Appendix 5

TULANE UNIVERSITY SCHOOL OF PUBLIC HEALTH AND TROPICAL MEDICINE

RESULTS OF DISSERTATION DEFENSE

Student's Name _Veronica Barcelona de Mendoza_

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The undersigned committee members have:

☑ 1. Approved the dissertation as presented.

☐ 2. Approved the dissertation with minor changes only.

☐ 3. Approved the dissertation with significant revisions.

☐ 4. Not approved the dissertation; the student can no longer continue in the doctoral program.

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Committee Chair: _Emily Harville_

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Katherine Theall

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Effects of acculturation on intent to breastfeed, anxiety and birth outcomes in pregnant Latina women

A Dissertation

Submitted on the Eleventh day of March 2015

To the Department of Epidemiology

In Partial Fulfillment of the Requirements

Of the School of Public Health and Tropical Medicine

Of Tulane University

For the Degree of

Doctor of Philosophy

By

Veronica Barcelona de Mendoza, MSN, MPH, RN

APPROVED:

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ABSTRACT

Background: Social determinants affect perinatal health and play a role in health disparities in the United States. Among Latinas, significant heterogeneity in cultures, behaviors and practices affect health. Little is known about how the psychological adaptation to acculturation effects the health of Latina women other than Mexicans.

Aims: The purpose of this study is to investigate the effects of acculturation on birth outcomes, intent to breastfeed, and anxiety in a sample of predominantly Puerto Rican women.

Methods: Three studies were completed using secondary analysis of a prospective cohort study conducted in Massachusetts called Proyecto Buena Salud (PBS). Approximately 1600 pregnant women from Puerto Rico and the Dominican Republic participated in PBS. Acculturation measures included the Psychological Acculturation Scale (PAS), preferred language and generation. Birth outcomes (preterm birth, low birthweight, and small for gestational age), were abstracted from medical records; intent to breastfeed was assessed at delivery; and anxiety (trait and state), were measured three times during pregnancy.

Results: Women with lower levels of acculturation as measured by the PAS were more likely to have a preterm birth (aOR 1.62 [0.90, 2.91]), and had babies with significantly lower birthweights as compared to women with higher levels of acculturation. Higher acculturation as measured by English language preference (aOR 0.61 [0.42-0.88]) and second or third generation in the US (aOR 0.70 [0.52-0.95]) was inversely associated with odds of intending to breastfeed. Women with higher acculturation measured by English language preference (beta=1.41, SE 0.7, p=0.04) and generation (beta=1.83, SE 0.6, P<.01) had higher trait anxiety scores after adjustment.

Conclusions: Low acculturation was associated with possible increased odds of adverse birth outcomes, increased odds of intending to breastfeed exclusively and decreased trait anxiety in pregnancy.

I.   INTRODUCTION AND BACKGROUND

A.1   *Social determinants and perinatal health*

Perinatal health indicators describing maternal and neonatal morbidity and

mortality are often considered to be general markers of the overall health of a society.

Known medical and obstetric risk factors for preterm birth include multiple gestation,

previous preterm birth, infections, hypertension, poor nutrition, short inter-pregnancy

interval and diabetes.[1] In addition, social determinants of health are also becoming more

widely accepted as influential causes of health disparities.[2] Experiences of intimate

partner violence,[3] substance abuse,[4] racism[5,6] and increased acculturation[7,8] are some

examples of social and behavioral phenomena that have been shown to be associated with

increased risk of preterm and low birthweight babies. These findings have supported the

shift from the medically-oriented approach to preventing adverse birth outcomes via

prenatal care to improving maternal and fetal health via a social determinants perspective

which includes further understanding of how behavior and environment interact to

influence health.

Neonatal health is often quantified using measures of duration of pregnancy and

infant weight at birth. A full-term pregnancy is one that lasts between 38 and 42 weeks,

based on the last menstrual period. Preterm birth (PTB, birth <37 weeks gestation) is the

leading cause of all infant deaths in the United States, resulting in total costs to society of

$26 billion dollars a year in 2008.[1] Preterm birth carries short and long-term sequelae as

well, such as respiratory distress, infections, neurological and cognitive delays, cerebral

palsy and developmental delays.[9] Not all infants who are preterm, however, are also low

birthweight. Low birthweight is influenced by rate of intrauterine growth and duration of

pregnancy, and is defined by the World Health Organization as an infant who weighs less than 2500g at birth.[10] Infants born with LBW have long been hypothesized to be at higher risk for obesity, diabetes and other non-communicable diseases in adulthood,[11] and are 20 times more likely to die than normal weight infants.[12] Finally, the indicator of small for gestational age (SGA) is defined as birthweight less than the 10th percentile of gestational age, based on a standard reference population. All low birthweight babies are preterm, SGA or both, as seen in Figure 1. LBW and SGA infants are at elevated risk of neonatal and post-neonatal mortality, growth stunting, endocrine dysfunction and non-communicable diseases in adulthood.[13,14]

Several health behaviors and outcomes associated with social class, poverty and culture in the United States also contribute to poor birth outcomes. Tobacco and alcohol use, poor nutrition and obesity, and physical inactivity are among the largest contributors to chronic diseases in the United States.[15] Smoking has been consistently linked to adverse birth outcomes (low birthweight and preterm birth),[16] small for gestational age,[17] and infertility,[18] and fetal exposure to cigarettes has long-term effects on the child as well, even into adulthood.[19] Low socioeconomic status and lack of health insurance greatly increase the risk of smoking in pregnancy.[20] Similarly, alcohol and illegal drug use in pregnancy adversely affect fetal growth and have been shown to have long-term effects on neurocognitive development in childhood.[21]

Breastfeeding has been well-documented as an important health behavior that improves the health of neonates and mothers. Breastfeeding has been shown to have multiple long-term health benefits for the child, including lower rates of obesity, ear infections, asthma, diabetes and leukemia than formula-fed babies.[22] Breastfed infants are

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also less likely to die of Sudden Infant Death Syndrome.[23] There is even some research to support higher intelligence among breastfed infants.[24] Breastfeeding mothers also benefit from decreased rates of ovarian cancer[25] lower risk of diabetes,[26] and increased weight loss postpartum and long-term.[27] Breastfeeding can also promote maternal-infant bonding in the postpartum period.[28] Although breastfeeding is a cost-effective way to promote maternal and infant health, social policies that do not support breastfeeding, such as little to no paid maternity leave for women, and negative cultural norms surrounding it, have resulted in low breastfeeding rates among the poorest, most vulnerable communities of women.[29]

Mental health in pregnancy is another important consideration related to health equity and birth outcomes. The World Health Organization estimates that by 2020, mental illness will be the second leading cause of global morbidity,[30] and the leading cause of disease burden for women of reproductive age.[31] Low socioeconomic status, poverty and violence as social determinants of health also contribute to adverse mental health outcomes for women.[30] Despite often being a time of joy and anticipation, pregnancy presents a new set of challenges to the expectant mother, including psychological adaptation to the new role of parenthood.[32] As many as 12-13% of childbearing women have "likely" depression,[33,34] 8% of women may experience post-traumatic stress disorder (PTSD),[35] and stress and anxiety disorders have also been commonly reported in pregnancy.[36] It is estimated that generalized anxiety affects 21.7% of pregnant women.[37] Stress and anxiety in pregnancy have been associated with adverse birth outcomes such as preterm birth, low birthweight and small for gestational age.[38-40] A recent systematic review and meta-analysis has contributed further evidence that

pregnancy anxiety is associated with both PTB and LBW.[41] Depression and anxiety

together have also been linked to preterm birth.[42] Long-term effects on children who

were exposed in utero to maternal anxiety have also been predictive of "difficult" infant

temperament,[43] increased rates of emotional/behavioral problems,[44] and long-term

cognitive dysfunction related to changes in the orbitofrontal cortex of the brain.[45]

Despite knowledge of how these and other social and behavioral factors influence the

development of adverse birth outcomes, they do not fully explain them.[46,47]

    A.2   *Maternal and child health of Latinos*

Racial and ethnic minorities in the United States are consistently at higher risk for

a constellation of poor health indicators. Immigrants are faced with additional and

unique risk factors for illness, largely due to limited access to care and health insurance.[48]

The US Census Bureau estimates that the national population will become a "majority

minority" nation by 2043.[49] The largest of these minority groups is Latinos, and 35.5%

of those living in the US were foreign-born in 2012.[50] Latino ethnicity has been

traditionally defined by the US Census Bureau as an identification or origin in Latin

America, which encompasses over 35 different cultures and unique traditions. Women of

Latina ethnicity are the largest and fastest growing ethnic group in the United States.[51]

Due to their relative youth and fertility, the growth of the US population can be largely

attributed to women of Latina origin, and future growth can be expected to be attributed

to this ethnic group. The percentage of Latina women of childbearing age is projected to

increase 92% by 2050, compared to 10% of black women.[52] This growing and changing

demographic has implications for maternal and child health. As the Latino population

continues to grow and acculturate to US lifestyles, there will likely be an increase in preterm birth in this population.[53]

Racial and ethnic disparities in maternal and child health are well-documented. Although Latina women have lower rates of adverse birth outcomes than African-Americans, the gap in preterm birth between Latinos and whites is declining at a slower rate compared to other ethnic groups.[54] Latina women have similar or lower rates of preterm birth, low birthweight and small for gestational age than white women. Within the category of Latino, however, lies a more complex picture of heterogeneity. In 2012, the highest rates of preterm birth occurred in Cuban mothers, followed by Puerto Rican, Central/South American and Mexican descent.[54] Socioeconomic, historical and immigration differences also exist between these groups of Latina women.[55]

Morbidity and mortality rates also differ by country of origin among Latinos. Infants born to Latina mothers account for more than 20% of all infant deaths, and rates were highest among women of Puerto Rican descent (7.1 per 1,000 live births).[54] The leading cause of infant mortality among Latinas was birth defects in 2010, followed by preterm birth/low birthweight, maternal complications and Sudden Infant Death Syndrome.[54] Latina women are also significantly more likely to have an infant with a neural tube defect than black or white women.[54] Although Latina women are less likely than other women to report preconception multivitamin use, additional genetic and environmental factors may exist that contribute to a higher incidence of neural tube defects.[56]

Women of Latina origin also bear a higher prevalence of behavioral and demographic risk factors which place them at increased risk for adverse outcomes.

Latina women of childbearing age have higher rates of obesity than white women (27.8% vs. 22%), diabetes (3.9% vs. 2.7%), and hypertension in pregnancy (4.3% vs. 2.8%), respectively.[52] Latina women are more likely to have a teen pregnancy, be late entrants to prenatal care, and to be uninsured than white women.[57] According to birth certificate data, more than one third (36.6%) of Latina mothers have less than a high school education, compared to 8.9% of white mothers.[54]

 A.3   *The Hispanic Paradox, acculturation, and the circular migration of Puerto Ricans*

Despite many apparent social disadvantages that Latina women share with other minority groups, their birth outcomes remain better than other racial/ethnic minorities. This phenomenon has been described in several terms, including the Latino epidemiologic paradox, Latino acculturation paradox, and Mexican epidemiologic paradox, and has been well-documented in the literature for over 20 years.[58-61] This paradox is strongest for birthweight and breastfeeding behaviors, but has not been shown to apply to mental illnesses,[53] such as anxiety. Acculturation has been defined as "the process by which immigrants adopt the attitudes, values, customs, beliefs and behaviors of a new culture".[62] Foreign-born Latina women, especially those with lower levels of education, are less likely to have a low birthweight infant,[63] and are less likely non-Latina US born white women to have an infant die in the first year of life.[64,65] Newly emigrated Latina women have lower risk of preterm birth as well than their US-born Latina counterparts, despite low socioeconomic status.[66] The acculturation paradox demonstrates that as health behaviors, language acquisition and time in the US increases, so do rates of negative health behaviors, risk factors and adverse birth outcomes.[67,68]

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Some have gone farther to find that living in communities with large proportions of Latinos is even protective for women who are not of that ethnicity.[69]

The measurement of acculturation itself has been the topic of some debate in the literature, and theoretical frameworks for its examination have evolved over time. Early research utilized linear methods of measuring acculturation, with the underlying idea that length of time in the United States directly and positively correlates with increased identification with the dominant or majority culture. Marin's Short Acculturation Scale[70] is a 12-item instrument that assesses preferred language (spoken and written), as well as social and cultural interactions, using a 5- point Likert scale. Barona's 12-item Short Acculturation Scale-Youth[71] similarly focuses on language use in different situations, focusing on leisure time, social interaction and also includes language preference of extended family members. These linear measures focus on behaviors and language as the main indicators of acculturation,[70-72] and assume that as a person acculturates, they lose their identification with their original culture. Proxies of acculturation have been used in various studies, including language, generational status, age at immigration, place of birth and place of education.[53] The underlying assumption is that as the new immigrant learns English, they are becoming more adapted to the dominant (white) culture. Supporters of uni-dimensional measures of acculturation consider it to be a "zero-sum" phenomenon, and assume that people do not move from one extreme of culture to another.[73-75] In this way, as people gain a new culture, they lose their original culture.

Newer theories and measures have evolved to include more complex measures of bilingualism and biculturalism, including a wider variety of components that make up one's cultural identification.[76,77] Marin's Bi-dimensional Acculturation Scale[76] utilizes

24 items; one scale (12 items) assesses maintenance of Latino culture, and the other scale (12 items) focuses on adherence to Anglo-American culture. Language use, linguistic proficiency and language preference for electronic media are assessed in each scale, and scores are given for cultural identification to each culture. A person may identify strongly as Latino, Anglo-American or bi-cultural.[76] Bi-dimensional or multi-dimensional models, in contrast to uni-dimensional models, focus on biculturalism.[78] Within bi-dimensional models, several sub-categories have been proposed, including assimilation, separation, integration and marginalization.[73] Of interest to the present studies, one bi-dimensional measure, the Psychological Acculturation Scale, instead focuses on how an individual internalizes and adapts on a psychocultural level to the new cultural norms and expectations.[77] A person's emotional attachment to culture, measured through loyalty, solidarity, identification and comprehension may be a more meaningful measure.[79]

Still others suggest[80] that culture alone as an explanation for the acculturation paradox is inadequate and that there should be increasing focus on structural inequalities such as racism and immigration policy; while others propose that there is insufficient evidence for an acculturation paradox at all.[81] Selective migration, denial of social and historical immigration contexts and inappropriate control groups are cited as fundamental problems with the Latino paradox.[81] Regardless of the myriad arguments about measurement or whether or not acculturation contributes to health disparities, further study of racial and ethnic disparities in maternal and child health is paramount and of high priority for public health and medicine. The science of acculturation research

continues to evolve and a gold-standard for measuring this concept has not yet been developed.

