal/d) than women in Mexico. English-dominant women were significantly less likely to ever smoke cigarettes than the Mexican group.

Conclusions—Our findings add to the limited scientific literature on the relationships among acculturation, health behavior, and family history of breast cancer in Mexican and MA women.

Breast cancer is the most commonly diagnosed cancer in Hispanic/Latina women in the United States (American Cancer Society [ACS], 2012). Although women from this ethnic group have a lower incidence of breast cancer (91.1 per 100,000) than non-Hispanic White (NHW) women (127.3 per 100,000; Siegel, Ma, Zou, & Jemal, 2014), they present less frequently with localized disease (ACS, 2012), and their risk of dying from breast cancer is higher compared with NHW women, even after adjustment for age and stage (Jemal et al., 2004), and after adjustment for age, stage, treatment, and hormone receptor tumor status (Ooi, Martinez & Li, 2011). Lower survival rates in Hispanic/Latina women could be attributed to a variety of factors including lower rates of preventative screening and delayed follow-up of abnormal screening tests (ACS, 2012), higher prevalence of poor prognostic factors (e.g., younger age at diagnosis, unfavorable tumor subtypes; ACS, 2012; Ooi et al., 2011), or lack of access to appropriate treatment after diagnosis (ACS, 2012; Siegel et al., 2014).

Risk for breast cancer varies among Hispanic/Latina women by country of origin and acculturation (John, Phipps, Davis, & Koo, 2005; Keegan et al., 2010). According to John et al. (2005), breast cancer risk is significantly lower in foreign-born compared with U.S.-born Hispanic/Latina women; furthermore, risk increases with each successive year lived in the United States. Arguably, changes in breast cancer risk within the same racial/ethnic group cannot be explained by genetic differences alone and are likely influenced by other risk factors, including behavioral and reproductive factors (Slattery et al., 2012).

According to the ACS (2011), physical inactivity, post-menopausal obesity, and alcohol consumption are lifestyle factors associated with an increased risk for breast cancer; increased risk from cigarette smoking remains inconclusive (ACS, 2011; Warren, Alberg, Kraft, & Cummings, 2014). Existing studies comparing established nonreproductive risk factors for breast cancer between Hispanic/Latina and NHW women have reported Hispanics to be more physically active (John, Horn-Ross, & Koo, 2003), have a higher body mass index (BMI; Hines et al., 2010; John, Sangaramoorthy, Phipps, Koo, & Horn-Ross, 2011), are less likely to report a family history of breast cancer (Hines et al., 2010), and consume less alcohol (Hines et al., 2010). However, similar to overall risk for breast cancer, prevalence of these and other risk factors has also been shown to vary by level of acculturation (John et al., 2005; Keegan et al., 2010; Nodora et al., 2014).

The concept of acculturation is commonly used to explain differences in risk profiles for various chronic diseases, including cancer, among immigrant populations living in the United States. The process of acculturating to a host country's cultural practices, traditions, and values has been reported to influence both positive and negative behavioral change (Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005; Morales, Lara, Kington, Valdez, & Escarce, 2002). In general, as individuals become more acculturated, their health behaviors more closely resemble those of the host country than those of their country of origin (Broesch & Hadley, 2012; Cabassa, 2003; Thomson & Hoffman-Goetz, 2009). Several authors have criticized acculturation models because of the potential confounding by socioeconomic status (SES), including education (Abraido-Lanza, Armbrister, Florez, & Aguirre, 2006; Cabassa, 2003; Carter-Pokras & Bethune, 2009). Despite these criticisms, few published articles assessing acculturation have accounted for SES or education in their analyses.

This study aims to describe and compare distributions of behavioral risk factors and family history of breast cancer along a cultural continuum. More specifically, we compare prevalence of risk factors among women residing in Mexico and Mexican-American (MA) women in the United States categorized into one of three levels of language acculturation while controlling for education.

Materials and Methods

Study Design and Participants

The data used in this study are part of the *Ella* Binational Breast Cancer study, a collaborative effort among three sites in Mexico and two in the United States. Detailed methods for the *Ella* Study have been previously published (Martínez et al., 2010). Briefly, eligible participants were female, 18 years of age or older, self-identified as being of Mexican descent (U.S. participants), and diagnosed with invasive breast cancer 24 months before study enrollment. Participants with in situ and/or recurrent breast cancer diagnoses were ineligible. A total of 1,201 women participated in the study—581 Mexican and 620 MA women. All participants provided written informed consent in their preferred language (English or Spanish). Institutional review board (IRB) approval was obtained from each of the participating institutions. Approval for the use and analyses of the *Ella* Study data for the current research was obtained from the University of California, San Diego, and San Diego State University IRBs.

