Acculturation and decreased breastfeeding among Hispanic women:

An analysis of data from the 2000-2001 Oregon Pregnancy Risk Assessment Monitoring System

by

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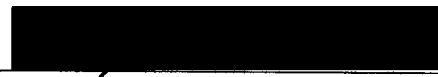

Elizabeth Adams, PhD

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ARSMA-II	Acculturation Rating Scale for Mexican-Americans-II
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
HIV	Human Immunodeficiency Virus
IRB	Institutional review board
LBW	Low birthweight
MVM	Multivariable model
NIS	National Immunization Survey
OHSU	Oregon Health & Science University
OR	Odds ratio
PHD	Public Health Division
PRAMS	Pregnancy Risk Assessment Monitoring System
PSU	Primary sampling unit
SAS	Short Acculturation Scale
SPSS	Statistical Package for the Social Sciences
SUDAAN	Survey Data Analysis
U.S.	United States
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

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ABSTRACT

Background

Human breast milk provides health benefits to breastfed babies, mothers who breastfeed, and society in general. However, breastfeeding rates in the United States are in need of improvement.[1] While Hispanic women overall have high breastfeeding rates compared to other minority groups,[1] it has been hypothesized that acculturation among Hispanic women can impact breastfeeding behavior.

Acculturation is a process by which immigrants acquire the cultural norms, attitudes, beliefs, and behaviors of a dominant society.[2] Many risk factors and adverse health outcomes among Hispanic women have been associated with increased acculturation, particularly outcomes surrounding the perinatal period. This study tests the hypothesis that more acculturated Hispanic women are less likely to breastfeed at ten weeks than less-acculturated Hispanic women.

Methods

The 2000-2001 Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) dataset was used to study the relationship between acculturation and any breastfeeding at ten weeks postpartum. Acculturation was defined by two measures, maternal nativity and survey language, and women were grouped into three categories of acculturation (low, intermediate, and high). Simple logistic regression analyses identified associations between breastfeeding and each independent variable, and a backward elimination approach to variable selection eliminated statistically non-significant variables from the model. All analyses conducted account for the sampling weights due to the complex sampling design.

Results

Acculturation was significantly associated with any breastfeeding at ten weeks in univariable analysis ($p < 0.001$). After adjusting for other variables, highly acculturated women were less likely to breastfeed than low-acculturation women (OR 0.34; 95% CI 0.23 – 0.50). The relationship between acculturation and breastfeeding was modified by WIC enrollment and parity. For highly acculturated women, those not enrolled in WIC were more likely to breastfeed at ten weeks than women who *were* in WIC (OR 3.34; 95% CI 1.86 – 6.00). Similarly, among the highly-acculturated women, primiparous women were more likely to breastfeed than multiparous women (OR 2.25; 95% CI 1.24 – 4.11). However, for women with intermediate or low levels of acculturation, WIC enrollment and parity had no effect on breastfeeding. Although several factors were associated with breastfeeding at ten weeks, acculturation remained the strongest predictor of breastfeeding throughout all analyses.

Discussion

This study found a significant association between increased acculturation and any breastfeeding at ten weeks. Highly acculturated Hispanic women may benefit from targeted breastfeeding promotion programs or culturally appropriate advice on breastfeeding from health care providers. Because acculturation is a complex process by nature, further research is needed to help clarify reasons why breastfeeding practices decline as women acculturate. Such research would aid in developing breastfeeding promotion programs to encourage breastfeeding among highly acculturated Hispanic women. Because the Hispanic population in Oregon is growing and will continue to make up an increasing segment of the population, it is important that Hispanic women

receive adequate breastfeeding advice and interventions. This study provides information that can be used to improve breastfeeding promotion programs and health care practices related to breastfeeding.

INTRODUCTION

Importance of Breastfeeding

Human breast milk is the most complete form of nutrition available to human infants.[1,3,4] The many health benefits that breastfed babies, mothers who breastfeed, families, and society in general stand to gain make breastfeeding an important public health issue.[3,4]

Several authors have outlined the benefits of breastfeeding, many of which were synthesized in the American Academy of Pediatrics policy statement on breastfeeding.[4] For instance, breastfed babies have a decreased incidence of infectious diseases,[5] including otitis media,[6-11] urinary tract infections,[12,13] diarrhea,[6,14-19] bacterial meningitis,[20,21] and respiratory tract infections.[19,22-29] Children who were breastfed as babies have also been shown to have a decreased incidence of other health outcomes throughout the course of life, such as sudden infant death syndrome,[30-36] childhood cancers,[37-39] diabetes,[40-42] overweight and obesity,[43-51] asthma,[24,25,27,28] and high cholesterol.[52] Additionally, breastfeeding has been associated with increased levels of cognitive development.[53-63]