In summary, the Hispanic Paradox has mainly been proven to exist for Mexicans, and has not included other Latino subgroups. Puerto Ricans have distinct migration patterns, culture and history from other Latinos, set apart primarily by the fact that they have possessed US citizenship since 1917 with the signing of the Jones-Shafroth Act, which made the island a US territory. As such, Puerto Ricans are technically internal migrants when moving to the continental US, and their experiences as "immigrants" may not be the same as other Latinas in the US The hallmarks of this circular migration pattern among Puerto Ricans include bilingual language skills and dual home bases both on the island the mainland.[82] Some suggest that future research including Latinos should specify by country of origin, as aggregate data may not be telling the full story for diverse groups within the category of Latino,[83] and highlighting the fact that acculturation is a relevant and important risk factor for all Latinos.

A.4 *Significance*

Much of the literature examining social determinants of health and disparities in birth outcomes has been limited to white-black comparisons, leaving out the important and growing demographic of Latina women. Inadequate sample sizes and language barriers may contribute to Latina women being underrepresented in research.[84] An improved understanding of health within Latino subgroups allows for identification of modifiable risk factors and social pathways that affect maternal and child health, and targets interventions to one of the most high-risk groups of Latinas, Puerto Ricans. In

addition, Puerto Ricans have among the highest rates of preterm birth,[54] and mental illness[85], and among the lowest rates of breastfeeding initiation and duration rates[86] when compared to Latinos born in other countries.

B. LITERATURE REVIEW

B.1 Acculturation and birth outcomes

Acculturation has been shown to be related to risky health behaviors and adverse health outcomes, and studies have suggested that when studying immigrant populations and risk factors for adverse perinatal outcomes, acculturation should be taken into consideration.[87] The literature on acculturation and adverse perinatal outcomes is not conclusive, and the majority of research has been focused on Mexican women living in the United States. The methodology of available studies has varied, as well as the strength and direction of associations. The research on acculturation and birth outcomes can be categorized based on stress hormone involvement theories, maternal nativity studies and the idea that the paradox only holds for birth outcomes due to selective migration.

Some studies support the prevailing notion of increased acculturation levels being linked to poorer perinatal outcomes, mainly due to stress. One pathway for this association may exist via cortisol as a mediator. Higher levels of acculturation have been associated with earlier gestational age and lower birthweight among Mexican American women living in the United States, as well as a flatter diurnal cortisol slope in pregnancy.[88] Another study found that family cohesion, cortisol and acculturation together predicted preterm birth in Mexican women.[89]

Others maintain that the difference in acculturation and birth outcomes lies with maternal nativity only. One study found that foreign born women have best birth outcomes when compared with US born women.[66] The same study found that US-born Latinas do not experience better birth outcomes than whites, but foreign-born Latinas experience better birth outcomes for several endpoints compared with US-born Latinas.[66] The protective effect of foreign-born status on low birthweight among Latina women is strongest among those women with the lowest levels of education and heavily influenced by Mexicans, as they are the largest group of Latinos in the US.[90]

Finally, some research has failed to find a relationship between acculturation and birth outcomes at all. One such study demonstrated little evidence of an acculturation effect among immigrant Mexican women and instead suggested that selective migration may be the mechanism at play.[91] Furthermore, an analysis carried out in Canada concluded that the healthy-migrant effect is outcome-specific to birth outcomes and not psychological distress, and that this effect may be time-limited and more difficult to quantify as acculturation increases.[92] Another study found that crudely, foreign born women had better birth outcomes. After adjustment for age, parity, education, insurance status and pregnancy complications, foreign-born Latina women were more likely to have a low birthweight baby (OR=1.18, 95% CI 0.83-1.88) when compared to white women, which contrasts with the paradox hypothesis,[83] although these results were not statistically significant. That same study also found limited evidence of acculturation modifying poor outcomes.[83] Although the general paradox was supported in another large population-based study, the foreign-born advantage of protecting against LBW did not hold for Puerto Ricans.[90]

Women whose country of origin is Puerto Rico or the Dominican Republic are have lower average incomes and worse health status than the average US born woman. In fact, the preterm birth rate in Puerto Rico was 16.9% in 2012, which is higher than the US national average (11.5%) for all women and for that of Latinas alone (11.7%).[93] Women living in the Dominican Republic have a preterm birth rate which is not as high as Latinas in the United States (10.8%).[94] In Massachusetts specifically, the percentage of births that were preterm for Latinas was 11.6%, compared to 10% for non-Latino whites and 13.7% for non-Latino blacks.[54] Access to prenatal care for Latina women varies by citizenship status. As US citizens, Puerto Ricans qualify for income-based Medicaid. Just over ninety percent of Latina women in Springfield, MA in 2010 attended publicly funded prenatal care programs, which provides free care to women who are pregnant, regardless of citizenship status.[95]

B.2   *Acculturation and breastfeeding*

Latina women had the highest rate of breastfeeding initiation in 2000 (77.6%), followed by whites (71.8%) and blacks (47.4%).[96] These rates increased in 2008 to 58.9% among blacks, 75.2% in whites and 80.0% in Latinas who had ever breastfed.[96] These national data suggest that rates of breastfeeding in Latina women are similar to or better than those of white women; however, certain low-income subgroups of Latinas have worse breastfeeding continuation rates.[97,98] When breastfeeding rates by country of origin are examined, mothers who were born outside the United States were more likely than US-born mothers to breastfeed either term or preterm infants in all racial and ethnic groups.[99] National surveys of breastfeeding, including PRAMS, often lump all Latinas into one category and do not include country of birth, length of stay in the US or national

origin. Lack of measurement of acculturation may be important to consider when looking at breastfeeding initiation rates for Latinas, and country of origin is also important as rates differ among women from different countries in Latin America.[100] Among Latina women, breastfeeding rates have historically been similar to those in their home countries.[101] Culturally sensitive interventions that are informed by research and target groups with the worst breastfeeding outcomes are needed.[97]

In a recent national analysis of breastfeeding among Latina women, Spanish language was used as a proxy for lower acculturation, and English indicated higher acculturation. This study found that women with higher levels of acculturation were 12 percent less likely to breastfeed than women with lower acculturation (prevalence ratio = 0.88, 95% CI .86-.90).[102]   Another study of Latina WIC participants found that lower acculturation was associated with increased breastfeeding behaviors, although the authors used proxy measures to measure acculturation and one multi-dimensional assessment of language.[103] Other studies utilizing uni- and bi-dimensional acculturation scales support this finding and demonstrate better breastfeeding practices among less acculturated Latina women.[104,105]

Cultural interpretations of breastfeeding must also be considered in conjunction with traditional risk factors for Latina women. There is evidence of lack of knowledge regarding breastfeeding recommendations and a belief that any breastfeeding is sufficient.[106] Puerto Rican women may view a fat baby as healthier[107] and may be more prone to supplement with formula.[106] Traditional risk factors associated with lower reported breastfeeding intent among Latina women include unmarried status, low educational achievement and no prenatal care.[108] Intent to breastfeed is defined for

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purposes of the present study as a woman's verbal indication to a health care provider of how she plans to feed her infant. Social desirability bias may be present as women may tell health care providers what they think is the "right answer", however, women's attitudes and decision making about whether or not to breastfeed are often solidified in early pregnancy, and are predictive of initiation and duration of breastfeeding.[109,110]

A literature review of acculturation and breastfeeding identified only 13 studies,[62,99,102-105,108,111-116] four of which looked at intent to breastfeed[105,108,113,114] specifically, instead of actual breastfeeding initiation and duration. Only three[111,114,117] identified women by country of origin beyond "Latina" or "non-Mexican", and included Puerto Ricans, often due to dataset limitations in reporting ethnicity. The effect measures reported by these studies (range of odds ratios (95% CI): 2.2 (1.22-4.43) to 2.5 (0.87, 7.56) in intent studies) consistently support the inverse association of increased breastfeeding intent and behaviors for less acculturated women. Study designs were largely cross-sectional (n=6) or cohort (n=5), and sample sizes ranged from 114 in a small randomized controlled trial[111] to 33,121 in a national survey.[104] Just two studies used validated instruments to measure acculturation: Chapman and Perez-Escamilla[111] ((Acculturation Rating Scale for Mexican-Americans (ARSMA-II)) and Rassin[113] (based on the original ARSMA); all other studies used proxy measures of acculturation, most frequently language or nativity.

In conclusion, there is a growing body of research on acculturation and breastfeeding, yet only one study utilized a well-established and validated instrument, and no research was found which utilized a psychological adaptation approach to measuring acculturation. Building on previous research,[111] there is a need for sufficiently

powered research to elucidate differences in breastfeeding intention among Latina

subgroups. Puerto Rican women have lower rates of exclusive breastfeeding, compared

with women from Central or South America,[101] and are understudied. Therefore, the

proposed study adds to the current literature in significant ways, including a large sample

size and a novel way of looking at acculturation (PAS) in two understudied Latina

subgroups.

B.3   *Acculturation and anxiety in pregnancy*

The relationship between acculturation and mental health among immigrants has

yet to be conclusively determined. Early studies hypothesized that immigrants would be

more vulnerable to mental illness due to acculturative stress, language barriers and racial

discrimination.[118] More recent epidemiologic studies have challenged this, however,

finding that through maintaining cultural ties and strong identification, the mental health

status of new immigrants is better than their US born counterparts,[119-121] and that they

may be less likely to abuse illegal drugs.[122] This may be attributed to living in protective

communities or ethnic enclaves.[69] As time goes on, however, higher levels of

acculturation have been found to be associated with higher rates of PTSD, substance

abuse, depression and phobias.[121]

The combination of acculturation and prevalence of mental illness in pregnancy

then presents an interesting and unique set of stressors and risks for demographically at-

risk women such as Latinas. In a nationally representative sample, Puerto Ricans had the

highest overall prevalence of mental illness of all Latino groups (39.0%), and nearly a

third of Latina women (30.2%) had a psychiatric disorder over the course of their

lifetime.[123] Previous studies have found that increases in maternal pregnancy-related

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anxiety are associated with decreased gestational age in samples of primarily Mexican Latinas,[124-126] but there were no studies found on the prevalence of anxiety in Latinas either as a whole, or by subgroup.

A review of the literature on the relationship between acculturation and anxiety (either generalized or pregnancy-specific) in pregnancy revealed only six published studies.[125,127-131] The findings from these studies are inconsistent; three studies found no association,[127-129] one found that higher acculturated women had lower pregnancy-related anxiety,[130] and two found that higher acculturation was associated with increased anxiety.[125,131] All of these studies looked at Mexicans or Mexican-Americans as the primary Latina subgroup, five had a prospective study design, and one was cross-sectional. Total sample sizes in these investigations ranged from 265-1064 pregnant women, and only one used a contemporary scale to measure acculturation (ARSMA-II).[128] Others utilized Szapocznik's Biculturalism Scale (1978),[129] Cuellar's ARSMA scale (1980),[125] or proxies, including maternal nativity[127,130] and generational status[131] in the United States.

In conclusion, there is strong evidence that psychological distress, including stress and anxiety, in pregnancy affects birth outcomes.[132] What is less obvious is how acculturation is related to anxiety in pregnancy, and how this differs among women of Latina ethnicity. It is plausible that cultural and immigration factors may place different and unique stressors on a woman in pregnancy and mitigating, where possible, anxiety in pregnancy for this group merits further investigation. The present study is novel in that it is studying this issue in Puerto Rican and Dominican women, and has adequate sample sizes and validated instruments to do so.

In sum, our knowledge is limited on both the fluid and individual nature of acculturation and how it may impact the perinatal health of Latinas. What is known, however, is that Latinas are a group made up of people with varying experiences both in terms of health and immigration, and the focus of research in this area has been largely on Mexicans. These studies will be undertaken in an effort to contribute new knowledge on the subject.

C. RESEARCH QUESTIONS AND HYPOTHESES

Manuscript 1: Is acculturation associated with adverse birth outcomes (i.e. preterm birth, low birthweight, small for gestational age infant)?

Hypothesis: Lower acculturation will be associated with a lower risk of preterm birth, low birthweight and small for gestational age.

Manuscript 2: Is acculturation associated with intent to breastfeed?

Hypothesis: Higher acculturated women will be less likely to intend to breastfeed than women with lower levels of acculturation.

Manuscript 3: Is acculturation associated with state or trait anxiety in pregnancy? Is acculturation associated with change in state anxiety over the course of pregnancy?

Hypothesis: Higher acculturation will be associated with increased state and trait anxiety in pregnancy.

D. METHODS AND MATERIALS

The following three manuscripts examine how acculturation affects birth outcomes, intent to breastfeed, and anxiety in pregnancy in a sample of predominantly Puerto Rican women. These secondary analyses utilize data from Proyecto Buena Salud, a prospective cohort study carried out between 2006-2001 in Springfield, Massachusetts. The aim of the original study was to examine the effects of exercise and nutrition on gestational diabetes in pregnancy, and over 1600 women were enrolled.[133] Acculturation is the exposure of interest in all three manuscripts, and was assessed at study enrollment in early pregnancy. A validated bi-dimensional instrument was utilized to measure acculturation (Psychological Acculturation Scale[77]); as well as proxies of generation in the United States and preferred spoken and written language. Birth outcomes were abstracted from medical records after delivery, as was intent to breastfeed. The State-trait anxiety Scale[134] was used to measure anxiety in early, mid and late pregnancy. Study approval was received from the Institutional Review Boards of the University of Massachusetts-Amherst, Baystate Health and Tulane University.

The first manuscript examines the association of acculturation and adverse birth outcomes. Descriptive statistics and bivariate associations were examined using Chi-square tests for categorical variables and t-tests for continuous variables. Unadjusted and multivariable logistic regression was employed to examine birth outcomes as dichotomous outcomes. Unadjusted and multiple linear regression was also utilized to examine continuous birthweight and gestational age. Potential confounders were identified via a priori knowledge and Directed Acyclic Graphs (DAGs).[135] Based on

DAGs, the following covariates were included in multivariable models: age, education and living with a partner. Factor analysis was employed to assess the reliability of the instrument in this sample. Sensitivity analyses were also conducted to distinguish low birthweight babies who were born preterm from those who were growth restricted.[136] Similarly, sensitivity analyses for small for gestational age were conducted to distinguish preterm from growth restriction effects.

Acculturation and infant feeding intention were studied in the second manuscript. Women reported either before or immediately after delivery whether they planned to breastfeed exclusively, breast and formula feed, or formula feed exclusively. Feeding intent was dichotomized as intent to exclusively breastfeed versus intent to formula feed or a combination of breast and formula feed. A three-level outcome was also used to examine feeding as: intent to breastfeed, intent to formula feed, or intent to combination feed. Directed Acyclic Graphs (DAGs)[135] and 10% change in estimate procedures were used to identify covariates for inclusion in multivariable models; these included age, education, living with a partner, parity and history of preterm birth. Chi-square and t-tests were utilized to examine bivariate associations between acculturation and infant feeding intent. Logistic regression was used to conduct unadjusted and multivariable analyses for the dichotomous outcome of intent to breastfeed (yes, no). A multinomial logistic regression model was also fit to examine the three-level feeding intent variable (generalized logit) to produce separate odds ratios for predicting intent to breastfeed and intent to combination feed compared to intent to exclusively formula feed.