Data Collection

A risk factor questionnaire was administered to the participants and completed in their language of choice, Spanish or English. Data collection ran continuously from March 2007 through June 2011. The majority of the questionnaires were administered in person by a trained research assistant (93%); the remainder (7% at the MD Anderson site only) were completed over the phone. Risk factors relevant to our analysis included BMI, waist circumference, physical activity, alcohol consumption, cigarette smoking, and family history. Age at diagnosis and education were also collected and served as covariates in the analyses. Education was the only SES variable collected in this study.

Physical measurements to assess obesity included BMI and waist circumference. Participants were asked to report their current height and weight in the year before diagnosis. BMI was calculated via height (m) and weight (kg) variables using the formula kg/m^2. If height or weight were missing from the questionnaire, primarily owing to woman's lack of knowledge regarding one or both, values were obtained from medical records; otherwise they were classified as missing ($n = 122$). BMI was categorized into four groups according to World Health Organization standards (World Health Organization, 2000), as follows: underweight, less than 18.5; normal, 18.5 to 24.9; overweight, 25.0 to 29.9; and obese, 30.0 or greater. For our analyses, the first three BMI groups (BMI < 30) were combined into a nonobese category and compared with the obese group (<30.0). Waist circumference was measured in centimeters by placing the tape measure between the ribs and the top of the iliac crest of the participant. Values were then categorized into two groups according to risk of developing obesity-related metabolic disorder using the guidelines proposed by the National Heart, Lung and Blood Institute, where a value of 88.9 cm or less was considered to be high waist circumference for women (National Heart, Lung and Blood Institute, 2014). There were 212 missing values for waist circumference, 84 of these owing to phone interview questionnaire administration and the remainder to logistical issues in conducting measurements.

Education categories included completing less than or some high school, high school or the GED test, or post high school education. Owing to small number of current smokers (5%), participants who reported being current or past smokers were combined into a single group of ever smokers. Alcohol consumption for various types of drinks was collected in number of drinks per day, week, or month and averaged to assess the number of drinks consumed per week. Participants who reported having one or more first-degree relative(s) diagnosed with breast cancer were considered as having a family history of breast cancer. For assessment of physical activity, participants were asked to report their activities in the year before diagnosis using a modified version of the International Physical Activity Questionnaire; the reliability and validity of this instrument have been assessed internationally (Craig et al., 2003). The following activities were used to generate a summary variable of total energy expenditure in kilocalories per day for each participant (not including sleeping): walking as a means of transportation, walking at work, walking for leisure, moderate and vigorous exercise during work, housework and yardwork, and moderate and vigorous recreational activities. The median total energy expenditure was approximately 533 kcal/d, which was used to classify higher and lower total energy expenditure.

The acculturation measurement used for this study was based on Marin and Gamba's (1996) Bidimensional Acculturation Scale (Cabassa) and described in previously published *Ella* manuscripts (Garcia et al., 2012; Nodora et al., 2014). Results from the acculturation questions, also a part of the risk factor questionnaire, placed participants into three acculturation groups: Spanish dominant, bilingual, and English dominant. Spanish-dominant participants were considered to be low acculturated, whereas English-dominant women were high acculturated. Only women living in the United States completed the acculturation scale.

Statistical Analyses

Multivariate logistic regression was used to test for associations between acculturation level and each risk factor. Mexican women were used as the reference group and adjustments were made for age (continuous) and level of education (ordinal). Individual risk factors were dichotomized as follows: obese (≥30.0 vs. < 30 kg/m^2); high waist circumference (≥88.9 vs. < 88.9 cm); alcohol consumption (>1 vs. ≤ 1 drink per week); cigarette smoking (ever vs. never smoked); total energy expenditure (median value ≤ 533 kcal/d); and family history of breast cancer (≥1 first degree relative vs. none). For each variable, four separate models were constructed: crude, age adjusted, education adjusted, and age and education- adjusted (full model). Tests for trend were included in the full model for each risk factor. We considered *p*-values less than .05 significant. CIs were set at 95% and were considered significant if these excluded 1. The SAS 9.3 program software was used for all statistical analysis.

Results

Distributions of behavioral factors and family history by country of residence and U.S. MA level of acculturation are shown in Table 1. Mexican women had the oldest mean age at diagnosis (54.5 years) and Spanish-dominant patients had the lowest. Mexican and Spanish-dominant MA women had the lowest level of education. Obesity increased while prevalence of high waist circumference decreased across level of acculturation. Self-reported family history of breast cancer was least among Mexican women and increased with increasing acculturation. There was no clear trend between cigarette smoking and level of acculturation. Alcohol consumption increased across level of acculturation in MA women. Mean self-reported total energy expenditure was greatest in Spanish-dominant women and decreased across level of acculturation.

Table 2 shows distributions for behavioral risk factors and family history by level of education. Age at diagnosis decreased across education level. Mexican and MA women with greater than a high school education had lower percentages of obesity, high waist circumference, and cigarette smoking compared with those with less than high school education. Alcohol consumption increased, whereas mean self-reported total energy expenditure decreased, across level of education. Family history of breast cancer was reported with the least frequency among women with less than high school education and was nearly equal in the higher education groups.