Mothers who breastfeed also stand to gain considerable health benefits compared to mothers who don't breastfeed.[64] These mothers tend to have a quicker and easier recovery from pregnancy and childbirth,[65] increased weight loss postpartum,[66] reduced risk of breast cancer[67-72] and ovarian cancers,[73] and increased ability to bond with their newborn,[3,74-76] among other benefits.[4]

Families and society in general benefit from higher rates of breastfeeding in other ways. Families experience decreased rates of employee absenteeism[77] and loss of family

income due to caring for sick infants.[4] The United States stands to gain about $3.6 billion from decreased health care expenditures related to increased breastfeeding, mainly through a decline in the number of illnesses, prescriptions, and medical visits that are otherwise prevalent in infants who are not breastfed.[78,79] Certain public health programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which provides many vouchers for mothers to purchase infant formula, would save money if more women breastfed their babies instead of bottle-feeding.[4,80] Additionally, the environmental burden for breastfeeding is less than that of formula feeding; an increase in breastfeeding would lead to a decrease in the disposal of bottles and cans required for infant formula, as well as a decrease in energy required to produce and transport formula.[4,81,82] While some costs to society would be alleviated, other costs associated with breastfeeding may be incurred due to a potential increase in breastfeeding consultation programs, breastfeeding promotion programs, and purchase of breast pumps.[4] However, the estimated cost of formula-feeding is up to four times that of breastfeeding ($1200 per year for formula powder versus $300 per year for increased food for the lactating mother).[83]

While breastfeeding has been recommended as the preferred method of infant feeding by the American Academy of Pediatrics, the American Dietetic Association, and the Surgeon General in most cases, there are certain rare instances in which mothers should not breastfeed. Women in the United States who are infected with human immunodeficiency virus (HIV) should not breastfeed.[84] However, for HIV-infected women in other countries that are afflicted by a high prevalence of infectious diseases and nutritional deficiencies, the risks of not breastfeeding may outweigh the risk of HIV

transmission.[3,4,85] Additionally, women with human T-cell leukemia virus type 1 should not breastfeed.[86,87] Other scenarios may contraindicate breastfeeding on a case by case basis, and should be evaluated by a physician. These conditions in the mother include environmental exposures causing the mother to be clinically ill,[88] Hepatitis C,[89] illicit drug use,[90,91] implants or breast surgery,[92] pharmaceutical drug use,[3] and tobacco and alcohol consumption.[3] Most conditions in an infant are still compatible with breastfeeding; however, infants born with galactosemia, a metabolic disorder, cannot metabolize lactose and must not be breastfed.[3,93]

A National Agenda Promoting Breastfeeding

Recognition of the importance of breastfeeding has led to the development of many policies and programs on breastfeeding across the United States by organizations such as the American Academy of Pediatrics,[94] the American College of Obstetricians and Gynecologists,[95] the American Academy of Family Physicians,[96] the American Dietetic Association,[97] the American College of Nurse-Midwives,[98] the National Medical Association,[99] and the American Public Health Association.[100]

In 1998, the United States Breastfeeding Committee was established as a collaborative partnership of many government departments, non-governmental organizations, and health profession associations.[101] This committee developed a strategic plan to protect, promote, and support breastfeeding in the United States. Concurrently, in 1998, the United States Department of Health and Human Services, through its document *Healthy People 2010,* set objectives of increasing the proportion of mothers who breastfeed during the early postpartum period from a baseline of 64% in

1998 to the targeted goal of 75%. Additional goals to increase the proportion of mothers who breastfeed at six months and one year were set at 50% and 25%, respectively.[102]

Current progress toward achieving these objectives shows improvement from baseline measurements. Data2010, from the *Healthy People 2010* database shows that in 2002 the proportion of women breastfeeding during the early postpartum period (breastfeeding a newborn before being discharged from the hospital[103]), at six months, and at one year were 70%, 33%, and 20%, respectively.[104] At that time, two additional objectives were set to increase the proportion of women who breastfeed exclusively (to give no formula or food supplementation other than breast milk) at three months to 60%, and at six months to 25%.[102] Table 1 shows the proportion of women who breastfed at baseline in 1998, actual 2002 progress, and the targeted goals for each breastfeeding measure in *Healthy People 2010.*