Finally, the third manuscript investigated the association between acculturation and anxiety (state and trait) in pregnancy. Anxiety was assessed three times in this study, using the Spielberger State-Trait Anxiety Inventory (STAI).[134] The first anxiety measurement was taken at the enrollment visit, using the STAI-T, which assesses anxiety as a baseline personality trait. This scale contains 20 statements about how an individual responds with anxiety to stressful situations, and measures anxiety proneness. The STAI state anxiety scale (STAI-S) was then used at two additional interviews in pregnancy- at 18-20 weeks and then at 24-28 weeks. This state anxiety scale measures how a stressful situation, specifically pregnancy, evokes anxiety in a woman.[134] Both scales utilize a 4-point Likert-type scale, ranging from 1 (almost never) to 4 (almost always). Scores range from 20-80, and higher anxiety is represented by higher scores. Relatively few confounders were identified via Directed Acyclic Graphs[135]; these included age, education, parity and living with a partner. Basic descriptive statistics (means, standard deviations and frequencies) were computed for the exposure, outcome and covariates of interest. Bivariate associations were calculated using t-tests for continuous variables, Chi-square tests for categorical variables, and ANOVA for associations between categorical and continuous variables. Unadjusted and multivariable linear regression was utilized to examine continuous anxiety scores and the difference between state anxiety measurements. Unadjusted and multivariable logistic regression was also employed to evaluate change in state anxiety (dichotomous increase or decrease).

E. MANUSCRIPT 1: Acculturation and adverse birth outcomes in a predominantly
   Puerto Rican population

Abstract

Background: Latinas in the United States on average have poorer birth outcomes than
Whites. Considerable heterogeneity exists within Latina subgroups, however, and Puerto
Ricans have some of the highest rates of preterm birth and low birthweight. The goal of
this study was to determine if acculturation was associated with adverse birth outcomes
in a predominantly Puerto Rican population.

Methods: We conducted a secondary analysis of data from Proyecto Buena Salud, a
prospective cohort study of Latina women. Birth outcomes (gestational age and
birthweight) were abstracted from medical records after delivery (n=1362).
Acculturation was measured in early pregnancy; directly via a psychological
acculturation scale, and via proxies of language preference and generation in the United
States.

Results: After adjustment for important risk factors, women with lower levels of
acculturation as measured by the PAS (aOR 1.62 [0.90, 2.91]), Spanish language
preference (aOR 1.34 [0.86, 2.09]), and first generation in the US (aOR 1.43 [0.95, 2.14])
were more likely to have a preterm birth as compared to women with higher levels of
these acculturation measures, although these measures were not statistically significant.
Women with Spanish language preference were more likely to have a low birthweight
baby (aOR 1.56 [0.97, 2.52]) compared to those with English language preference.
Women with lower levels of acculturation had babies with statistically significantly lower
gestational age and birthweights as compared to women with higher levels of
acculturation.

Conclusions: Low acculturation was associated with lower gestational age and
birthweights and a possible increased risk of adverse birth outcomes.

Racial and ethnic minorities in the United States are consistently at higher risk for a constellation of poor health indicators.[1] Latinos represent the largest minority group in the country and by 2043, the US will be a "majority minority" nation.[2] Latina women have rates of preterm birth, low birthweight and small for gestational age that are similar to or lower than those of white women.[3] Within the category of Hispanic (Latino), however, lies a more complex picture of heterogeneity. Puerto Ricans have higher rates of preterm birth (13.2%) than Central/South Americans (11.8%) and women of Mexican descent (11.1%), and have higher rates of low birthweight (9.4%) than Cuban, Central/South American and Mexican descended women.[4]

Several factors have been associated with adverse birth outcomes, including medical and obstetric risk factors,[5] stress and anxiety,[6,7] and social determinants of health.[8] A less studied social determinant, acculturation, has been defined as "the process by which immigrants adopt the attitudes, values, customs, beliefs and behaviors of a new culture".[9] Acculturation has been negatively related to risky health behaviors and adverse health outcomes.[10,11] Therefore, studies have suggested that when studying immigrant populations and risk factors for adverse perinatal outcomes, acculturation should be taken into consideration.[12] The literature on acculturation and adverse perinatal outcomes is not conclusive, and the majority of research has focused on Mexican women living in the United States. As compared to other Hispanics, Puerto Ricans and Dominicans experience the greatest health disparities, lower levels of education and income, and exhibit more adverse behaviors such as poor nutrition.[6,7]

Acculturation has been measured using linear (i.e., uni-dimensional) scales[13,14] which focus on behaviors and language as the main indicators of acculturation, and assume that as a person acculturates, they lose their identification with their original culture. Bi-dimensional measures include a wider variety of components that make up one's cultural identification, and allow for biculturalism.[15] The Psychological Acculturation Scale (PAS)[16] is a bi-dimensional scale that focuses on psychological attachment to both cultures, and may be preferable as it incorporates the individual's unique psychological response to cultural exposures.

A recent literature review revealed a total of 14 prior studies[11,12,17-28] that have evaluated the association between acculturation and adverse birth outcomes. Only five prior studies of acculturation and adverse birth outcomes utilized a bi-dimensional acculturation measure[12,17,18,21,23], and no studies on this topic have used the PAS. The remainder used language preference or birthplace as a proxy for acculturation. In addition, eight[11,17,25-28] of the fourteen studies were cross-sectional, limiting the ability to identify the direction of associations and only two[26,27] were conducted among a predominantly Puerto Rican population. Findings have been conflicting. While some studies found that increased acculturation measured via uni-[24] or bi-dimensional scales[21,23], English language preference[23], or US birthplace[22,26] led to increased risk of adverse birth outcomes, seven studies had null findings,[11,12,17-20,27] and two studies found that US birthplace was associated with a decreased risk of adverse birth outcomes.[25,28]

One possible explanation for this finding is that Puerto Rican women are US citizens and have freedom of movement to and from the mainland; therefore their

experience as "immigrants" may differ from other Latinas in the US. The hallmarks of this circular migration pattern among Puerto Ricans include bilingual language skills and dual home bases both on the island the mainland.[29] Thus, the association between acculturation and adverse birth outcomes may differ among Puerto Ricans relative to other Hispanic subgroups.

Therefore, the purpose of our study was to investigate if acculturation was associated with adverse birth outcomes in a sample of pregnant women in a population of predominantly Puerto Rican women.

Methods

Proyecto Buena Salud (PBS) was a prospective study in Western Massachusetts conducted from 2006-2011. Details on the PBS study design have been published elsewhere.[30] The study was based in the public obstetrics and gynecology clinic and midwifery practice at Baystate Medical Center, a large tertiary care facility in Western Massachusetts which serves a predominantly Puerto Rican Latino population. The overall goal of PBS was to examine how physical activity and psychosocial stress influenced the onset of gestational diabetes mellitus in this high risk and understudied population. Eligibility was restricted to women who had heritage from and who: 1) were born in Puerto Rico or the Dominican Republic, 2) had a parent born in Puerto Rico or the Dominican Republic, or 3) had two grandparents born in Puerto Rico or the Dominican Republic, and who spoke either English or Spanish. Exclusion criteria included 1) current medications that can affect glucose tolerance, 2) multiple gestation, 3)

history of chronic renal disease, hypertension, diabetes or heart disease and 4) age <16 years or >40 years.

Bilingual interviewers recruited patients at a prenatal care visit early in pregnancy (up to 20 weeks gestation), informed them of the aims and procedures of the study, and obtained written informed consent (in English or Spanish) as approved by the Institutional Review Boards of the University of Massachusetts-Amherst and Baystate Health. In order to minimize language barriers, face-to-face interviews were conducted in the participant's preferred spoken language, and answers were recorded on language-corresponding paper surveys. At the time of recruitment, interviewers collected information on socio-demographic factors, pre-pregnancy BMI, physical activity, psychosocial stress, cigarette smoking, and acculturation. After delivery, medical records were abstracted for medical and obstetric history, clinical characteristics of the current pregnancy, and birth outcomes. Exempt status was received by Tulane University's Institutional Review Board for this secondary analysis.

A total of 1583 prenatal care patients were eligible and enrolled in Proyecto Buena Salud between January 2006 and October 2010. For the current analysis, we excluded 68 participants who experienced a miscarriage, and 8 with multiple gestations. Six women were missing information on all exposure variables (PAS, preferred language and generation in the United States), and 139 participants were missing delivery information (i.e. didn't deliver at Baystate Hospital). This resulted in a final sample of 1362 for analyses.

Assessment of Acculturation

In PBS, acculturation was determined directly using the Psychological Acculturation Scale,[16] as well as via generation and language. These measures were assessed at the time of enrollment, before 20 weeks of pregnancy. The Psychological Acculturation Scale (PAS) is a 10-item bi-dimensional instrument that measures psychological attachment to each culture, allowing for bicultural identification. A Likert scale from 1 to 5 was used for each item; a score of 3 defines a bicultural orientation, less than three indicates a low acculturation, and a score of 3 or greater to indicate high acculturation to the dominant white culture. The mean of the responses on each item was calculated in PBS to create an overall acculturation score. The PAS has high internal consistency, with alpha coefficients of 0.90 (Spanish) and 0.83 (English) in Puerto Rican populations.[16] Acculturation was treated as a categorical variable (high = greater than three, bicultural = three, low = less than three), a dichotomized variable (high = greater than or equal to three, low = less than 3), and as a continuous measure, as has been done in previous analyses of this study.[30] Proxy measures of acculturation were also considered, including preferred language (dichotomous English/Spanish) and generation in the United States. Generation in the United States was defined as first (woman born in Puerto Rico/Dominican Republic), second (at least one parent born in Puerto Rico/Dominican Republic) or third (at least two grandparents born in Puerto Rico/Dominican Republic), based on self-report, and was examined as both a three-level categorical variable and a dichotomous variable (first generation vs. second or third generation).

Assessment of Birth Outcomes

After delivery, information on birth outcomes was obtained from medical records by abstractors who were blinded to information on acculturation and other exposures. The study obstetrician confirmed all cases of preterm birth and low birthweight. Birth outcomes were treated as dichotomous variables based on conventional clinical definitions (birthweight <2500g, preterm <37 weeks of pregnancy, small for gestational age defined as less than 10th percentile for gestational age based on an reference standard.[31] Small for gestational age was calculated based on an established external cohort of Hispanic infants.[32] Birthweight and gestational age at delivery were also examined as continuous variables.

Assessment of covariates

We collected information on known or suspected risk factors for adverse birth outcomes, including maternal age, education (highest level of education completed), annual household income, parity (refers to number of births), cigarette smoking during pregnancy, living with a partner, medical complications (history of placenta previa, pre-eclampsia, toxemia, or uterine infection) in a prior pregnancy, and history of preterm birth.[33]

Statistical Analysis

Bivariate associations between exposure, outcome and covariates were examined using Chi-square tests for categorical variables and t-tests for continuous variables. Unadjusted and multivariable logistic regression was employed to examine birth outcomes as dichotomous outcomes. Unadjusted and multiple linear regression was also utilized to examine continuous birthweight and gestational age. Potential

confounders were identified via a priori knowledge and Directed Acyclic Graphs (DAGs).[34] Based on DAGs, the following covariates were included in multivariable models: age, education and living with a partner. Additional assessment of confounders using 10% change in estimate methods was also employed, but did not result in significant changes in results. Factor analysis was also employed to assess the reliability of the instrument in this sample.

Finally, sensitivity analyses were conducted, as some have suggested, to distinguish low birthweight babies who were born preterm from those who were growth restricted.[35] Similarly, sensitivity analyses for small for gestational age were conducted to distinguish preterm from growth restriction effects. Specifically, infants that were born after 37 weeks' gestation and who weighed less than 1500g were coded as "1" for "term low birthweight", while other combinations (preterm, >1500g; preterm, <1500g; term, >1500g) were coded as "0". Similarly, infants that were full-term (>37 weeks) and SGA were coded as "1" for "term SGA", while other combinations (preterm, not SGA; preterm, SGA; term, not SGA) were coded as "0". Validity and internal consistency were also examined for the PAS in this sample. All analyses were conducted using SAS 9.3 (Cary, N.C.).

Results

The final sample of 1362 women were mainly low acculturated, with a mean level of psychological acculturation of 2.4 ± 0.6 (range 1-5, and 3 being bicultural). Approximately 24% of women preferred Spanish, and 47% were first generation in the US. Preterm birth occurred in 9.9% of women, low birthweight in 8.3% and small-for-

gestational age in 12.7%. The majority of participants were young (under the age of 24),

pregnant with their first child and just over half had completed high school or more

education (Table 1).

Women who were higher acculturated were more likely to prefer to speak

English (93.8%) than women who were lower acculturated (69.8%) (p<.0001). Among

women born in Puerto Rico/Dominican Republic, women were more likely to be low

acculturated (52.6%) than higher acculturated (28.5%) (p<.0001). As generation in the

US increased (at least one parent born in Puerto Rico/Dominican Republic or

grandparents born in Puerto Rico/Dominican Republic), women were more likely to

report higher psychological acculturation (compared to women who were themselves

born in Puerto Rico/Dominican Republic). None of the other socio-demographic or

behavioral covariates were significantly associated with acculturation (Table 2).

We then examined the relationship between acculturation and birth outcomes

in unadjusted and multivariable analyses (Table 3). After adjustment for important risk

factors, women with lower levels of psychological acculturation were more likely to

have a preterm birth (aOR 1.62 [0.90, 2.91]) than high acculturated women, although

this was not statistically significant. Similarly, there was also the suggestion that

women who preferred to speak Spanish were more likely to have a preterm birth (aOR

1.34 [0.86, 2.09]) as compared to those who preferred to speak English. Finally, women

who were first generation in the US were more likely to have a preterm birth (aOR 1.43

[0.95, 2.14]) compared to those who were second generation or later, but again this was

not statistically significant.

In terms of the association between acculturation and low birthweight, women who preferred to speak Spanish were more likely to have a low birthweight baby (aOR 1.56 [0.97, 2.52]) as compared to women who preferred English, but this was not statistically significant (Table 3). There were no statistically significant associations between psychological acculturation or generation in the US and low birthweight. Finally, there were no statistically significant associations between the acculturation measures and small-for-gestational-age (Table 3).