Table 3 shows crude and adjusted odds ratios (ORs) for each behavioral factor and family history of breast cancer according to level of language acculturation, using Mexican women as the referent group. An effect of education in the associations was shown for obesity (stronger) and alcohol consumption (weaker) and no effect for cigarette smoking, energy expenditure, or family history of breast cancer. Adjustment for age had no material effect on the ORs. In the final model, U.S. English-dominant women were significantly more than twice as likely to be obese than Mexican women. Similarly, compared with Mexican residents, U.S. English-dominant women were significantly more likely to consume one or more alcoholic drinks per day. There was no clear association between waist circumference and level of acculturation. For cigarette smoking, U.S. English-dominant patients were

significantly less likely to have ever smoked compared with Mexican women. Women in all three U.S. acculturation groups were significantly more likely to have lower self-reported energy expenditure compared with Mexican women. Finally, compared with Mexican women, U.S. bilingual and English-dominant patients were significantly more likely to report a positive family history of breast cancer.

Discussion

In this study, we observed differences in behavioral risk factors and family history of breast cancer by language acculturation and country of residence. Results showed that, after adjusting for age and education, level of acculturation was associated significantly with several factors, including obesity, ever smoking cigarettes, alcohol consumption, physical inactivity, and family history of breast cancer. Few studies have reported comparisons for breast cancer risk factors by level of acculturation (John et al., 2005; Keegan et al., 2010; Nodora et al., 2014); ours was the only to include women from the country of origin (Nodora et al., 2014). Our results suggest that the process of acculturation is associated with increased prevalence of health behaviors that have both positive and negative implications for risk of breast cancer in Mexican and MA women.

This is the fourth in a series of publications from our study describing individual risk profiles among breast cancer patients of Mexican descent in both the United States and Mexico. Martínez et al. (2010) first reported significant variations in breast cancer risk profiles between MAs and Mexican residents, thereby setting the stage for further inquiry into distributions of risk profiles by level of acculturation. Garcia et al. (2012) found that mammography use, self-detecting breast cancer, and being uninsured varied by level of acculturation; however, associations were attenuated after controlling for education and health insurance. Finally, Nodora et al. (2014) reported early age at menarche, younger age at first full-term pregnancy, and breast-feeding were all significantly associated with level of acculturation, although breastfeeding and age at menarche were the only factors that remained significant after adjustment for education.

Abraído-Lanza et al. (2006) suggest that changes in SES are correlated more strongly with changes in health behavior and health outcomes in immigrant populations than the process of acculturation. Despite this, education is not included frequently as a covariate in the existing acculturation literature. In our study, level of education was used as a proxy for SES and included in the multivariate models. We found that, after controlling for education, the association of acculturation with obesity whereas associations for cigarette smoking, physical activity, and family history were not affected appreciably after adjustment.

Data in the literature on acculturation or nativity related to obesity are mixed. Similar to our observations, DuBard and Gizlice (2008) reported English-dominant Hispanic/Latino men and women to be significantly more obese than Spanish-dominant individuals after adjustment for age, sex, and education. Unlike our results, Keegan et al. (2010) found obesity to be lower in U.S.-born than foreign-born Hispanic/Latina women in California. Keegan et al. (2010) postulated that their observed incidence differences by nativity might

be owing to differences in distribution of breast cancer risk factors in the general population; however, this did not hold true for obesity.

Results for physical activity and acculturation in the literature are also mixed. A potential reason for this variation may be the inconsistency with which physical activity is measured across studies. Although some studies measured only recreational activity (DuBard & Gizlice, 2008), more common activities prevalent in Hispanic/Latina women should also be considered (i.e., household chores and walking as transportation). In John et al.'s study (2003), although Hispanic/Latina women reported lesser lifetime levels of recreational physical activity than NHWs, they reported greater lifetime physical activity when considering household and outdoor chores. Accordingly, studies that only measured recreational, vigorous, or leisure-time physical activities found low acculturated Hispanic/ Latinos to be less active than highly acculturated Hispanic/Latinos (DuBard & Gizlice, 2008). Using nativity rather than acculturation, Keegan et al. (2010) reported that foreign-born women were more sedentary than those born in the United States. Conversely, when lifetime physical activity is measured, which includes both nonoccupational and occupational physical activity, U.S.-born Hispanic/ Latina women are found to have lesser activity levels than their foreign-born counterparts (John et al., 2005). Thus, when assessing physical activity in Hispanic/Latina women, it is beneficial to include forms of energy expenditure that extend beyond recreational activities. Results of our study, which accounted for recreational, occupational, and household activities, show that English-dominant women report lower activity levels than Mexican as well as Spanish-dominant women.