Table 1. National progress toward Healthy People 2010 breastfeeding goals

	1998*	2002*	2010 Target
Any early postpartum†	64%	70%	75%
Exclusive‡ at three months	N/A§	43%	60%
Any at six months	29%	33%	50%
Exclusive‡ at six months	N/A§	13%	25%
Any at 1 year	16%	20%	25%

* 1998 and 2002 data were collected by the Mother's Survey, Ross Products Division, Abbott Laboratories, Inc.[103]

† Breastfeeding in the early postpartum period means initiating breastfeeding a newborn prior to being discharged from the hospital. [103]

‡ Exclusive breastfeeding involves feeding the infant only breast milk; no formula and no other food supplementation.

§ Goals were set in 2002; 1998 baseline data not available.

More recent figures on breastfeeding data have been provided by the National Immunization Survey (NIS), a survey conducted by the Centers for Disease Control (CDC) National Immunization Program. The 2005 survey results show that 21 states achieved the Healthy People 2010 objective of having 75% of mothers initiate breastfeeding. Five states achieved the goal of having 50% of mothers breastfeeding at 6 months, and 11 states had 25% of mothers breastfeeding at 12 months. However, only five states achieved all three of these objectives: California, Hawaii, Oregon, Vermont, and Washington. Oregon proved unique in the survey in that it was the only state that achieved an exclusive breastfeeding rate of greater than 25% at six months.[105] Table 2 shows the prevalence of ever-breastfeeding in Oregon from 2003-2005, as well as at three months, six months, and twelve months, according to the Centers for Disease Control's National Immunization Survey.

Table 2: Prevalence of breastfeeding among all Oregon women, 2003-2005*

	2003	2004	2005
Ever-breastfeeding†	88%	86.0%	89.4%
Exclusive at 3 months‡	58.1%	54.7%	59.2%
Any at 6 months	54.1%	53.0%	57.6%
Exclusive at 6 months‡	26.8%	22.3%	26.6%
Any at 1 year	27.8%	26.2%	37.0%

* Data were collected by the National Immunization Survey
† Ever-breastfeeding means a mother breastfed her child at least one time.
‡ Exclusive breastfeeding involves feeding the infant only breast milk; no formula and no other food supplementation.

Factors Affecting Breastfeeding Practices

Many personal and socio-demographic factors besides acculturation can affect a woman's breastfeeding practices and behaviors. Some of these factors include

race/ethnicity,[106] age,[106,107] education,[107,108] annual household income,[107,108] enrollment in WIC,[109] low birthweight,[110] obesity,[111] parity,[109]marital status,[112] area or region of residency,[109] and type of delivery (vaginal versus cesarean).[113] These investigations reported that white women are more likely to breastfeed than women of other racial/ethnic groups, as are older women, those with higher educational attainment, higher income and socio-economic status, previous breastfeeding experience, those who are not enrolled in WIC, women who have a normal birthweight baby, those who are not obese, primiparous women, those who are married, and those who deliver vaginally.

Environmental obstacles that affect breastfeeding practices include insufficient prenatal education on breastfeeding,[114,115] hospital policies and practices that may encourage formula feeding, including distribution of free formula gift-packs in hospitals,[116,117] maternal employment or returning to work,[118,119] lack of postnatal care,[120] lack of family and societal support,[121] portrayal and promotion of formula feeding as the societal norm,[122] and lack of guidance and encouragement for breastfeeding from health care providers.[123-125]

U.S. Trends in Prevalence of Breastfeeding

While improvement is being made toward *Healthy People 2010* goals, certain groups of women, including low-income and particular racial and ethnic populations, are less likely to initiate and sustain breastfeeding. Nationally, in 1998 68% of white women breastfed while 66% of Hispanic women and 45% of black women breastfed in the early postpartum period.[1] In addition, at six months postpartum, the disparity continued, with 31% of white women breastfeeding, and only 28% of Hispanic women and 19% of black women doing so.[1] One of the additional goals of *Healthy People 2010* is to eliminate

health disparities among racial and ethnic minorities. Because the U.S. Hispanic population is the largest minority group in the nation,[126] and its population is expected to increase from 12.5% in 2000 to 17% of all U.S. citizens by 2020,[127] it is important to identify disparities in breastfeeding among the Hispanic population.