We then evaluated the association between the acculturation measures and the continuous outcomes of gestational age and birthweight (Table 4). After adjustment for age, education and living with a partner, every unit increase in PAS score was associated with an increase in gestational age of 0.22 weeks (SE=0.1, p=0.04). Women who preferred to speak Spanish had significantly lower gestational age babies (adjusted beta= -0.39, SE= 0.2, p=0.02) than women who preferred English. Women who were first generation in the US had significantly lower gestational age babies (adjusted beta= -0.33, SE=0.1, p=0.02) as compared to women who were later generation.

In terms of the association between acculturation measures and birthweight, women who reported 'bicultural' levels of psychological acculturation had babies 201.7 grams (SE=77.8, p=0.01) less than women with high psychological acculturation (Table 4). Finally, in adjusted analyses, women who were first generation in the US had babies who weighed 76.11g less (SE=35.2, p=0.03) than women who were second generation or later. Factor analysis revealed that the first two questions on the PAS ["With which culture do you 1) share the most beliefs or values, and 2) have the most in common

with"] represented the majority of the variance for the instrument. Cronbach's alpha was 0.87 overall for this sample, demonstrating good internal consistency of the PAS. The reliability of the Spanish PAS was 0.84, and English was 0.85. Finally, the sensitivity analyses conducted to distinguish low birthweight babies who were born preterm from those who were growth restricted showed no significant differences in findings.

Comments

In this prospective study of predominantly Puerto Rican women, we found that after adjustment for important risk factors, women with lower levels of acculturation as measured by the psychological acculturation, Spanish language preference, and first generation in the US were approximately 30-60% more likely to have a preterm birth as compared to women with higher levels of these acculturation measures, although these measures were not statistically significant. Women with Spanish language preference were 60% more likely to have a low birthweight baby compared to those with English language preference, but again this was not statistically significant. Findings for continuous birth outcomes were stronger, with women with lower levels of acculturation having babies with statistically significantly lower gestational age and birthweights as compared to women with higher levels of acculturation.

These findings are inconsistent with some[12,17-24,26] but not all[11,25,27,28] prior studies on acculturation and Latina women. No previous studies, however, have used the PAS, and few focused on Puerto Ricans. Our findings that low levels of acculturation as measured by the PAS may be associated with increased risk of adverse birth outcomes

were in contrast to one of the two[26,27] prior studies which were conducted among a predominantly Puerto Rican population, although neither used the PAS. Specifically, Engel et al. utilized data from a national sample of 127,818 Puerto Rican women in 1995 with linked infant birth and death records and compared nativity and birth outcomes.[26] Puerto Rican born women had lower odds of low birthweight (OR=0.94 [0.89, 0.97]) and SGA (OR=0.93 [0.89, 0.97]) than US born women. However, consistent with our findings, the Puerto Rican Maternal and Infant Study failed to find a statistically significant association between nativity and generation and risk of low birthweight among 1146 Puerto Rican mothers who were interviewed in person about their pregnancy in 1999.[27]

In the current study, we found that women born in Puerto Rico/Dominican Republic had a higher odds of low birthweight (aOR=1.16 [0.75, 1.78]) as compared to women born in the US. Similarly, in a sample of Latinas (n=258,680) (28.5% Puerto Rican) obtained from New York vital records, island-born Puerto Rican women in that study had a higher risk of preterm birth than women who were US born.[25] Similarly, another analysis among 4443 participants (6% Puerto Rican) in New York City PRAMS data[28] found that island-born Puerto Ricans had higher odds of low birthweight (OR=1.72 [0.73, 4.06]) than US born whites, as did mainland born Puerto Ricans (OR=1.17 [0.6, 2.09]), although these results were not statistically significant. Finally, a national sample of Latinas (6.7% Puerto Ricans) reported increased odds of low birthweight for island-born women compared to US born Puerto Ricans (OR 1.08 [1.00, 1.16]), although this was not statistically significant.[11]

Although language as a proxy for acculturation was collected in several studies,[12,18,21-24] only one study reported results for adverse birth outcomes by language. In that study of Mexican women, high English proficiency was associated with increased prevalence of preterm birth (10.1%, p<.05).[23] In contrast, in our study, we found that women with Spanish language preference were more likely to have a low birthweight baby (aOR 1.56 [0.97, 2.52]) compared to those with English language preference.

Our findings may be reflective of a woman's level of acculturation and adherence to behaviors and beliefs that are not optimal for maternal and child health. There may also be less selective migration for Puerto Ricans which contribute to the poorer outcomes for newer arrivals. The circular migration patterns unique to Puerto Ricans may also contribute to the lack of strong ties in the US, and although we attempted to control for social support by controlling for living with a partner, this may be an incomplete measure.

There are several strengths and limitations to this study. To our knowledge, this was the first study to use the PAS to investigate whether acculturation was associated with adverse birth outcomes in a predominantly Puerto Rican population. There was evidence of good reliability of the PAS in this sample. Other strengths included the prospective nature of the study, considerable sample size and high participation rates. It is possible that there was residual confounding because there was no information on length of time spent in the United States or migration patterns before and during pregnancy.

In summary, in this prospective cohort of predominantly Puerto Rican women we found that low acculturation was associated with lower gestational age and birthweight and a possible increased risk of adverse birth outcomes. Future research should consider prospective designs and inclusion of acculturation, nativity and ethnicity when studying disparities in birth outcomes among Latinas.

Acknowledgements

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Table 1. Baseline characteristics of study population, Proyecto Buena Salud, 2006-2011, N=1362

	Total sample		
	n	*%*	missing
Primary exposures			
Psychological Acculturation Scale (PAS)			
Low <3	917	79.4	207
High ≥3	238	20.6	
Low (<3)	917	79.4	207
Bicultural (3)	91	7.9	
High (>3)	147	12.7	
Continuous PAS Score (mean, SD)	2.4	0.6	207
Language preference for speaking/reading			
Spanish	314	24.4	76
English	972	75.6	
Generation (dichotomized)			
First generation (Born in PR/DR)	622	47.1	42
Second generation (Parent or grandparents born in PR/DR)	698	52.9	
Generation in the United States			
First generation (Born in PR/DR)	622	47.1	42
Second generation (At least one parent born in PR/DR)	622	47.1	
Third generation (Grandparents born in PR/DR)	76	5.8	
Primary outcome variables			
Preterm birth			
No	1227	90.2	1
Yes	134	9.9	
Gestational age at delivery (mean, SD)	39	2.6	1
Low birthweight			
No	1233	91.7	18
Yes	111	8.3	
Birthweight (mean, SD)	3198.5	602.2	18
Small for gestational age			

	No	1174	87.3	18
	Yes	170	12.7	

Primary covariates

Age

	16-19	426	31.3	0
	20-24	533	39.1	
	25-29	240	17.6	
	≥30	163	12.0	

Education

	< High School	596	48.6	136
	High School graduate	398	32.5	
	Some college/graduate	232	18.9	

Annual household income

	≤$15,000	365	58.4	737
	>$15,000-$30,000	184	29.4	
	>$30,000	76	12.2	

Live with partner/spouse

	No	591	48.8	151
	Yes	620	51.2	

Any smoking in pregnancy

	No	1046	84.2	119
	Yes	197	15.9	

Parity

	Nulliparous	565	41.6	3
	1	406	29.9	
	≥2	388	28.6	

Pregnancy complications *

	None	1284	95.6	19
	Yes	59	4.4	

History of preterm birth

	No	1198	89.6	25
	Yes	139	10.4	

*History of previa, pre-eclampsia, toxemia, or uterine infection in a prior pregnancy.
Numbers may not sum to 100 due to rounding
PR= Puerto Rico, DR= Dominican Republic

Table 2. Bivariate associations by level of acculturation, Proyecto Buena Salud, 2006-2011

	Psychological Acculturation Scale				
	Low (1 to <3)		High (≥3)		
	(n=917)		(n=238)		
	n	*%*	n	%	P-value
Language preference for speaking/reading					
Spanish	263	30.2	14	6.3	<.0001
English	609	69.8	210	93.8	
Generation in the United States					
First generation (Born in PR/DR)	464	52.6	66	28.5	<.0001
Second generation (Parent or grandparents born in PR/DR)	418	47.4	166	71.6	
Generation in the United States					
First generation (Born in PR/DR)	464	52.6	66	28.5	<.0001
Second generation (At least one parent born in PR/DR)	381	43.2	143	61.6	
Third generation (Grandparents born in PR/DR)	37	4.2	23	9.9	
Age					
16-19	296	32.3	66	27.7	0.49
20-24	357	38.9	99	41.6	
25-29	165	18	42	17.7	
≥30	99	10.8	31	13	
Education					
< High School	446	48.6	108	45.6	0.63
High School graduate	299	32.6	79	33.3	
Some college/graduate	172	18.8	50	21.1	
Annual household income					
≤$15,000	272	59.7	82	56.9	0.59
>$15,000-$30,000	132	29	41	28.5	
>$30,000	52	11.4	21	14.6	
Living with partner					
No	476	52.4	110	47	0.14
Yes	433	47.6	124	53	
Any smoking during pregnancy					
No	759	85.3	187	82	0.22
Yes	131	14.7	41	18	
Parity					
Nulliparous	388	42.4	94	39.8	0.28
1	288	31.4	68	28.8	
>2	240	26.2	74	31.4	

Numbers may not sum to 100 due to rounding
P-values generated from Chi-Square tests
PR= Puerto Rico, DR= Dominican Republic

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Table 3. Odds ratios and 95% confidence intervals for the effects of acculturation variables on adverse birth outcomes, Proyecto Buena Salud, 2006-2011.

	Preterm Birth						Low Birth Weight						Small for Gestational Age					
			Unadjusted		Adjusted				Unadjusted		Adjusted				Unadjusted		Adjusted	
	n	%	OR	95%CI	OR	95%CI	n	%	OR	95%CI	OR	95%CI	n	%	OR	95%CI	OR	95%CI
Psychological Acculturation Scale (PAS)																		
PAS - 2 level																		
Low (<3)	86	86.0	1.66	[0.93,2.97]	1.62	[0.90,2.91]	68	82.9	1.29	[0.71,2.33]	1.38	[0.74,2.54]	111	78.7	1.0	[0.62,1.47]	1.0	[0.62,1.50]
High (≥3)	14	14.0	Reference		Reference		14	17.1	Reference		Reference		30	21.3	Reference		Reference	
PAS - 3 level																		
Low (<3)	86	86.0	1.17	[0.62,2.19]	1.13	[0.60,2.13]	68	82.9	0.91	[0.48,1.72]	0.96	[0.49,1.88]	111	78.7	0.75	[0.46,1.21]	0.73	[0.44,1.21]
Bicultural (3)	2	2.0	0.25	[0.06,1.16]	0.25	[0.05,1.14]	2	2.4	0.25	[0.01,1.16]	0.27	[0.06,1.23]	7	5.0	0.45	[0.19,1.10]	0.42	[0.17,1.05]
High (>3)	12	12.0	Reference		Reference		12	14.6	Reference		Reference		23	16.3	Reference		Reference	
Continuous PAS Score (mean, SD)	2.3	0.6	0.75	[0.54,1.02]	0.77	[0.56,1.05]	2.3	0.7	0.78	[0.55,1.10]	0.78	[0.55,1.10]	2.4	0.7	1.08	[0.82,1.42]	1.07	[0.81,1.41]
Language preferred for speaking/reading																		
Spanish	37	28.7	1.28	[0.86,1.92]	1.34	[0.86,2.09]	33	31.7	1.47	[0.95,2.27]	1.56	[0.97,2.52]	42	26.1	1.09	[0.75,1.59]	1.23	[0.82,1.84]
English	92	71.3	Reference		Reference		71	68.3	Reference		Reference		119	73.7	Reference		Reference	
Generation in the United States																		
First generation (Born in PR/DR)	68	52.3	1.26	[0.88,1.81]	1.43	[0.95,2.14]	54	49.5	1.12	[0.76,1.66]	1.16	[0.75,1.78]	73	44.0	0.87	[0.63,1.21]	0.90	[0.63,1.28]
Second or third generation (Parent or grandparents born in PR/DR)	62	47.7	Reference		Reference		55	50.5	Reference		Reference		93	56.0	Reference		Reference	
Generation in the United States																		
First generation (Born in PR/DR)	68	52.3	1.75	[0.68,4.48]	1.58	[0.61,4.12]	54	49.5	2.32	[0.71,7.61]	2.10	[0.63,7.03]	73	44.0	1.13	[0.52,2.45]	1.06	[0.48,2.33]
Second generation (At least one parent born in PR/DR)	57	43.9	1.43	[0.56,3.69]	1.12	[0.43,2.94]	52	47.7	2.21	[0.67,7.25]	1.93	[0.58,6.41]	85	51.2	1.34	[0.62,2.88]	1.20	[0.55,2.63]
Third generation (Grandparents born in PR/DR)	5	3.9	Reference		Reference		3	2.8	Reference		Reference		8	4.8	Reference		Reference	

*Adjusted model included age, education and living with a partner

PR= Puerto Rico, DR= Dominican Republic

OR= Odds ratios; CI= Confidence Intervals

Table 4. Beta coefficients, standard errors and p values for effects of acculturation variables on gestational age and birthweight, Proyecto Buena Salud, 2006-2011.

	Gestational Age (weeks) (n=1361)						Birthweight (grams) (n=1344)					
	Unadjusted			**Adjusted**			**Unadjusted**			**Adjusted**		
	β	*SE*	*p-value*	*β*	*SE*	*p-value*	*β*	*SE*	*p-value*	*β*	*SE*	*p-value*
Psychological Acculturation Scale (PAS)												
PAS - 2 level												
Low (<3)	-0.27	0.2	0.11	-0.26	0.2	0.12	-43.74	42.2	0.30	-38.59	42.5	0.36
High (≥3)	Reference			Reference			Reference			Reference		
PAS - 3 level												
Low (<3)	-0.14	0.2	0.49	-0.12	0.2	0.56	26.27	51.4	0.61	38.99	51.9	0.45
Bicultural (3)	0.33	0.3	0.28	0.37	0.3	0.24	183.59	77.2	0.02	201.67	77.8	0.01
High (>3)	Reference			Reference			Reference			Reference		
Continuous PAS Score (mean, SD)	0.23	0.1	0.03	0.22	0.1	0.04	22.56	26.4	0.39	18.30	26.7	0.49
Language preferred for speaking/reading												
Spanish	-0.39	0.2	0.02	-0.39	0.2	0.02	-51.00	38.9	0.19	-67.43	41.4	0.10
English	Reference			Reference			Reference			Reference		
Generation in the United States												
First generation (Born in PR/DR)	-0.33	0.1	0.02	-0.33	0.1	0.02	-60.33	33.4	0.07	-76.11	35.2	0.03
Second or third generation (Parent or grandparents born in PR/DR)	Reference			Reference			Reference			Reference		
Generation in the United States												
First generation (Born in PR/DR)	-0.68	0.3	0.03	-0.53	0.3	0.09	-144.55	73.6	0.049	-158.43	76.6	0.04
Second generation (At least one parent born in PR/DR)	-0.39	0.3	0.21	-0.23	0.3	0.46	-94.45	73.6	0.20	-92.04	76.0	0.23
Third generation (Grandparents born in PR/DR)	Reference			Reference			Reference			Reference		

*Adjusted model included age, education and living with a partner

PR= Puerto Rico, DR= Dominican Republic

β= Beta coefficient; SE= Standard Error

F. MANUSCRIPT 2: Acculturation and intention to breastfeed among a population of predominantly Puerto Rican women

Abstract

Background: Latina women have the highest breastfeeding initiation rates of any ethnic/racial group in the United States, yet certain low-income subgroups have worse rates. In the US, Puerto Ricans have lower exclusive breastfeeding rates than women from Central and South America. The purpose of this study was to determine if acculturation was associated with intent to breastfeed in a predominantly Puerto Rican population.