Although there is a paucity of detailed demographic tobacco use data at a national level for MA women (i.e., by acculturation, language, country of origin), we are able to make some comparisons to relevant literature. As noted, given the low prevalence of current smoking in our population, we analyzed prevalence of ever smoking instead. Our data reflect the low national average of current smoking among MA women (8.6%; Blanco et al., 2014). However, our finding of English-dominant MAs being significantly less likely to have ever smoked (than Mexicans and both bilingual and Spanish dominant women) is not consistent with prior studies for current smoking patterns by level of acculturation. Perez-Stable et al. (2001) found that highly acculturated respondents and those whose language preference was English (largely of Mexican origin) were more likely to be current smokers than those who were less acculturated and preferred to communicate in Spanish. DuBard and Gizlice (2008) also reported that English speakers had higher current smoking rates; these data, however, were not broken down by ethnic group or sex. As suggested in the conclusions of the two previously cited publications (DuBard & Gizlice, 2008; Perez-Stable et al., 2001), the smoking-related risk profiles for MA women are complex, evolving, and merit detailed study.

Orom, Cote, Gonzalez, Underwood, and Schwartz (2008) showed that reporting of family history of cancer is less accurate in immigrant groups and that non-White immigrants are less likely to report such family history cancer than their white counterparts. John et al. (2005) showed that foreign-born His-panic women reported a lower frequency of family history of breast cancer than U.S.-born Hispanics and that there was a clear and significant increasing trend in prevalence of family history by level of acculturation, which is consistent

with the results of our study. Differences in reporting by nativity and level of acculturation may reflect the underlying risk of breast cancer, awareness and knowledge, or both. These may also owing to cultural factors, such as stigma associated with the diagnosis of cancer as well as concerns about upsetting or worrying family members.

Strengths and Limitations

There are important strengths related to this study. As previously reported, response rates for our clinic-based study were over 90% (Martínez et al., 2010). Additionally, several novel research methods used in our design contributed to the strengths of the study. These include the enrollment of participants residing in the country of origin as a reference group and compared solely with women of Mexican descent in the United States; the use of three acculturation groups, as opposed to a dichotomized categorization; and controlling for education in the analyses. These strengths, however, must be juxtaposed with study limitations. Although education is associated strongly with SES, it does not take into account other factors, such as income. Similarly, our study used language acculturation alone; inclusion of multiple indicators of acculturation may better capture this process (e.g., identity, values, attitudes, social affiliation). Given the very low prevalence of current smoking and the low levels of alcohol consumption in our population, we were not able to assess true high-risk behaviors. In addition, although we had relatively few missing data for variables such as family history of breast cancer (1%) and alcohol consumption (5%), this was not the case for BMI (10%), energy expenditure (13%), and waist circumference (18%). Last, because of the cross-sectional, case-only study design, we were unable to assess risk of developing breast cancer and our results do not represent distributions of behavioral risk factors in the general population of Mexican or MA women.

Implications for Practice and/or Policy

Our results add to the existing literature on the relationship between the process of acculturation and behavioral risk factors and family history of breast cancer. Findings show that acculturation has both positive and negative effects on these risk factors in women of Mexican descent. Interventions and public health policies may benefit from considering the increase in risk factors occurring with acculturation among U.S. MA women as well as those in Mexico. Interventions and policies that decrease the rising rates of obesity and physical inactivity are particularly relevant and should tailor both measures and activity based on the individual’s characteristics (e.g., BMI and activity levels) and their culture. Also, public support for community education to reduce cancer-related stigma may contribute to more accurate reporting of cancer-related family history.

Conclusions

We found differences in certain behavioral risk factors and family history of cancer by language acculturation and country of residence which were independent of educational level. Findings from this and our prior research underscore the complexity of culture and its impact on cancer-related risk factors.

Acknowledgments

The authors are indebted to Erin Ashbeck, Rachel Garcia, and Fang Wang for their contribution as well as Malaika Tobias for help with manuscript preparation.

Funding statement: This work was supported by NIH/NCI (UO1CA153086, CA023074-2953, CA116199-02S1); Cancer Center Support Grant (P30CA023074); the Avon Foundation; the Susan G. Komen for the Cure® (KG090934); and the ACS Mentored Research Scholar grant MRSG-11-102-01-CPPB-ACS/MRSG.

References

Abraido-Lanza AF, Armbrister AN, Florez KR, Aguirre AN. Toward a theory-driven model of acculturation in public health research. American Journal of Public Health. 2006; 96(8):1342–1346. [PubMed: 16809597]

American Cancer Society (ACS). Breast cancer facts & figures 2011–2012. Atlanta: Author; 2011.

American Cancer Society (ACS). Cancer facts & figures for Hispanics/ Latinos: 2012–2014. Atlanta: Author; 2012.