At first glance, the rates of breastfeeding in the early postpartum period between Hispanic women (66%) and non-Hispanic white women (68%) do not appear to be significantly different. In fact, data from the 2000-2001 Oregon Pregnancy Risk Assessment Monitoring System show that Hispanic women were more likely to breastfeed at ten weeks than non-Hispanic white women. Hispanic women were the most likely to breastfeed at ten weeks (71.4%), followed by Asian/Pacific-Islanders (69.6%), non-Hispanic whites (67.2%), American Indian/Alaskan Natives (59.4%), and African Americans (51.4%).

Recent research, however, suggests that certain sub-groups of Hispanic women are breastfeeding at lower rates than others.[128-134] Some of these studies indicate that a woman's level of acculturation can impact her breastfeeding practices, among other health behaviors and outcomes.

Definition of "Hispanic"

The term "Hispanic" has been assigned by the U.S. government as a term to identify people of Latin American origin who live in the U.S. for census purposes.[126,135] People who are of Mexican, Puerto Rican, Cuban, South American, and Central American descent are all historically linked by the Spanish language, and are designated "Hispanic".[135] While there is ambiguity in the use of the terms "Hispanic" or "Latino", both terms are commonly used in the literature to refer to people described above. In

keeping with the designation given by the U.S. Census Bureau, this paper will use the term "Hispanic".

Trends in Breastfeeding among Hispanic Women

While the prevalence of breastfeeding among Hispanic women in the United States is close to that of white women, breastfeeding in foreign Hispanic cultures is markedly different. However, it is important to note that breastfeeding practices vary by country and region, and even within countries and regions.

In Mexico, the prevalence of breastfeeding is high. It has been estimated that more than 90% of mothers initiate breastfeeding in Mexico,[136] and that the mean national duration of breastfeeding was nine months in 1999.[137] In addition, the World Health Organization Global Data Bank on Breastfeeding and Complementary Feeding shows that the rate of ever-breastfeeding among Mexican mothers from various geographic regions has ranged from 66 – 99%, with the national average ranging from 77 – 89%.[138] Many cultural traditions and beliefs drive the high prevalence of breastfeeding in Mexico.

It is believed by some Mexican populations that maternal emotions can affect the quality of breast milk produced, in turn impacting the duration of breastfeeding. For example, if a breastfeeding mother becomes angry or frightened, it is believed that the milk will spoil and perhaps cause diarrhea in the infant; however, if a mother does not express her milk, she will become ill and die.[139-141] Additionally, traditional Mexican concepts greatly influence how childbearing and childrearing are viewed, and have the potential to greatly affect breastfeeding practices of Mexican women. The concept of *la familia* (family) has a strong influence, consisting of a large network of strong, enduring relationships between family members.[142] Other female family members, particularly the

maternal grandmother, serve as important role models who offer support to new mothers.[143] Because families place such a strong emphasis on childbearing and childrearing, one of the primary goals during pregnancy is *tener un bebe saludable* (to seek a healthy baby).[144] This may play a large role in the high prevalence of breastfeeding among Mexican women, if breastfeeding is viewed as a healthy activity for the baby.

In contrast to Mexican women, results of a study on a population of Puerto Rican women showed that cultural beliefs did not impact their breastfeeding practices.[145,146] The proportion of breastfeeding in Puerto Rican infants also remains lower than in Mexican infants. Before 1960, 59% of infants were ever breastfed; between 1970 and 1974, only 25% of Puerto Rican infants were breastfed; and 38% were breastfed between 1980 and 1982.[147] Even into the 1990s, breastfeeding initiation in Puerto Rico remained lower than the United States and Latin America,[148] and until recently (2002), breastfeeding in public was considered indecent exposure. Fortunately, laws in Puerto Rico now allow for breastfeeding in public and in the workplace.[149]

Little research has been done on breastfeeding among women from Central and South American countries.[150] However, it has been estimated that the proportion of women who initiate breastfeeding in Latin American countries ranged from 74% to 97% between 1980 and 1982.[147]

One qualitative study on the breastfeeding practices and attitudes of Hispanic women did report that Hispanic women perceived many differences between breastfeeding in the U.S. and breastfeeding in their country of origin, especially among women from the Dominican Republic. [139] These women described their native countries

as being more supportive of breastfeeding than the U.S., and that mothers typically breastfed in public places in their native country more than in the U.S. Also, breastfeeding was viewed as more of an expectation in the country of origin, and that women in the U.S. are more occupied and hurried than women in their own countries. In addition, formula was noted as more expensive back home.[139]

Breastfeeding practices and beliefs are not homogenous throughout all countries from which Hispanic women originate. Thus, it is important to take these factors into account when interpreting results of breastfeeding studies done with populations of diverse Hispanic heritage.