Methods: We conducted a secondary analysis among 1323 participants in Proyecto Buena Salud, a prospective cohort study of Latina women. Infant feeding intent was abstracted from medical records and categorized as intent to exclusively breastfeed, intent to exclusively formula feed, or intent to combination feed. Acculturation was measured in early pregnancy via the Psychological Acculturation Scale (PAS), and by language preference and generation in the United States.

Results: Increasing acculturation as measured by English language preference (aOR 0.61, 95% CI 0.42-0.88) and second or third generation in the US (aOR 0.70, 95% 0.52-0.95) was inversely associated with odds of intending to breastfeed. Similarly, women with higher levels of acculturation as measured by the PAS (aOR 0.67, 95% CI 0.45-0.99), English language preference (aOR 0.48, 95% CI 0.33-0.70) and second or third generation in the US (aOR 0.42, 95% CI 0.31-0.58) were less likely to report intent to combination feed as compared to women with lower acculturation.

Conclusions: Acculturation as measured by the psychological acculturation scale, language preference, and generation in the US was inversely associated with intent to exclusively breastfeed as well as intent to combination feed in this predominantly Puerto Rican sample.

Children who are breastfed have multiple long-term health benefits including lower rates of obesity, ear infections, asthma, diabetes and leukemia as compared to formula-fed babies.[1] Mothers who breastfeed also may have decreased rates of ovarian cancer,[2] lower risk of diabetes,[3] and increased weight loss in the immediate post-partum period as well as long-term.[4] Women's attitudes and decision making about whether or not to breastfeed are often established early in pregnancy, and are predictive of initiation and duration of breastfeeding.[5,6].

Latina women have the highest rates of breastfeeding initiation of any ethnic/racial group in the US (80.0% have ever breastfed), higher than non-Latina whites (75.2%) and blacks (58.9%).[7] However, these data mask the fact that certain subgroups of Latinas have lower breastfeeding initiation rates compared to non-Latina whites.[8,9] National surveys of breastfeeding often group all Latinos into one category and do not include country of birth, length of stay in the US or national origin.[10] Puerto Rican women typically have poorer indicators for a variety of health behaviors and outcomes,[11] including lower exclusive breastfeeding rates (27.6%) as compared to Central (60.0%) or South Americans (69.6%).[12] In addition, prior studies suggest that Latinas in the US have a lack of knowledge regarding breastfeeding recommendations and may believe that any breastfeeding is sufficient.[13] Indeed, studies have suggested that Puerto Rican women may be more prone to supplement with formula.[13]

Acculturation is the process by which immigrants take on the dominant culture's language, customs and behaviors.[14] Several instruments exist to measure this construct. Linear (or uni-dimensional) acculturation scales [15,16] focus on behaviors and language

and assume that identifying with a new culture simultaneously occurs with losing identification with the original culture. Bi-dimensional acculturation scales allow for bicultural identification and include other components such as media use in different languages.[17] The Psychological Acculturation Scale [18] is an example of a bi-dimensional instrument that also incorporates the individual's psychological acculturation and response to cultural exposures.

A literature review of acculturation and breastfeeding identified 13 prior studies on this topic,[19-31] four of which examined intent to breastfeed as a specific outcome,[21,22,27,29] while the remainder examined actual breastfeeding initiation and duration. Only three [20,21,32] identified women by country of origin beyond "Latino" or "non-Mexican" and included Puerto Ricans. Study designs were cross-sectional (n=6), prospective (n=4), retrospective cohort (n=1), or randomized trials (n=2). Only two studies used validated bi-dimensional instruments to measure acculturation;[32,29] all other studies used proxy measures of acculturation, most frequently language or nativity.

Therefore, the purpose of this study was to investigate if acculturation was associated with intent to breastfeed in a sample of predominantly Puerto Rican pregnant women. Our hypothesis was that higher acculturated women would be less likely to express the intent to breastfeed their infants than women with lower levels of acculturation.

Methods

We utilized data from Proyecto Buena Salud, a prospective study of Latina women conducted from 2006-2010 in Western Massachusetts.[33] Study recruitment took

place in the public obstetrics and gynecology clinic and midwifery practice at Baystate Medical Center, which has a Latino patient population of predominantly Puerto Rican women. The original study was designed to investigate how physical activity and psychosocial stress influenced the onset of gestational diabetes mellitus. Eligibility was restricted to women who had heritage from Puerto Rico (PR) or the Dominican Republic (DR) and who: 1) were born in PR/DR, 2) had a parent born in PR/DR, or 3) had two grandparents born in PR/DR, and who spoke either English or Spanish. Exclusion criteria included 1) current medications that could affect glucose tolerance, 2) multiple gestation, 3) history of chronic renal disease, hypertension, diabetes or heart disease and 4) age <16 years or >40 years.

Women were recruited by trained interviewers at a prenatal care visit early in pregnancy (up to 20 weeks gestation). Study participants gave informed consent in either English or Spanish according to patient preference, and were provided information on the study protocol. Bilingual recruiters minimized language barriers by recording participant's answers on paper during the face-to-face interview in the participant's preferred spoken language. At the initial study visit, acculturation, demographic, cigarette use and physical activity information was collected. Medical outcomes including obstetric history and information on feeding intent were abstracted from medical records after delivery. The study received approval from the University of Massachusetts-Amherst and Baystate Health, and the present analysis was approved by Tulane University's Institutional Review Board.

Proyecto Buena Salud enrolled 1583 prenatal care patients between January 2006 and October 2010. Participants were then excluded for the current analysis if they were: 1) missing data on all three acculturation measures (PAS, preferred language, and generation in the United States) [n=6]), 2) were missing infant feeding intent [n=246] largely due to not delivering at Baystate Medical Center (84%), and 3) multiple gestations [n=8]. This resulted in total of 1323 women contributing data to analyses.

Assessment of Acculturation

The Psychological Acculturation Scale (PAS)[18] was used to measure acculturation at the time of enrollment. The PAS measures psychological attachment to both Anglo and Latino culture, via a questionnaire with ten Likert-type questions. Scores ranged from 1 to 5 per question, and a lower score indicates less psychological attachment to Anglo culture. Each participant's acculturation score was created based on mean responses for all questions. The PAS has been validated in Puerto Rican populations and has shown high internal consistency.[18] Acculturation (PAS score) was also examined as a dichotomous variable (high≥3 or low<3) and categorical variable (high>3, bicultural=3 and low<3). Other proxies of acculturation, including preferred spoken language for reading (i.e., English, Spanish) and speaking, as well as generation in the United States, were also collected. First generation was defined as the participant herself being born in Puerto Rico/Dominican Republic, second generation was defined as having at least one parent born in Puerto Rico/Dominican Republic, and third generation was defined as having grandparents born in Puerto Rico/Dominican Republic. We created a dichotomous generation variable with first generation compared

to second and third generation, and a three-level generation variable with first, second and third generation categories.

Assessment of Intent to Breastfeed

Feeding intent was abstracted from the medical record. Women reported either before or immediately after delivery whether they planned to breastfeed exclusively, breast and formula feed, or formula feed exclusively. Feeding intent was dichotomized as intent to exclusively breastfeed versus intent to formula feed or a combination of breast and formula feed. We also examined feeding intent as a three-level outcome: intent to breastfeed, intent to formula feed, or intent to combination feed.

Assessment of covariates

Information on several socio-demographic and medical risk factors which influence a mother's choice of infant feeding was collected at baseline via self-report or from the medical record.[33] These included maternal age, highest level of education completed, lack of prenatal care, annual household income, parity, cigarette smoking during pregnancy, living with a partner, and depression, anxiety and stress measures.[22,34] Directed Acyclic Graphs (DAGs) [35] and 10% change in estimate procedures were used to identify covariates for inclusion in multivariable models; these included age, education, living with a partner, parity and history of preterm birth.

Statistical Analysis

Chi-square and t-tests were utilized to examine bivariate associations between acculturation and infant feeding intent. Logistic regression was used to conduct

unadjusted and multivariable analyses for the dichotomous outcome of intent to breastfeed (yes, no). A multinomial logistic regression model was also fit to examine the three-level feeding intent variable (generalized logit) to produce separate odds ratios for predicting intent to breastfeed and intent to combination feed compared to intent to exclusively formula feed. All analyses were conducted using SAS 9.3 (Cary, N.C.).

Results

The majority of study participants (79.3%) were low acculturated as indicated by low mean PAS acculturation scores (<3), preferred Spanish language (24.3%) and were born in Puerto Rico (first generation) (47.0 %) (Table 1). Most women expressed intent to breastfeed (40.2%), followed by formula (31.3%) and combination (breast/formula) (28.3%) feeding. Overall, women were young (under the age of 24), pregnant with their first child and just over half had completed high school or greater education.

In bivariate analyses, the PAS was not associated with feeding intent (Table 1). However, women with higher levels of acculturation as measured by English language preference (40.1%) were less likely to report intent to breastfeed than those who preferred Spanish (41.3%). Women who were second/third generation in the US (41.4%) were more likely to intend to breastfeed than those who were first generation (40.1%). (Table 1). Women with less than high school education were less likely to report breastfeeding intent (30.2%) than both women with high school and those with some college, and were more likely to intend to formula feed (37.6%) or combination feed (32.1%) than women with more education (p<.0001). Women who reported income less than $15,000 were more likely to report intent to breastfeed (37.9%) than formula (32.6%) or combination

(29.5%) (p=.01). Any smoking in pregnancy was also associated with increased intent to formula feed (46.1%) than breastfeeding (23.8%) or combination feeding (30.1%) (p<.0001). First time mothers were more likely to report breastfeeding intent (49.7%) than formula (22.8%) or combination feeding (27.5%) (p<.0001). Age and living with a partner were not associated with intent to breastfeed.

Next we examined the relationship between acculturation and intent to breastfeed in unadjusted and multivariable logistic analyses (Table 2). Women with high acculturation as measured by the 2-level (aOR=0.98, 95% CI 0.71-1.34) or 3-level (aOR=0.93, 95% CI 0.63-1.38 high vs. low) PAS variables were not significantly less likely to intend to breastfeed as compared to women with low acculturation. Women who spoke English (higher acculturated) had lower odds of reporting intent to breastfeed (aOR=0.89, 95% CI 0.66-1.21), although these findings were not statistically significant. Second or third generation in the United States (higher acculturation) was not significantly associated with intent to breastfeed (aOR=1.07, 95% CI 0.80-1.36).

Multinomial logistic regression was then performed to further investigate the effects of acculturation on odds of reporting intent to breastfeed or combination feed versus intent to formula feed (Table 3). Psychological acculturation as measured by 2-level (aOR 0.81, 95% CI 0.56-1.16) or 3-level (aOR 0.77, 95% CI 0.49-1.19) PAS scores were not significantly associated with the odds of intent to breastfeed vs intent to formula feed. However, English language preference (higher acculturation) was associated with decreased odds of intent to breastfeed (aOR 0.61, 95% CI 0.42-0.88). Similarly, Women who were second or third generation (parent or grandparents born in Puerto

Rico/Dominican Republic) were significantly less likely to report intent to breastfeed than women who were first generation (aOR 0.70, 95% CI 0.52-0.95).

Higher psychological acculturation was significantly associated with decreased intent to combination feed as measured by the 2-level (aOR=0.67, 95% CI 0.45-0.99) and continuous (aOR 0.78, 95% CI 0.61-0.99) but not the 3-level (aOR=0.66, 95% CI 0.41-1.06) PAS variables (Table 3). Women who preferred to speak English (higher acculturation) were significantly less likely to report intent to combination feed (aOR 0.48, 95% CI 0.33-0.70). Similarly, women who had parents or grandparents born in the US (higher acculturated) were significantly less likely to report intent to combination feed (aOR 0.42, 95% CI 0.31-0.58) as compared to first generation women.

We then compared characteristics of women missing acculturation and infant feeding measures (16% of the original sample) to those who had this data. Women missing information were more likely to have higher levels of education (28.4% had greater than high school) as compared to women in the final analytic dataset (18.8% had greater than high school, p=0.01).

Discussion

In this analysis of a prospective cohort study of predominantly Puerto Rican women, women with higher levels of acculturation as measured by preferred language and generation in the US were approximately 30-40% less likely to report intent to breastfeed than formula feed. In addition, higher acculturation was associated with 25-55% decreased risk of intent to combination feed versus formula feeding, as measured by psychological acculturation, preferred language and generation in the United States.

Our findings are consistent with several[19,21-26,28-31] but not all[20,27] previous studies on acculturation and Latina women as a group. Among the studies that looked at feeding intent instead of initiation or duration,[21,22,27,29] only two[21,29] provided more than a dichotomous choice of intent to breastfeed versus formula feed, limiting inferences regarding intent to combination feed.

No previous studies used the PAS to measure acculturation, however, and most did not include Puerto Ricans as a majority of their sample. Chapman et al. conducted a randomized controlled trial of 114 Latina women (51.6% Puerto Rican) and found that based on a bi-dimensional acculturation scale, lower acculturative-type women were significantly less likely to stop breastfeeding than higher acculturative-type (HR 0.16, (0.05-0.55)).[24] Another study measured acculturation based on a uni-dimensional measure and found that low acculturated women were more likely to indicate intent to breastfeed than higher acculturated women (84.1% vs. 72.2%), p=.001.[29]

Four studies[19,22,26,31] reported results by language as a proxy for acculturation, and only one of these included intent to breastfeed as an outcome.[22] In that study, multiparous Spanish speakers (lower acculturated) were more likely to intend to breastfeed (OR=1.57 95% CI 0.60-4.09) than English speakers, supporting our findings.