Assessing Your Weight and Health Risk. 2014. Available from http://www.nhlbi.nih.gov/health/educational/lose_wt/risk.htm

Blanco L, Garcia R, Perez-Stable EJ, White MM, Messer K, Pierce JP, Trinidad DR. National trends in smoking behaviors among Mexican, Puerto Rican, and Cuban men and women in the United States. American Journal of Public Health. 2014; 104(5):896–903. [PubMed: 24625159]

Broesch J, Hadley C. Putting culture back into acculturation: Identifying and overcoming gaps in the definition and measurement of acculturation. Social Science Journal. 2012; 49(3):375–385.

Cabassa LJ. Measuring acculturation: Where we are and where we need to go. Hispanic Journal of Behavioral Sciences. 2003; 25(2):127–146.

Carter-Pokras O, Bethune L. Defining and measuring acculturation: a systematic review of public health studies with Hispanic populations in the United States. A commentary on Thomson and Hoffman-Goetz. Social Science and Medicine. 2009; 69(7):992–995. discussion 999–1001. [PubMed: 19631433]

Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, … Oja P. International physical activity questionnaire: 12-country reliability and validity. Medicine and Science in Sports and Exercise. 2003; 35(8):1381–1395. [PubMed: 12900694]

DuBard CA, Gizlice Z. Language spoken and differences in health status, access to care, and receipt of preventive services among US Hispanics. American Journal of Public Health. 2008; 98(11):2021–2028. [PubMed: 18799780]

Garcia RZ, Carvajal SC, Wilkinson AV, Thompson PA, Nodora JN, Komenaka IK, … Martinez ME. Factors that influence mammography use and breast cancer detection among Mexican-American and African-American women. Cancer Causes and Control. 2012; 23(1):165–173. [PubMed: 22080276]

Hines LM, Risendal B, Slattery ML, Baumgartner KB, Giuliano AR, Sweeney C, … Byers T. Comparative analysis of breast cancer risk factors among Hispanic and non-Hispanic white women. Cancer. 2010; 116(13):3215–3223. [PubMed: 20564638]

Jemal A, Clegg LX, Ward E, Ries LA, Wu X, Jamison PM, … Edwards BK. Annual report to the nation on the status of cancer, 1975–2001, with a special feature regarding survival. Cancer. 2004; 101(1):3–27. [PubMed: 15221985]

John EM, Horn-Ross PL, Koo J. Lifetime physical activity and breast cancer risk in a multiethnic population: The San Francisco Bay area breast cancer study. Cancer Epidemiology, Biomarkers, and Prevention. 2003; 12(11 Pt 1):1143–1152.

John EM, Phipps AI, Davis A, Koo J. Migration history, acculturation, and breast cancer risk in Hispanic women. Cancer Epidemiology, Bio-markers, and Prevention. 2005; 14(12):2905–2913.

John EM, Sangaramoorthy M, Phipps AI, Koo J, Horn-Ross PL. Adult body size, hormone receptor status, and premenopausal breast cancer risk in a multiethnic population: The San Francisco Bay Area breast cancer study. American Journal of Epidemiology. 2011; 173(2):201–216. [PubMed: 21084558]

Keegan TH, John EM, Fish KM, Alfaro-Velcamp T, Clarke CA, Gomez SL. Breast cancer incidence patterns among California Hispanic women: Differences by nativity and residence in an enclave. Cancer Epidemiology, Biomarkers, and Prevention. 2010; 19(5):1208–1218.

Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DE. Acculturation and Latino health in the United States: A review of the literature and its sociopolitical context. Annual Review of Public Health. 2005; 26:367–397.

Marin G, Gamba RJ. A new measurement of acculturation for His-panics: The bidimensional acculturation scale for Hispanics (BAS). Hispanic Journal of Behavioral Sciences. 1996; 18(3): 297–316.

Martínez ME, Gutiérrez-Millan LE, Bondy M, Daneri-Navarro A, Meza-Montenegro M, Anduro-Corona I, … Thompson P. Comparative Study of Breast Cancer in Mexican and Mexican-American Women. Health. 2010; 2(9):1040–1048. http://dx.doi.org/10.4236/health.2010.29153.

Morales LS, Lara M, Kington RS, Valdez RO, Escarce JJ. Socioeconomic, cultural, and behavioral factors affecting Hispanic health outcomes. J Health Care Poor Underserved. 2002; 13(4):477–503. [PubMed: 12407964]

Nodora JN, Gallo L, Cooper R, Wertheim BC, Natarajan L, Thompson PA, … Martinez ME. Reproductive and hormonal risk profile according to language acculturation and country of residence in the Ella Binational Breast Cancer Study. Journal of Womens Health (Larchmont). 2014; 23(6):532–540.