Acculturation

Acculturation is a process by which immigrants begin to adopt the cultural norms, attitudes, beliefs, and behaviors of the dominant culture to where they have immigrated;[2] these include language preferences, food choice, dress, music, and sports, etc.[151] The acculturation hypothesis proposes that as immigrant men, women, and children adapt to the values, behaviors, attitudes, and beliefs of the U.S. mainstream culture, they experience adverse health effects.[143,152]

One area in which the acculturation hypothesis has been extensively tested is that of birth outcomes for pregnant Hispanic women, especially low birthweight.[153-155] Rates of low birthweight among Hispanic women are low compared to national averages, and are similar to rates of non-Hispanic white women. The overall prevalence of low birthweight in the U.S. in 2004 was 8.1%, while among non-Hispanic whites it was 7.2%, and among Hispanics it was 6.8%.[156] This data, and data from several investigations provide evidence for what has been dubbed the "epidemiologic paradox"; the paradox is

that, despite having socio-economic disadvantages, Hispanic women continue to experience lower rates of low birthweight and infant mortality than non-Hispanic white women.[157-162] As researchers have explored this phenomenon, it has come to light that acculturation levels impact birth outcomes among Hispanic women. While women with lower levels of acculturation tend toward having less education, lower socioeconomic status, higher rates of uninsurance, and less access to health care, they continue to experience fewer adverse perinatal outcomes than women with higher levels of acculturation.[163]

Numerous other studies have assessed the relationship between acculturation levels of Hispanic women and other perinatal outcomes such as psychosocial stress factors,[164] alcohol and tobacco use,[165] family planning practices,[166] prenatal care,[167] and the use of and attitudes toward contraception,[168] among others. Many such studies have found that adverse outcomes or risk behaviors are associated with higher levels of acculturation.

Assessment of Acculturation

Acculturation is a complex process and is difficult to measure. Studies assessing the effects of acculturation on perinatal health outcomes have used a variety of means to measure acculturation, including various unidimensional and bidimensional models. Unidimensional models assess acculturation along a continuum, from not acculturated to completely acculturated, and assume that as an individual acculturates to the dominant culture, he or she loses affiliation with the original culture.[151,169-172] Bidimensional models, on the other hand, suggest that an individual can acculturate to the dominant society while maintaining aspects of his or her original culture.[151,169,173-177] In such a

model, a person can range from fully participating to fully rejecting either culture's traditions, beliefs, and practices.[151,169,173] The major difference between unidimensional and bidimensional models of acculturation is that unidimensional models assume that as a person acculturates, he or she "gives up" certain aspects of the culture of origin, while bidimensional models account for the maintenance of traditional beliefs and practices throughout the acculturation process.

In addition, biculturalism is an important aspect of the process of acculturation, and is often revealed as a non-linear process.[151,174] For instance, a person who speaks mainly Spanish in the home may socialize more with non-Hispanics, while other individuals may speak primarily English, but socialize mainly with other Hispanic men, women, and children.[151,174]

Some studies on acculturation and a variety of outcomes, including alcoholism, smoking, dietary intake, AIDS/HIV knowledge, and breastfeeding, among others, have assessed acculturation levels using the Short Acculturation Scale (SAS). The SAS is a validated language scale that asks questions solely regarding language use.[132,178] Others have used the Acculturation Rating Scale for Mexican-Americans-II (ARSMA-II).[142,154,166,170] The ARSMA-II asks questions on a Likert scale, addressing items pertaining to language, ethnic interaction, and ethnic identity.[170] Others still have used a variety of single or combined indicators for acculturation, including language spoken at home, language ability, survey language, ethnic self-identification, country of birth, country in which the last schooling was received, length of time in the new country, migration history, and print and electronic media preferences.[131,152,179,180] Many more investigators than those listed here have used one or more of the previous listed measures

of acculturation. Maternal nativity alone or language use variables alone have also been used to assess acculturation,[143,181,182] however, English et al. used both language and mother's birthplace as proxy measures for acculturation.[183]

Breastfeeding and Acculturation

While many studies have been conducted on a variety of birth outcomes among Hispanic women, few studies have examined the relationship between acculturation among Hispanic women and breastfeeding practices, particularly beyond breastfeeding initiation. However, most of the studies that have been conducted on breastfeeding among Hispanic women have found that breastfeeding declines with increased acculturation.