Although generation as a proxy for acculturation was collected in several studies,[21-23,25,27-31] only four[21,22,27,29] reported results for intent to breastfeed by nativity. A cross-sectional study of 382 women of all ethnicities in New York found that in general, foreign born women were more likely to intend to breastfeed than US born women (OR 2.23 95% CI 1.22-4.43).[21] A cohort study of women of Mexican origin in

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Texas found that Mexican-born mothers were more likely to elect to breastfeed (54.8%) than US born mothers (45.2%), p<.0001.[29] A cross-sectional study also of Mexican women in Texas found that multiparous women born in Mexico were more likely (OR 1.72, 95% CI 1.19-2.5) to intend to breastfeed than formula feed.[22] A prospective cohort study on Mexicans in California reported null findings, with 83.3% of higher acculturated women intending to breastfeed, compared to 94.6% of lower acculturated women (p for trend=0.20).[27]

There are several strengths to the present study, including its comprehensive measurement of acculturation, large sample size and high response rates. Limitations include a lack of information on family relationships that influenced a woman's decision on infant feeding. There is also the possibility of residual confounding as information on previous breastfeeding behaviors was not available. Differential loss to follow-up may have occurred as women with more negative health behaviors or unstable home environments may have chosen not to continue in the study or to deliver at their predicted hospital, which may result in an overestimation of our effect estimate. Social desirability bias may also be present, as women were likely interviewed about infant feeding by health care providers, and may have wanted to give the "correct" answer, however this type of misclassification would result in biasing our results toward the null. Study findings may not be generalizable beyond Puerto Rican women outside of the Northeast, as migration patterns and health behaviors may differ. Women missing information on acculturation and infant feeding (16% of sample), and therefore not included in this dataset, were more likely to have higher levels of education as compared to women in the final dataset. To the extent that education is associated with both acculturation and infant

feeding, this may have biased results towards the null. Future work with Latinas should improve education in prenatal settings on the benefits of long term, exclusive breastfeeding and include a comprehensive assessment of generational status, country of origin and acculturation.

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Table 1. Bivariate associations by feeding intention, Proyecto Buena Salud, 2006-2011

| | Total sample (N=1323) | | Feeding Intention | | | | | | |
| | | | Breastfeed (n=533) | | Formula feed (n=415) | | Combination feed (n=375) | | |
	n	%	n	%	n	%	n	%	P-value
Psychological Acculturation Scale (PAS)									
Low <3	895	79.3	364	40.7	264	29.5	267	29.8	0.08
High ≥3	234	20.7	97	41.5	83	35.5	54	23.1	
Language preference for speaking/reading									
Spanish	303	24.3	125	41.3	75	24.8	103	34.0	<.01
English	945	75.7	379	40.1	316	33.4	250	26.5	
Generation (dichotomized)*									
First generation	603	47.0	242	40.1	161	26.7	200	33.2	<.0001
Second or third generation	679	53.0	281	41.4	242	35.6	156	23.0	
Generation in the United States*									
First generation	603	47.0	242	40.1	161	26.7	200	33.2	<.0001
Second generation	604	47.1	245	40.6	218	36.1	141	23.3	
Third generation	75	5.9	36	48.0	24	32.0	15	20.0	
Age									
16-19	412	31.1	172	41.8	124	30.1	116	28.2	0.39
20-24	517	39.1	212	41.0	155	30.0	150	29.0	
25-29	235	17.8	81	34.5	82	34.9	72	30.6	
≥30	159	12.0	68	42.8	54	34.0	37	23.3	
Education									
< High School	579	48.5	175	30.2	218	37.6	186	32.1	<.0001
High School graduate	391	32.8	181	46.3	110	28.1	100	25.6	
Some college/graduate	224	18.8	127	56.7	46	20.5	51	22.8	
Annual household income									
≤$15,000	359	58.6	136	37.9	117	32.6	106	29.5	0.01
>$15,000-$30,000	179	29.2	82	45.8	55	30.7	42	23.5	
>$30,000	75	12.2	43	57.3	22	29.3	10	13.3	
Living with partner									
No	577	48.9	222	38.5	183	31.7	172	29.8	0.26
Yes	603	51.1	258	42.8	186	30.9	159	26.4	
Any smoking during pregnancy									
No	1019	84.1	444	43.6	285	28.0	290	28.5	<.0001
Yes	193	15.9	46	23.8	89	46.1	58	30.1	
Parity									
Nulliparous	549	41.6	273	49.7	125	22.8	151	27.5	<.0001
1	396	30.0	149	37.6	133	33.6	114	28.8	
≥2	375	28.4	109	29.1	156	41.6	110	29.3	

Numbers may not sum to 100 due to rounding

P-values generated from Chi-Square tests

PR= Puerto Rico, DR= Dominican Republic

*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican Republic

Table 2. Odds ratios and 95% confidence intervals for the effects of acculturation variables on infant feeding intent, Proyecto Buena Salud, 2006-2011 (n=1323).

	n	%	Unadjusted OR	Unadjusted 95%CI	Adjusted* OR	Adjusted* 95%CI
			| Intent to Breastfeed |			
Psychological Acculturation Scale (PAS)						
PAS - 2 level						
Low (<3)	895	79.3	1.00	Reference	1.00	Reference
High (≥3)	234	20.7	1.03	0.78-1.40	0.98	0.71-1.34
PAS - 3 level						
Low (<3)	895	79.3	1.00	Reference	1.00	Reference
Bicultural (3)	90	8.0	0.97	0.63-1.51	1.05	0.65-1.68
High (>3)	144	12.8	1.07	0.75-1.53	0.93	0.63-1.38
Continuous PAS Score (mean, SD)	2.4	0.6	1.10	0.92-1.33	1.08	0.88-1.32
Language preference for speaking/reading						
Spanish	303	24.3	1.00	Reference	1.00	Reference
English	945	75.7	0.95	0.73-1.24	0.89	0.66-1.21
Generation in the United States						
First generation	603	47.0	1.00	Reference	1.00	Reference
Second or third generation	679	53.0	1.05	0.84-1.32	1.07	0.83-1.38
Generation in the United States						
First generation	603	47	1.00	Reference	1.00	Reference
Second generation	604	47.1	1.02	0.81-1.28	1.04	0.80-1.36
Third generation	75	5.9	1.38	0.85-2.23	1.31	0.76-2.25

*Adjusted model included age, education, living with a partner, parity and preterm birth

PR= Puerto Rico, DR= Dominican Republic

OR= Odds ratios; CI= Confidence Intervals

*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican Republic

Table 3. Odds ratios and 95% confidence intervals for the effects of acculturation on infant feeding intent, Proyecto Buena Salud, 2006-2011 (n=1323).

	Breastfeed vs. formula feed				Combination feed vs. formula feed			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Psychological Acculturation Scale (PAS)								
PAS - 2 level								
Low (<3)	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
High (≥3)	0.85	0.61-1.18	0.81	0.56-1.16	0.64	0.44-0.94	0.67	0.45-0.99
PAS - 3 level								
Low (<3)	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Bicultural (3)	0.79	0.48-1.30	0.87	0.51-1.49	0.63	0.36-1.12	0.68	0.38-1.22
High (>3)	0.89	0.59-1.33	0.77	0.49-1.19	0.65	0.41-1.05	0.66	0.41-1.06
Continuous PAS Score (mean, SD)	0.98	0.79-1.22	0.95	0.75-1.20	0.79	0.62-0.99	0.78	0.61-0.99
Language preference for speaking/reading								
Spanish	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
English	0.72	0.52-0.99	0.61	0.42-0.88	0.58	0.41-0.81	0.48	0.33-0.70
Generation in the United States								
First generation	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Second or third generation	0.77	0.59-1.01	0.70	0.52-0.95	0.52	0.39-0.69	0.42	0.31-0.58
Generation in the United States								
First generation	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Second generation	0.75	0.57-0.98	0.68	0.50-0.93	0.52	0.39-0.70	0.42	0.30-0.59
Third generation	1.00	0.57-1.74	0.88	0.47-1.64	0.50	0.26-0.99	0.45	0.22-0.92

*Adjusted for age, education, living with a partner, parity, and history of preterm birth
PR= Puerto Rico, DR= Dominican Republic
OR= Odds ratios; CI= Confidence Intervals
*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican Republic

G. MANUSCRIPT 3: Effects of acculturation on prenatal anxiety among Latina women

Abstract

Background: Anxiety in pregnancy has been associated with adverse birth outcomes. Despite Latinas being the largest minority group in the US, relatively few studies have investigated how acculturation affects mental health in pregnancy. The goal of this study was to determine if acculturation was associated with anxiety over the course of pregnancy in a sample of pregnant, predominantly Puerto Rican women.

Methods: Women were recruited in pregnancy for participation in Proyecto Buena Salud, a prospective cohort study of Latina women (n=1412). Acculturation was measured in early pregnancy via the Psychological Acculturation Scale (PAS) and proxies of language preference and generation in the United States. Anxiety was measured in early, mid, and late pregnancy using the State-Trait Anxiety Instrument. Linear and logistic multivariable regression were used to investigate associations.

Results: After adjustment for important risk factors, women with bicultural identification (PAS=3) had significantly lower trait anxiety scores in early pregnancy (beta -3.62, SE 1.1, p<0.001) than low acculturated women (PAS<3). Women with higher levels of acculturation as indicated by English language preference (β=1.41, SE 0.7, p=0.04) and second or third generation in the US had significantly higher trait anxiety scores in early pregnancy after adjustment (β=1.83, SE 0.6, p<.01). We observed the suggestion that higher psychological acculturation w (aOR 1.57, 95% CI 0.80-3.08), English language preference (aOR 1.80, 95% CI 0.92-3.53), and second or third generation in the US (aOR 1.10, 95% CI 0.64-1.90) were associated with an increase in state anxiety from mid to late pregnancy, but these findings were not statistically significant.

Conclusions: Bicultural psychological acculturation was associated with lower trait anxiety in early pregnancy, while proxies of acculturation (i.e., English language preference and increasing generation in the US) were associated with higher trait anxiety in early pregnancy. There was the suggestion, although not statistically significant, that women with higher acculturation were more likely to have an increase in state anxiety between mid- and late-pregnancy.

The World Health Organization estimates that by 2020, mental illness will be the second leading cause of global morbidity,[1] and the leading cause of disease burden for women of reproductive age.[2] Pregnancy often presents physical and psychological challenges to the expectant mother, including adaptation to the role of parenthood.[3] Stress and anxiety disorders are commonly reported in pregnancy,[4] and it is estimated that between 21-24% of women experience anxiety disorders in pregnancy.[5,6] A recent systematic review and meta-analysis found that maternal anxiety was associated with an increased risk of both preterm birth and low birthweight.[7] Long-term effects of maternal anxiety have also been predictive of problematic infant temperament,[8] increased rates of emotional/behavioral problems,[9] and long-term cognitive dysfunction.[10]

Latina women bear a higher prevalence of behavioral and demographic risk factors which place them at risk for adverse outcomes.[11] Latinas are more likely to have a teen pregnancy, be late entrants to prenatal care, and to be uninsured than white women.[12] According to birth certificate data, more than one third (36.6%) of Latina mothers have less than a high school education, compared to 8.9% of white mothers.[13] Latinas are also the largest and fastest growing ethnic group in the US.[14,15] The percentage of Latina women of childbearing age is projected to increase 92% by 2050, compared to 10% growth for black women.[11] In a nationally representative sample, Puerto Ricans had the highest overall prevalence of mental illness of all Latino groups (39.0%), and nearly a third of Latina women (30.2%) had a psychiatric disorder over the course of their lifetime.[16] Most studies on anxiety in pregnancy have been carried out among non-Latina white women.

It has been hypothesized that cultural changes due to acculturation may influence psychological health. Acculturation refers to the process of taking on attitudes, behaviors and customs of the dominant culture.[17] Latina women in the United States vary in their levels of English language fluency and maintenance of cultural traditions, therefore, the process of acculturation should also be considered as a potential risk factor for adverse mental health in pregnancy.[18] As US citizens, Puerto Ricans are internal migrants and may have experiences that are distinct from other Latina immigrants.

A review of the literature on the relationship between acculturation and anxiety in pregnancy revealed only six published studies.[19-24] The findings from these six studies were inconsistent; three studies found no association,[19,20,23] one found that higher acculturated women had lower pregnancy-related anxiety[24] and two found that higher acculturation was associated with increased anxiety.[21,22] All of these studies were limited to Mexicans or Mexican-Americans as the primary Hispanic subgroup; none included Puerto Ricans. Five were prospective cohort studies and one was cross-sectional. Although all of the studies investigated anxiety, none examined change in anxiety over the course of pregnancy. Only one used a bi-dimensional scale to measure acculturation,[19] and none used the Psychological Acculturation Scale. The remainder of studies used uni-dimensional scales such as Szapocznik's Biculturalism Scale (1978),[23] Cuellar's ARSMA scale (1980),[21] or proxies, including maternal nativity[20,23,24] and generational status[22] in the United States. As opposed to bi-dimensional scales, uni-dimensional scales are limited by the assumption that as a person acculturates, they lose their identification with their original culture. Bi-dimensional measures allow for identification with both cultures.

In sum, findings for the association between acculturation and anxiety in pregnancy have varied. Therefore, we evaluated the hypothesis that higher acculturation would be associated with increased anxiety in pregnancy, in a sample of predominantly Puerto Rican women.

Methods

Women were recruited for participation in Proyecto Buena Salud (PBS) from a public obstetrics and gynecology clinic at Baystate Medical Center, a large tertiary care facility located in Western Massachusetts. PBS was a prospective cohort study carried out from 2006-2011; study details have been previously published.[25] Eligible participants had heritage from Puerto Rico or the Dominican Republic, defined as a woman who: 1) was born in Puerto Rico or the Dominican Republic, 2) had a parent born in Puerto Rico or the Dominican Republic, or 3) had two grandparents born in Puerto Rico or the Dominican Republic, and who spoke either English or Spanish. The overall goal Proyecto Buena Salud was to investigate the influence of physical activity and psychosocial stress on the onset of gestational diabetes mellitus. Women were excluded from participation if they: 1) were taking medications that can affect glucose tolerance, 2) had a multiple gestation, 3) had a history of chronic renal disease, hypertension or heart disease, and 4) were less than 16 years old or greater than 40 years old at enrollment.

Participating women were enrolled by bilingual research staff during prenatal clinics in early pregnancy (before 20 weeks gestation), and provided written informed consent in either English or Spanish, according to their preference. Interviews were conducted face-to-face, and responses were documented on paper surveys. At the initial visit, information on socio-demographic factors, physical activity, mental health

indicators, alcohol and tobacco use, and acculturation was obtained. Subsequent visits took place in mid and late pregnancy allowing information to be updated on mental health, substance use and physical activity. Study approval was received from the Institutional Review Boards of the University of Massachusetts-Amherst, Baystate Health, and Tulane University.