Ooi SL, Martinez ME, Li CI. Disparities in breast cancer characteristics and outcomes by race/ethnicity. Breast Cancer Research and Treatment. 2011; 127(3):729–738. [PubMed: 21076864]

Orom H, Cote ML, Gonzalez HM, Underwood W 3rd, Schwartz AG. Family history of cancer: Is it an accurate indicator of cancer risk in the immigrant population? Cancer. 2008; 112(2):399–406. [PubMed: 18072272]

Perez-Stable EJ, Ramirez A, Villareal R, Talavera GA, Trapido E, Suarez L, … McAlister A. Cigarette smoking behavior among US Latino men and women from different countries of origin. American Journal of Public Health. 2001; 91(9):1424–1430. [PubMed: 11527775]

Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. CA: A Cancer Journal for Clinicians. 2014; 64(1):9–29. [PubMed: 24399786]

Slattery ML, John EM, Torres-Mejia G, Lundgreen A, Herrick JS, Baumgartner KB, … Wolff RK. Genetic variation in genes involved in hormones, inflammation and energetic factors and breast cancer risk in an admixed population. Carcinogenesis. 2012; 33(8):1512–1521. [PubMed: 22562547]

Thomson MD, Hoffman-Goetz L. Defining and measuring acculturation: A systematic review of public health studies with Hispanic populations in the United States. Social Science and Medicine. 2009; 69(7):983–991. [PubMed: 19525050]

Warren GW, Alberg AJ, Kraft AS, Cummings KM. The 2014 Surgeon General's report: "The health consequences of smoking–50 years of progress": A paradigm shift in cancer care. Cancer. 2014; 120(13):1914–1916. [PubMed: 24687615]

WHO. Obesity: preventing and managing the global epidemic. Report on a WHO Consultation on Obesity; Geneva. 3–5 June, 1997; Geneva: World Health Organization; 2000. WHO/NUT/NCD/98.1. Technical Report Series Number 894

Biographies

Jesse N. Nodora, DrPH, is Assistant Professor in the Department of Family Medicine and Public Health and Moores UC San Diego Cancer Center. His research focus is in informed decision-making, patient-provider communication, health literacy, and systems interventions among poor and underserved populations.

Renee Cooper, MPH, performed the data analysis for this manuscript as a part of her Master's thesis requirement. Her interests are in health disparities, health care access, and immigrant Hispanic populations in the United States.

Gregory A. Talavera, MD, MPH, is Professor at San Diego State University's Graduate School of Public Health. His research projects explore the culture-specific beliefs that serve as barriers to chronic disease prevention and control.

Linda Gallo, PhD, is Professor in the Department of Psychology at San Diego State University. Her research focuses on psychosocial and behavioral processes in chronic disease risks and outcomes and on socioeconomic status and ethnicity-related health inequities.

María Mercedes Meza Montenegro, PhD, is Professor in Biotechnology Department at the Instituto Tecnólogico de Sonora. Her research interests are in understanding environmental and genetics factors which are responsible of the health adverse effects, specially cancer through the determination of novel biomarkers.

Ian Komenaka, MD, is a surgical oncologist and medical director of the Breast Center at Maricopa Integrated Health Center. His research interests are in patient-provider communication and health literacy and health outcomes in low-income populations.

Loki Natarajan, PhD, is Professor in the Department of Family Medicine and Public Health at UC San Diego. She is a biostatistician with interests in various areas of methodological research.

Luis Enrique Gutiérrez Millán, PhD, is Professor in Molecular Biology at the University of Sonora. His research interests are in conducting investigation on molecular biology of cancer.

Adrian Daneri-Navarro, PhD, is Professor in the Department of Physiology at the University of Guadalajara. His research interests are in identification of prognostic and predictive factors for breast cancer.

Melissa Bondy, PhD, is Professor at Baylor College of Medicine. As a genetic and molecular epidemiology, her research targets the development of innovative ways to assess the roles of heredity and genetic susceptibility.

Abenaa Brewster, MD, is an Associate Professor in the Department of Clinical Cancer Prevention at MD Anderson Cancer Center. She is a breast medical oncologist with research expertise in molecular epidemiology.

Patricia Thompson, PhD, is Professor in the Department of Pathology at Stony Brook University. Her research has focused on the evolution of molecular and cellular changes that occur during the development of breast and other cancers.

María Elena Martinez, PhD, is Professor in Family Medicine and Public Health at UC San Diego and Leader of the Reducing Cancer Disparities Program at Moores Cancer Center. Her research interests are understanding cancer disparities throughout the cancer continuum particularly in Hispanic populations.