Rassin et al. found that higher acculturation was significantly associated with decreased *initiation of breastfeeding* ("continued breastfeeding, even partially, at two to three weeks postnatally") among a sample of Hispanic women in a U.S.-Mexico border city (OR 0.66; 95% CI 0.52 – 0.83).[130] The investigators of this study measured acculturation through a 20 item scale that asked about items such as language use in various situations, food choices, music preferences, length of time living in the U.S. and Mexico, number of generations living in the U.S., and background of friends, neighbors, and social groups. Each woman was subsequently given a mean total acculturation score based on her responses.

In a study by Byrd et al., acculturation (as measured by language spoken at home, language ability, country of birth, and country of last schooling) was significantly associated with decreased *intention to breastfeed* among primiparous Hispanic women, and with lower *history of breastfeeding* (having ever breastfed a previous child) among

multiparous women. Also, among multiparous women, those who spoke both English and Spanish were 3.28 times more likely to have breastfed their previous child than those who spoke only English (95% CI 1.15 – 9.35); those who were born in Mexico were 1.55 times more likely to have breastfed than women born in the U.S. (95% CI 1.08 – 2.21); and those who finished schooling in Mexico were 1.63 times more likely to have breastfed than women who finished schooling in the U.S. (95% CI 1.12 – 2.37). When assessing intention to breastfed, the investigators found that among multiparous women, those who were born in Mexico were more likely to intend to breastfeed than those born in the U.S. (OR 1.72; 95% CI 1.19 – 2.50); among primiparous women, those who finished school in Mexico were more likely to intend to breastfeed than those who finished school in the U.S. (: 1.85; 95% CI 1.09 – 3.12). However, none of the language variables were found to be significantly related to previous breastfeeding or breastfeeding intention, either among primiparous or multiparous women.[131]

Similarly, Gibson et al. found in a nationally representative sample of the non-institutionalized population of the U.S., that acculturation among Hispanic women was associated with a decrease in *ever-breastfeeding* (OR 0.23; 95% CI 0.14 – 0.40), even after adjusting for education, age, and income. In this study, breastfeeding was determined through self-report data from the mother, by asking if the mothers had ever breastfed any of their children, and if so, how many and for how long.[132]

Finally, Scrimshaw et al. showed that acculturation (as assessed by questions concerning each woman's preferences for Mexican or American cultural events and materials, for speaking English or Spanish, number of years living in the U.S., self-identification, and urban or rural place of birth) was related to a woman's *decision to*

breastfeed, and *initiation of breastfeeding* (r = -0.0836); this was interpreted as only a trend because the level of correlation was low.[134]

In contrast, Anderson et al. found no association between acculturation and breastfeeding initiation among a sample of Puerto Rican women in Connecticut.[152] However, in a similar sample of Puerto Rican women in Connecticut, Perez-Escamilla et al. found that the mother's length of residence in the U.S was associated with a decline in breastfeeding initiation (ever vs. never-breastfed) (OR 0.92; 95% CI 0.87 – 0.98), but mother's place of birth was not.[184]

Additionally, Wiemann et al. found that acculturation variables, including being born in Mexico, speaking mainly Spanish in the home, and choosing to be interviewed in Spanish, were associated with the decision to breastfeed among Mexican-American adolescent mothers ($p < 0.001$) in bivariate analysis, but not in multivariate analysis.[185]

While five of these studies showed a relationship between increased acculturation and decreased breastfeeding, two studies show either no relationship or no relationship when accounting for other variables. One major limitation of comparing these studies to one another is that they all use different methods to assess acculturation, and they look at a variety of breastfeeding outcomes, from intention to breastfeed, to breastfeeding initiation, to breastfeeding at 2-3 weeks postpartum. In addition, several of the studies used convenience samples of Hispanic women, and several relied on maternal recall of breastfeeding events for prior children.