A total of 1575 women were enrolled in Proyecto Buena Salud. Women were excluded from the present analysis if they were missing data on all three exposure variables (PAS, preferred spoken language, and generation in the US) (n=6), or all three outcome measures (anxiety measures) (n=161). Four women were missing all exposures and outcomes, resulting in a final dataset of 1412 women.

Assessment of Acculturation

Acculturation was measured at enrollment using the Psychological Acculturation Scale.[26] This bi-dimensional scale measures psychological attachment to both mainstream Anglo and Latino culture via 10 items using a Likert scale from 1 to 5, and allows for identification with both cultures. Mean responses on each item were computed to generate an overall acculturation score. The Psychological Acculturation Scale has high internal consistency in Spanish (0.90) and English (0.83) in Puerto Rican populations.[26]

Acculturation was categorized as a 3-level variable with a score of less than three indicating low acculturation, a score of three indicating bicultural acculturation, and a score of greater than three indicating high acculturation to Anglo-American culture. In addition, acculturation was dichotomized (high= greater than or equal to three, low = less

than three), and was assessed as a continuous variable. Other proxy measures of acculturation were also measured at enrollment, including generation in the United States and preferred language (English or Spanish). Generation was defined as first (woman born in Puerto Rico/Dominican Republic), second (at least one parent born in Puerto Rico/Dominican Republic) or third (at least two grandparents born in Puerto Rico/Dominican Republic).

Assessment of Anxiety

Anxiety in pregnancy was assessed using the Spielberger State-Trait Anxiety Inventory (STAI)[27] in early, mid, and late pregnancy. Trait anxiety has been used to quantify characteristics of a person's general personality, while state anxiety refers to feelings which change based on the situation or specific stressor.[27] Specifically, the STAI trait anxiety scale (STAI-T) was used to assess anxiety as a baseline personality trait at enrollment. This scale contains 20 statements about how an individual responds with anxiety to stressful situations, and measures anxiety proneness. Subsequently, the STAI state anxiety scale (STAI-S) was administered at mid (18-20 weeks gestation) and late pregnancy (24-28 weeks gestation). The STAI-S measures how a stressful situation, specifically pregnancy, evokes anxiety in a woman.[27]

Both the STAI-T and the STAI-S scales utilize a 4-point Likert-type scale, ranging from 1 (almost never) to 4 (almost always), and a composite score was produced. Scores range from 20-80, and higher anxiety is represented by higher scores. The STAI has recently been identified by a systematic review as the instrument with the highest validity and reliability to measure anxiety in pregnant women, compared to ten other

commonly used instruments.[28] The STAI-T demonstrates high internal consistency

(0.96) in pregnant women.[29] The Spanish version has been validated and has an internal

consistency reliability of 0.87.[30]

Examining the change in the pattern of anxiety over the course of pregnancy may

also be important, as an increase in pregnancy-related anxiety has been shown to be a

better predictor of preterm birth than individual measures of anxiety alone.[31] Therefore,

we created two change variables. The first was a continuous variable, calculated by

taking the difference between the STAI-S from mid to late pregnancy. The second was a

dichotomous variable which indicates the direction of change between the mid and late

pregnancy STAI-S scores as either an increase (1) or decrease/no change (0).

Assessment of covariates

We considered social and demographic risk factors that could confound the

relationship between acculturation and anxiety via Directed Acyclic Graphs.[32] These

included age, education, parity and living with a partner. We chose not to include

cigarette smoking as a covariate because it could be considered an intermediary variable

(i.e., on the causal pathway) between acculturation and levels of anxiety.[33]

Statistical Analysis

We calculated descriptive statistics (means, standard deviations and frequencies)

for the acculturation exposures, anxiety outcomes, and covariates of interest. Bivariate

associations were calculated using t-tests for continuous by bivariate variables, Chi-

square tests for categorical variables, and ANOVA for continuous associations with

variables with more than two categories. Unadjusted and multivariable linear regression were utilized to examine the association between acculturation and the continuous anxiety scores in early, mid, and late pregnancy and the change in continuous anxiety from mid to late pregnancy. Unadjusted and multivariable logistic regression were also employed to evaluate change in state anxiety (dichotomous increase vs. decrease or no change) from mid to late pregnancy. Sensitivity analyses were conducted to examine if results differed when excluding women with no change in state anxiety (dichotomous increase or decrease), and to investigate if anxiety measurements differed among women who did not complete all three study interviews. All analyses were conducted using SAS 9.3 (Cary, N.C.).

Results

Of the 1412 women in the study, the majority were young (70.2% under 24 years of age) and over half had completed high school or some college (51.9%). Approximately half of the sample were living with a partner (51.1%) and most were pregnant with their first child (41.5%) (Table 1). Women who were thirty years or older, those who had at least some college, those who reported an annual income greater than $30,000, and those who were living with a partner had significantly lower levels of trait anxiety, on average, in early pregnancy. Women who were non-smokers and those who were pregnant with their first or second child also had lower trait anxiety levels. Age, education, income, living with a partner and parity were not associated with state anxiety measures in mid-pregnancy, while non-smokers continued to have significantly lower state anxiety scores at that point. There was no association between age, education,

living with a partner or parity with late-pregnancy state anxiety, however, women with higher incomes and non-smokers continued to have lower mean state anxiety scores.

Anxiety was assessed at mean gestational ages of 12.4 weeks (early pregnancy, n=1310), 21.2 weeks (mid-pregnancy, n=599 (45.7%)) and 30.8 weeks (late pregnancy, n=757 (57.8%)). Mean trait anxiety scores in early pregnancy were higher (39.7 ± 10.4) than mid-pregnancy (34.1 ± 11.7) and late pregnancy (32.8 ± 11.2). The majority of participants had low levels of psychological acculturation as measured by the PAS (78.9%) (Table 2), but were more highly acculturated as indicated by the proxies of language preference (75.2% preferred to speak English), and more than half were second or third generation in the US (53.3%).

Bivariate analyses showed that higher levels of psychological acculturation were associated with lower mean trait anxiety in early pregnancy (-37.3 ± 10.4, p<.0001), mid-pregnancy (-31.6 ± 11.6, p<.0001), and late pregnancy (-30.5 ± 11.2, p<.0001) (Table 2). In contrast, women who preferred to speak English (higher acculturated) had significantly higher trait anxiety scores (p=0.02) in early pregnancy than women who preferred Spanish. Women who were second or third generation also had significantly higher trait anxiety scores than first generation women (p<.01) in early pregnancy. Neither preferred language nor generation in the US were significantly associated with state anxiety measurements in mid- or late-pregnancy.

We then examined the relationship between acculturation and anxiety in pregnancy using unadjusted and multivariable linear regression (Table 3). There was no significant relationship between dichotomous psychological acculturation (low/high) and

trait anxiety in early, mid, or late pregnancy. High acculturation was also not associated with trait anxiety (beta= -0.69, SE 0.9, p=0.43), even after adjustment for important covariates; however, women with bicultural identification (PAS=3) had significantly lower trait anxiety scores (beta -3.62, SE 1.1, p<.001) in early pregnancy than low acculturated women (PAS<3). Psychological acculturation was not associated with anxiety in mid (beta=-0.17, SE 1.3, p=0.89) or late (beta=-0.00, SE 1.1, p=0.99) pregnancy in both unadjusted and adjusted models.

Women who preferred speaking English (higher acculturated) had higher trait anxiety scores after adjustment (beta=1.41, SE 0.7, p=0.04) in early pregnancy. Women who were second or third generation in the US (higher acculturated) also had higher trait anxiety scores after adjustment (beta=1.83, SE 0.6, p<.01) in early pregnancy. Preferred language (beta 1.55, SE 1.1, =0.17) and generation in the US (beta=0.78, SE 1.0, p=0.44) were not significantly associated with state anxiety scores in mid-pregnancy in both unadjusted and adjusted models. Similarly, English language preference (beta =-0.04, SE 1.1, p=0.96) or second/third generation in the US (beta=0.06, SE 0.9, p=0.94) were not associated with late pregnancy state anxiety.

Next, we analyzed the association between acculturation and change in state anxiety from mid to late pregnancy as a continuous variable using linear regression (Table 4). After adjustment for important covariates, psychological acculturation was not significantly associated with change in state anxiety scores (beta=-2.58, SE 1.6, p=0.12). Higher acculturation as measured by preference for speaking English (beta=-2.59, SE

1.60, p=0.11) and second or third generation in the US (beta=-0.31, SE 1.4, p=0.83) was also not associated with change in state anxiety scores.

Finally, change in state anxiety scores from mid to late pregnancy was examined as a dichotomous variable using logistic regression (Table 4). Women with high psychological acculturation were more likely to have an increase in state anxiety (OR 1.82, 95% CI 0.97-3.42), although this was not significant after adjustment (aOR 1.57, 95% CI 0.80-3.08). Higher acculturation as measured by English language preference (aOR 1.80, 95% CI 0.92-3.53) and second or third generation (aOR 1.10, 95% CI 0.64-1.90), was associated with an increase in state anxiety but neither finding was statistically significant.

We also conducted sensitivity analyses excluding women with no change in anxiety, and the results did not differ significantly. An additional sensitivity analysis was carried out to see if women who completed all three anxiety measurements differed on baseline characteristics from those who only had one or no state anxiety measurements, and no differences were found (data not shown).

Discussion

In this prospective study of predominantly Puerto Rican women, we found that women with bicultural levels of psychological acculturation had lower trait anxiety scores in early pregnancy than women who were less acculturated. In contrast, women with higher levels of acculturation as measured by English language preference and generation in the US had higher trait anxiety scores in early pregnancy. There was the

suggestion, although not statistically significant, that women with higher acculturation were more likely to have an increase in state anxiety between mid- and late-pregnancy.

We found mean state anxiety scores of 34.1 for mid-pregnancy and 32.8 for late pregnancy, and trait anxiety scores of 39.7. These are comparable but slightly lower than prior studies limited to largely non-Hispanic white populations. For example, Agrati et al. administered the STAI to 159 women (90% Caucasian) from Canada between 12-24 weeks gestation, and reported mean state anxiety scores of 36.5 ± 13.2 (range 20-74).[34] A study conducted in France among 634 pregnant women between 20-28 weeks gestation reported mean STAI trait anxiety scores of 38.8 ± 9.2 (range 20-73).[35] Laraia et al. also used the STAI with 606 primarily white (58%) and black (33%) low-income women before 20 weeks gestation, and observed mean trait anxiety scores of 39 ± 11.4 (range 20-77).[36] Lee et al. measured anxiety using the STAI in 798 participants (57% Latina) after a normal second trimester ultrasound and found state anxiety scores of 35 ± 10.[37]

Our findings for psychological acculturation were not entirely consistent with the few studies[19,21,23] on acculturation and anxiety in pregnant Latina women that used a validated measure of acculturation. However, none of these studies focused on women of Puerto Rican heritage, and none used the Psychological Acculturation Scale as its measure of acculturation. Zambrana, et al. in a sample of 911 Mexican women from California found that higher acculturation (focusing on language and ethnic identification as measured by the ARSMA, a uni-dimensional acculturation scale[38]) and cultural integration into U.S. society was linked to increased stress (a composite measure including anxiety, correlation= .172, p<.001), measured in late pregnancy (sample mean= 30 weeks gestation).[21] Campos et al., utilized a bidimensional acculturation scale in a

sample of 1,064 Mexican women and did not find a significant relationship between overall acculturation and pregnancy-related anxiety as measured by Rini's tool[39] in early pregnancy at the initial prenatal visit (r = -.01, p=ns).[19] However, the authors found that a Mexican orientation (lower acculturation) was associated with increased anxiety (r= 0.10, p<.0001) compared to an Anglo orientation. Engle et al., used a uni-dimensional acculturation scale in a sample of 291 Mexicans from California, found no association between acculturation and state anxiety measured by the STAI in late pregnancy.[23] While we found no association between high acculturation and trait anxiety, we did find that bicultural women had lower trait anxiety than low acculturated women. Differences in findings between our findings and these prior studies were likely due to differences in sample populations (e.g. Latino subgroup) and the tools used to measure acculturation and anxiety.

Our findings for language preference and generation in the US were similar to one study[22] but different from others.[20,24] In the only prior study to utilize the STAI to measure anxiety, Ruiz et al. in a study of 470 Mexican women from Texas also found that higher acculturation as measured by maternal nativity was positively associated with trait anxiety measured between 22-24 weeks gestation over generations (p<.001).[22] Contrary to our findings, another cross-sectional study of 292 Mexican women from Texas found that higher acculturated women had lower mean pregnancy-related anxiety measured by Rini's Pregnancy Anxiety scale[39] than lower acculturated women.[24] Finally, a prospective study of 265 Latinas (mostly Mexican American) in California found no difference between foreign-born and US-born Latinas and pregnancy-related anxiety measured by Rini's Pregnancy-Anxiety scale[39] in mid-pregnancy.[20] Our results may have

differed from these studies due to focusing on different Latino subgroups, differences in tools used to measure anxiety, and the fact that one study restricted participation to women who spoke English.[20]

Overall, our findings for the association between acculturation and anxiety differed in direction of effect according to measure of acculturation, with bicultural psychological acculturation associated with decreased trait anxiety scores, while proxies of higher acculturation (English language preference and 2nd or 3rd generation in the United States) were associated with higher trait anxiety scores. This difference in findings may have been due to the incongruence between length of time spent in the US and psychological attachment to the home culture. Indeed, while the majority of the participants had low psychological attachment to the Puerto Rican culture (as most of the sample had low PAS scores), the majority of the sample preferred English and were second or third generation in the US. Some have posited that, in contrast to other acculturation measures, English language proficiency is a marker for mental health risk, as it indicates loss of positive cultural factors.[16] Among the previous studies on acculturation and anxiety in pregnancy, none used multiple measures of acculturation.[19-24]

There are strengths and limitations to our study. This prospective study provided a large sample of predominantly Puerto Rican pregnant women, and contributes to the sparse literature on this understudied subgroup of Latinos. Limitations include missing data on state anxiety for some participants; however, as sensitivity analyses showed no differences in descriptive characteristics between women who were missing later anxiety measures and those who were not, the impact of this missing data is likely minimal.

Similarly, analyses limited to women with anxiety scores at each of the three time periods did not differ from those from the primary analyses.

In conclusion, we found that women with bicultural psychological acculturation as measured by PAS had lower trait anxiety in early pregnancy than less acculturated women, while proxies of higher acculturation (English language preference and 2nd or 3rd generation in the US) were associated with higher trait anxiety scores in early pregnancy. Future studies should consider using multiple measurements of acculturation when studying mental health risks in pregnancy, until a gold standard can be established.