Table 1

Lifestyle Risk Factors and Family History by Country of Residence and Level of Acculturation in *Ella* Participants (*n* = 1,201)

Patient Characteristics	Mexican (*n* = 581)	U.S. Mexican-American Language Acculturation Group		
		Spanish Dominant (*n* = 202)	Bilingual (*n* = 295)	English Dominant (*n* = 123)
Age at diagnosis (y), mean ± SD	54.5 ± 12.5	51.2 ± 12.0	49.5 ± 11.7	49.2 ± 12.2
Highest level of education, *n* (%)				
Less than high school	389 (67.0)	139 (68.8)	57 (19.3)	17 (13.8)
High school or equivalent	130 (22.4)	51 (25.3)	90 (30.5)	42 (34.2)
Post high school	62 (10.7)	12 (5.9)	148 (50.2)	64 (52.0)
BMI (kg/m^2), mean ± SD*	28.6 ± 5.3	30.1 ± 6.9	28.9 ± 6.0	29.8 ± 7.9
BMI category, *n* (%)				
Nonobese (<30)	332 (64.7)	102 (59.3)	168 (59.8)	62 (54.9)
Obese (≥30)	181 (35.3)	70 (40.7)	113 (40.2)	51 (45.1)
Waist circumference (cm), mean ± SD†	95.2 ± 12.9	95.6 ± 13.2	93.9 ± 14.6	93.9 ± 15.3
Waist circumference (cm) category, *n* (%)				
Normal (<88.9)	161 (29.0)	42 (29.6)	71 (34.0)	29 (35.4)
High (≥88.9)	395 (71.0)	100 (70.4)	138 (66.0)	53 (64.6)
Cigarette smoking (ever), *n* (%)	187 (32.2)	51 (25.3)	82 (27.8)	27 (22.0)
Alcohol consumption (>1 drink per week), *n* (%)‡	75 (13.3)	20 (10.7)	84 (30.6)	42 (36.2)
Total energy expenditure (kcal/d), mean ± SD§,‖	808.4 ± 666.3	917.6 ± 1093.8	735.4 ± 858.1	563.1 ± 668.3
Total energy expenditure category, *n* (%)¶				
Low (≤533)	206 (40.9)	90 (54.9)	161 (59.9)	66 (61.1)
High (>533)	298 (59.1)	74 (45.1)	108 (40.2)	42 (38.9)
Family history of breast cancer (≥1 first-degree relative), *n* (%)#	55 (9.6)	25 (12.6)	50 (17.1)	25 (20.7)

Abbreviations: BMI, body mass index; SD, standard deviation.

*Missing data for BMI for 122 participants.

†Missing data for waist circumference for 212 participants.

‡Missing data for alcohol consumption for 60 participants.

§Missing data for total energy expenditure for 156 participants.

‖Self-reported total energy expenditure calculated without sleep.

¶Dichotomized at the median.

#Missing data for family history of breast cancer for 17 participants.

Table 2

Lifestyle Risk Factors and Family History by Level of Education in *Ella* Participants (*n* = 1,201)

Patient Characteristics	<High School (*n* = 602)	High School (*n* = 313)	>High School (*n* = 286)
Age at diagnosis (y), mean ± SD	55.5 ± 12.8	49.9 ± 10.6	47.6 ± 11.4
BMI (kg/m^2), mean ± SD[*]	29.8 ± 6.0	28.5 ± 5.8	28.0 ± 6.4
BMI category, *n* (%)			
Nonobese (<30)	293 (56.4)	184 (63.5)	187 (69.5)
Obese (≥30)	227 (43.7)	106 (36.6)	82 (30.5)
Waist circumference (cm), mean ± SD[†]	97.0 ± 13.3	93.7 ± 12.6	91.3 ± 14.0
Waist circumference (cm) category, *n* (%)			
Normal (<88.9)	129 (24.8)	83 (33.9)	91 (40.6)
High (≥ 88.9)	391 (75.2)	162 (66.1)	133 (59.4)
Cigarette smoking (ever), *n* (%)	171 (28.4)	106 (33.9)	70 (24.5)
Alcohol consumption (>1 drink per week), *n* (%)[‡]	64 (11.1)	62 (21.2)	95 (34.7)
Total energy expenditure (kcal/d), mean ± SD[§,‖]	823.5 ± 840.2	810.9 ± 788.5	670.0 ± 733.3
Total energy expenditure, *n* (%)[¶]			
Low (≤533)	238 (47.1)	126 (45.7)	159 (60.2)
High (>533)	267 (52.9)	150 (54.4)	105 (39.8)
Family history of breast cancer (≥1 first-degree relative), *n* (%)[#]	56 (9.5)	53 (17.2)	46 (16.2)

Abbreviations: BMI, body mass index; SD, standard deviation.

[*] Missing data for BMI for 122 participants.

[†] Missing data for waist circumference for 212 participants.

[‡] Missing data for alcohol consumption for 60 participants.

[§] Missing data for total energy expenditure for 156 participants.

[‖] Self-reported total energy expenditure, calculated without sleep.

[¶] Dichotomized at the median.

[#] Missing data for family history of breast cancer for 17 participants.