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Table 1. Characteristics of study participants according to measures of anxiety, Proyecto Buena Salud, 2006-2011

				Anxiety measure								
	Total Sample (n=1412)		Trait (early pregnancy)			State (mid-pregnancy)			State (late-pregnancy)			
	n	%	*mean*	*sd*	p-value	*mean*	*sd*	p-value	*mean*	*sd*	p-value
Age											
16-19	441	31.2	39.8	9.8	0.02	33.5	10.8	0.59	32.4	10.0	0.82
20-24	551	39.0	40.2	10.2		33.7	11.1		32.7	11.2	
25-29	255	18.1	40.1	11.3		35.2	13.0		33.1	11.8	
≥30	165	11.7	37.4	10.9		34.9	14.2		33.6	13.3	
Education											
< High School	646	48.1	39.7	10.1	<.0001	34.8	11.5	0.43	33.9	11.5	0.05
High School graduate	429	31.9	41.0	10.7		33.4	11.8		32.9	11.3	
Some college/graduate	268	20.0	36.6	9.5		34.1	12.0		31.0	10.4	
Annual household income											
≤$15,000	400	57.6	41.7	11.1	<.0001	35.9	12.7	0.15	34.0	11.4	<.01
>$15,000-$30,000	202	29.1	38.3	9.8		33.0	10.2		31.0	10.8	
>$30,000	92	13.3	35.8	8.6		33.4	11.7		29.5	9.4	
Living with partner											
No	650	48.9	40.7	10.7	<.01	34.4	11.9	0.43	33.9	11.5	0.02
Yes	679	51.1	38.9	10.0		33.6	11.6		32.0	10.9	
Any smoking during pregnancy											
No	1144	83.9	38.9	10.1	<.0001	33.2	11.2	<.001	31.9	10.6	<.0001
Yes	220	16.1	44.7	11.0		38.1	13.3		37.3	13.3	
Parity											
Nulliparous	571	41.5	38.9	10.0	<.01	33.2	10.9	0.36	31.7	10.4	0.03
1	424	30.8	39.4	10.1		34.6	12.1		32.5	10.6	
>2	380	27.6	41.2	11.2		34.6	12.4		34.4	12.7	

Numbers may not sum to 100 due to rounding

P-values generated from one-way ANOVA and t-tests

Table 2. Bivariate associations of covariates by continuous measures of anxiety, Proyecto Buena Salud, 2006-2011

	Total Sample		Trait (early pregnancy)			State (mid-pregnancy)			State (late-pregnancy)		
	n	%	mean	sd	p-value	mean	sd	p-value	mean	sd	p-value
Continuous Psychological Acculturation score (mean, SD)	2.4	0.65	-37.3	10.4	<.0001	-31.6	11.6	<.0001	-30.5	11.2	<.0001
Psychological Acculturation Scale (PAS)											
Low <3	1014	78.9	39.8	10.4	0.39	34.1	11.6	0.77	32.8	11.2	0.65
High ≥3	271	21.1	39.2	10.4		33.7	11.7		33.3	11.2	
Low (<3)	1014	78.9	39.8	10.4	0.01	34.1	11.6	0.53	32.8	11.2	0.25
Bicultural (3)	101	7.9	36.8	10.3		32.1	11.1		31.6	11.9	
High (>3)	170	13.2	40.6	10.2		34.7	12.0		34.6	10.5	
Language preference for speaking/reading											
Spanish	333	24.8	38.6	11.1	0.02	33.5	12.2	0.44	33.2	12.3	0.70
English	1009	75.2	40.1	10.2		34.4	11.5		32.8	10.9	
Generation in the United States											
First generation	639	46.7	38.8	10.5	<.01	33.9	11.7	0.60	32.8	11.7	0.97
Second or third generation	730	53.3	40.6	10.2		34.4	11.7		32.9	10.8	
Generation in the United States											
First generation	639	46.7	38.8	10.5	0.001	33.9	11.7	0.74	32.8	11.7	0.89
Second generation	649	47.4	40.9	10.4		34.5	11.9		32.8	10.8	
Third generation	81	5.9	38.4	8.9		33.3	10.4		33.7	10.5	

Numbers may not sum to 100 due to rounding

P-values generated from one-way ANOVA and t-tests

*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican Republic

Table 3. Unadjusted and multivariable beta coefficients, standard errors and p values for effects of acculturation on trait and state anxiety scores, Proyecto Buena Salud, 2006-2011.

	Trait anxiety score						State anxiety score (mid-pregnancy)						State anxiety score (late-pregnancy)					
	Unadusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	β	SE	p-value	β	SE	p-value	β	SE	p-value	β	SE	p-value	β	SE	p-value	β	SE	p-value
Psychological Acculturation Scale (PAS)																		
PAS - 2 level																		
Low (<3)	Referent						Referent			Referent			Referent			Referent		
High (≥3)	-0.62	0.7	0.39	-0.93	0.7	0.19	-0.37	1.3	0.77	-0.17	1.3	0.89	0.48	1.0	0.65	0.00	1.1	0.99
PAS - 3 level																		
Low (<3)	Referent		0.01			<.01	Referent		0.53	Referent		0.65	Referent		0.25	Referent		0.89
Bicultural (3)	-3.03	1.1		-3.62	1.1		-1.92	1.9		-1.49	1.9		-1.26	1.5		-1.68	1.5	
High (>3)	0.79	0.9		0.69	0.9		0.60	1.5		0.66	1.6		1.76	1.3		1.27	1.3	
Continuous PAS Score (mean, SD)	-0.40	0.5	0.38	-0.55	0.5	0.22	-0.18	0.8	0.81	-0.24	0.8	0.76	0.19	0.7	0.78	0.05	0.7	0.95
Language preference for speaking/reading																		
Spanish	Referent						Referent			Referent			Referent			Referent		
English	1.53	0.7	0.02	1.41	0.7	0.04	0.84	1.1	0.44	1.55	1.1	0.17	-0.39	1.0	0.70	-0.04	1.1	0.96
Generation in the United States*																		
First generation	Referent						Referent			Referent			Referent			Referent		
Second or third generation	1.84	0.6	<.01	1.83	0.6	<.01	0.51	1.0	0.60	0.78	1.0	0.44	0.07	0.8	0.93	0.06	0.9	0.94
Generation in the United States*																		
First generation	Referent		<.01			<.01	Referent		0.74			0.71	Referent		0.30	Referent		0.99
Second generation	2.1	0.6		2.10	0.6		0.65	1.0		0.85	1.0		-0.06	0.8		0.03	0.9	
Third generation	-0.31	1.3		-0.41	1.3		-0.57	2.1		0.19	2.2		0.92	2.0		0.35	2.0	

*Adjusted model included age, education, parity and living with a partner
*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican
β= Beta coefficient; SE= Standard Error

Table 4. Unadjusted and multivariable beta coefficients, standard errors and p values for the association between acculturation and change in state anxiety from mid to late pregnancy, Proyecto Buena Salud, 2006-2011.

| | | | Continuous change in state anxiety | | | | | | Increase in state anxiety | | | |
| | | | Unadjusted | | | Adjusted | | | Unadjusted | | Adjusted | |
	n	%	β	SE	p-value	β	SE	p-value	OR	95%CI	OR	95%CI
Psychological Acculturation Scale (PAS)												
PAS - 2 level												
Low (<3)	201	80.4	Referent						Referent			
High (≥3)	49	19.6	-3.11	1.6	0.05	-2.58	1.6	0.12	1.82	0.97-3.42	1.57	0.80-3.08
PAS - 3 level												
Low (<3)	201	80.4	Referent		**0.10**			0.18	Referent			
Bicultural (3)	25	10.0	-1.72	2.1		-1.15	2.2		0.91	0.38-2.15	0.72	0.28-1.82
High (>3)	24	9.6	-4.55	2.2		-4.10	2.2		3.91	1.55-9.86	3.72	1.40-9.90
Continuous PAS Score (mean, SD)	2.3	0.7	-2.02	1.0	0.04	-1.45	1.0	0.15	1.55	1.04-2.31	1.46	0.95-2.24
Language preference for speaking/reading												
Spanish	61	24.9	Referent						Referent			
English	184	75.1	-1.94	1.6	0.22	-2.59	1.6	0.11	1.36	0.75-2.48	1.80	0.92-3.53
Generation in the United States*												
First generation	121	48.2	Referent						Referent			
Second or third generation	130	51.8	-0.38	1.4	0.79	-0.31	1.4	0.83	1.04	0.63-1.72	1.10	0.64-1.90
Generation in the United States*												
First generation	121	48.2	Referent		0.92			0.97	Referent			
Second generation	121	48.2	-0.47	1.4		-0.28	1.4		1.04	0.62-1.73	1.11	0.63-1.93
Third generation	9	3.6	-1.05	3.8		-0.66	3.7		1.14	0.29-4.45	1.03	0.25-4.27

*Adjusted model included age, education, parity and living with a partner

*First generation: born in Puerto Rico/Dominican Republic, Second generation: at least one parent born in Puerto Rico or Dominican Republic, Third generation: Grandparents born in Puerto Rico/Dominican Republic

OR= Odds ratios; CI= Confidence Intervals

H. DISCUSSION AND RECOMMENDATIONS

In summary, low acculturation was associated with possible increased odds of adverse birth outcomes, increased odds of intending to exclusively breastfeed and decreased trait anxiety in pregnancy, in a sample of predominantly Puerto Rican women. Our first hypothesis that lower acculturation would be associated with lower risk of adverse birth outcomes was not proven. This finding is contrary to the Hispanic Paradox[58-61], but consistent with some literature which finds no protective effects for island-born Puerto Rican women,[90,137-139]. This may be due to less selective migration for Puerto Ricans, which contributes to the poorer outcomes for new arrivals. Our findings also support previous research that has cited heterogeneity among Latinas, and calls for future studies to consider looking at differences within ethnic groups by country of origin.[83]

Our second hypothesis was that higher acculturation would be inversely related to intention to breastfeed. This study provides evidence supporting this hypothesis, as women with higher acculturation were less likely to report intent to breastfeed (vs formula feed) and intent to combination feed (vs formula feed) compared to women with lower acculturation. This inverse association is consistent with findings in Puerto Ricans as well as other Latino subgroups[105,108,111-114,116] as well as in studies where no subgroups beyond "Latino" were reported.[99,102-104,115,117] These findings highlight the need for health care providers to assess acculturation in pregnancy, as it may help to inform education around infant feeding and the benefits of breastfeeding. Even women who intend to breastfeed in pregnancy need support in order to so successfully and for a long enough duration for the child to truly receive the desired health benefits.

Finally, our third hypothesis was that higher acculturation would be associated with increased state and trait anxiety in pregnancy. This hypothesis was partially supported, as that relationship was observed only when the proxy measures of acculturation (English language preference and 2nd or 3rd generation) were used. Women who preferred English and were second or third generation in the US had higher trait anxiety scores after adjustment, but women with higher psychological acculturation had lower trait anxiety scores. In addition, over the course of their pregnancies, women with higher psychological acculturation were more likely to have an increase in state anxiety. Women who preferred to speak English were also at marginally higher odds of having state anxiety increase from mid to late pregnancy. The literature on anxiety in pregnancy and acculturation in Latinas is very sparse, and this study adds to the research base and underscores the need to study this important topic. Our findings were inconsistent with some,[127-130] but not all[125,131] studies on acculturation and anxiety. None of the identified studies[125,127-131] focused on women of Puerto Rican heritage, and none used the Psychological Acculturation Scale as its measure of acculturation. Comparability of the findings in the present study with the available literature is limited by the different subgroup of Latinas being study, as well as the varying measures of acculturation and anxiety utilized.

The three studies presented here highlight some important issues related to the study of acculturation among Puerto Ricans. First, we found that results varied based on the measure of acculturation that was utilized. It will be important for future research to identify appropriate tools for measurement of the construct of acculturation in different subgroups of Latinas. In addition, more comprehensive acculturation summary measures

could be created that take into account multiple factors, such as length of time spent in the US, fluency measures for each language (Spanish and English), as well as the more typically measured food, music and cultural identification items commonly used in bidimensional acculturation instruments. Second, longitudinal studies that investigate birth outcomes over time could provide a more complete picture of how acculturation differs over time, and how this affects maternal and infant health. Longitudinal surveys would also improve the quality of intergenerational comparisons of health, and provide the opportunity to include time spent in each country as an important, and often understudied factor.[140] Finally, these studies support the idea that in order to reduce racial and ethnic disparities in maternal and child health, researchers and health care providers alike must move beyond simply "checking the box" for race or language. More research should focus on how culture, language and sociodemographic circumstances interact to influence health, and look within subgroups of women by race and ethnicity for distinct problems, opportunities and solutions.

These studies contribute to the literature and are novel in that they use a validated tool to measure psychological acculturation, as few other studies identified in the literature review have done. In addition, the prospective nature and high response rates add to the study's strengths. Study limitations include possible social desirability bias for the intent to breastfeed outcome. Sensitivity analyses for the intent to breastfeed manuscript also showed that women with higher education were less likely to complete the study. To the extent that education is associated with both acculturation and infant feeding, this may have biased results towards the null. There may have also been

incomplete adjustment for confounding, especially related to the measure of social support.

The generalizability of these studies is limited to women in the Northeast, of Puerto Rican heritage, yet there are significant populations of Puerto Ricans living in this geographic region who may benefit from this research. The studies focus on a demographically high-risk subgroup of Latinas that have not been well-represented in perinatal epidemiology studies. This work is important as it can help inform the training of health care providers to improve cultural competency in assessment and treatment of Latina women, and serves as a reminder of the heterogeneity of Latinos in the US and the need to consider acculturation as a factor in the effort to reduce health disparities by race and ethnicity.

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APPENDIX A. The Psychological Acculturation Scale, Tropp, 1999

	Only with PR/D	More with PR/D than with Americans	The same with PR/D and Americans	More with Americans than with PR/D	Only with Americans
1. With which group(s) of people do you feel you share most of your beliefs and values?	1	2	3	4	5
2. With which group(s) of people do you feel you have the most in common?	1	2	3	4	5
3. With which group(s) of people do you feel the most comfortable?	1	2	3	4	5
4. In your opinion, which group(s) of people best understands your ideas (your way of thinking)?	1	2	3	4	5
5. Which culture(s) do you feel proud to be a part of?	1	2	3	4	5
6. In which culture(s) do you know how things are done and feel that you can do them easily?	1	2	3	4	5
7. In which culture(s) do you feel confident that you know how to act?	1	2	3	4	5
8. In your opinion, which group(s) of people do you understand best?	1	2	3	4	5
9. In which culture(s) do you know what is expected of a person in various situations?	1	2	3	4	5
10. Which culture(s) do you know the most about the history, traditions, and customs, and so forth?	1	2	3	4	5

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