Table 3

Crude and Adjusted Odds Ratios for Breast Cancer Lifestyle and Family History Risk Factors by Country of Residence and Level of Acculturation

Characteristic	Language Acculturation Group	*n* (%)*	Odds Ratio (95% CI)			
			Crude	Age Adjusted†	Education Adjusted‡	Age and Education Adjusted
Obese, BMI ≥30 kg/m^2	Mexican	181 (35.3)	1.00	1.00	1.00	1.00
	U.S. Spanish–dominant	70 (40.7)	1.26 (0.88–1.79)	1.36 (0.95–1.96)	1.21 (0.85–1.73)	1.30 (0.91–1.87)
	U.S. Bilingual	113 (40.2)	1.23 (0.92–1.66)	1.41 (1.03–1.91)	1.88 (1.33–2.65)	1.97 (1.39–2.79)
	U.S. English-dominant	51 (45.1)	1.51 (1.00–2.28)	1.74 (1.14–2.66)	2.44 (1.54–3.86)	2.57 (1.62–4.08)
						p_{trend} <.001
High waist circumference, ≥88.9 cm	Mexican	395 (71.0)	1.00	1.00	1.00	1.00
	U.S. Spanish–dominant	100 (70.4)	0.97 (0.65–1.45)	1.10 (0.73–1.66)	0.97 (0.65–1.47)	1.08 (0.71–1.64)
	U.S. Bilingual	138 (66.0)	0.79 (0.56–1.11)	0.92 (0.65–1.31)	1.13 (0.77–1.65)	1.18 (0.80–1.74)
	U.S. English-dominant	53 (64.6)	0.75 (0.46–1.21)	0.89 (0.54–1.46)	1.11 (0.66–1.88)	1.17 (0.69–2.00)
						p_{trend} = .382
Cigarette smoking, ever	Mexican	187 (32.2)	1.00	1.00	1.00	1.00
	U.S. Spanish–dominant	51 (25.3)	0.71 (0.50–1.02)	0.73 (0.51–1.05)	0.70 (0.49–1.01)	0.73 (0.50–1.05)
	U.S. Bilingual	82 (27.8)	0.81 (0.60–1.10)	0.85 (0.62–1.16)	0.81 (0.58–1.15)	0.83 (0.58–1.17)
	U.S. English-dominant	27 (22.0)	0.59 (0.37–0.94)	0.62 (0.39–0.99)	0.59 (0.36–0.96)	0.59 (0.36–0.97)
						p_{trend} = .031
Alcohol consumption (>1 drink per week)	Mexican	75 (13.3)	1.00	1.00	1.00	1.00
	U.S. Spanish–dominant	20 (10.7)	0.78 (0.46–1.32)	0.69 (0.40–1.16)	0.82 (0.48–1.39)	0.72 (0.42–1.23)
	U.S. Bilingual	84 (30.6)	2.86 (2.01–4.08)	2.45 (1.70–3.51)	1.88 (1.26–2.80)	1.82 (1.22–2.72)
	U.S. English-dominant	42 (36.2)	3.69 (2.36–5.79)	3.16 (1.99–5.01)	2.38 (1.46–3.88)	2.31 (1.41–3.80)
						p_{trend} < .001
Lower total energy expenditure, ≤533 kcal/d§	Mexican	206 (40.9)	1.00	1.00	1.00	1.00
	U.S. Spanish–dominant	90 (54.9)	1.76 (1.23–2.51)	1.94 (1.35–2.78)	1.79 (1.25–2.56)	1.99 (1.38–2.87)
	U.S. Bilingual	161 (59.9)	2.16 (1.60–2.92)	2.49 (1.82–3.40)	2.03 (1.45–2.84)	2.17 (1.54–3.05)
	U.S. English-dominant	66 (61.1)	2.27 (1.49–3.48)	2.65 (1.71–4.10)	2.15 (1.36–3.40)	2.28 (1.43–3.63)
						p_{trend} < .001
Family history of breast cancer (≥1 first-degree relative)	Mexican	55 (9.6)	1.00	1.00	1.00	1.00

Characteristic	Language Acculturation Group	*n* (%)*	Odds Ratio (95% CI)			
			Crude	Age Adjusted†	Education Adjusted‡	Age and Education Adjusted
	U.S. Spanish–dominant	25 (12.6)	1.36 (0.82–2.25)	1.43 (0.86–2.38)	1.36 (0.82–2.26)	1.47 (0.88–2.45)
	U.S. Bilingual	50 (17.1)	1.93 (1.28–2.92)	2.09 (1.38–3.19)	1.65 (1.04–2.60)	1.71 (1.07–2.71)
	U.S. English-dominant	25 (20.7)	2.45 (1.46–4.12)	2.67 (1.57–4.53)	2.03 (1.16–3.57)	2.11 (1.20–3.72)
						p_{trend} = .004

Abbreviation: BMI, body mass index.

*n is equal to the number of participants in each acculturation group with each risk factor.

†Age was treated as a continuous variable.

‡Education level was categorized into less than high school, high school or equivalent, and more than high school.

§Self-reported total energy expenditure, calculated without sleep; dichotomized at the median.