Study Rationale and Objectives

This study aims to be the first to assess the association between acculturation and breastfeeding among Hispanic women using a population-based sample of new mothers

that assesses breastfeeding beyond the neonatal time period (28 days after birth). The primary objective of this study was to test the hypothesis that higher levels of acculturation, as measured by maternal nativity and language use, are associated with a lower prevalence of breastfeeding at ten weeks postpartum among Hispanic women in Oregon. This was accomplished by building a multiple logistic regression model describing the relationship between breastfeeding and acculturation while controlling for other factors. Data from the Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) from the years 2000 and 2001 were used for this study.

Because breastfeeding offers numerous benefits, the proportion of women who breastfeed needs to be increased in order to meet and exceed the Healthy People 2010 benchmarks. While national rates of breastfeeding are improving, certain minority groups, including Hispanic women, are continuing to breastfeed at lower than targeted rates, particularly beyond the early postpartum time period.[105,156] Additionally, not all Hispanic sub-groups have identical breastfeeding practices, especially sub-groups that differ by level of acculturation. Because the Hispanic population makes up about 8% of Oregon's population and is growing, and is the second largest racial/ethnic group after non-Hispanic whites,[186] it is important that Hispanic women receive adequate attention regarding breastfeeding promotion and practices. Through the identification of a possible disparity in breastfeeding at ten weeks by acculturation status, breastfeeding promotion programs in Oregon will be able to target interventions toward groups of women who need it most.

METHODS

Oregon PRAMS Research Design

This is a population-based cross-sectional study using secondary data from the 2000-2001 Oregon Pregnancy Risk Assessment Monitoring System (PRAMS). This program was developed to assess the experiences and attitudes of new mothers before, during and immediately after pregnancy. Oregon PRAMS began in 1998 and is administered by the Office of Family Health, Oregon Public Health Division (PHD). It was initially modeled after the nationwide PRAMS system supported by the Centers for Disease Control and Prevention (CDC); however, Oregon PRAMS protocol differed from the CDC protocol until January, 2002, when Oregon began collecting data under CDC protocol. Therefore, the data obtained for this analysis were not collected under CDC protocol. For detailed information on the nationwide PRAMS, please visit http://www.cdc.gov/prams/methodology.htm .[187]

PRAMS Data Collection

Oregon resident women who had a live birth in 2000 or 2001 were selected monthly from Oregon birth certificate files through stratified systematic sampling. The survey was sent to 5,367 women out of 81,121 eligible births in Oregon. 3985 women completed the survey for a combined weighted response rate of 78.8% (72.6% unweighted).[188]

Every month, Oregon's birth certificate files were used to select a stratified random sample of women. Each selected woman was sent a series of PRAMS mailings, starting with a pre-letter introducing PRAMS and informing the mother that she would soon receive a PRAMS packet and questionnaire. The initial survey packet was sent to

mothers about three to seven days after the pre-letter. Both English and Spanish versions were sent to mothers identified as Hispanic according to birth certificate files. Women had the choice of filling out either the English or the Spanish survey. All women were given the option of a telephone interview instead of a written survey. If the survey was not returned, reminders were then mailed out, followed by a second survey packet seven to fourteen days later. Subsequently, for mothers who still had not responded, computer-assisted telephone interviews were initiated. The telephone-administered surveys asked about the same items as the mailed questionnaire; however, questions were slightly modified to facilitate the interviewing process. Telephone numbers were obtained through a variety of sources, and were called at various times of day and days of the week in order to reach each woman. Each telephone number was called no more than 15 times over two to three weeks, and appointments were arranged to conduct the survey at the mother's convenience, if necessary. Telephone surveys were conducted in either English or Spanish, according to each mother's preference.

Each mailing included its own set of materials. The first mailing packet included a cover letter that described PRAMS and its purpose, explained how and why the woman was chosen, elicited the mother's cooperation with PRAMS, described how to fill out and return the questionnaire, explained incentives and rewards, provided informed consent information and provided a toll-free telephone number for additional information. The process of obtaining informed consent was passive in that any woman who did not object to participating in the survey was considered to have given her consent to participate. Because PRAMS is a public health practice and surveillance program rather than research, the Oregon Public Health Division deemed the program exempt from

Institutional Review Board review, and deemed passive consent as acceptable for non-research activities. The second mailing contained a similar letter that was altered slightly by adding an additional appeal for a response. The mailings also included a number of other items, including the questionnaire booklet (containing 20 pages of 84 questions with a colorful cover and two blank pages for the mother's comments); a self-addressed return envelope with postage paid for easy return of the questionnaire; a "Frequently Asked Questions about PRAMS" fact sheet; a three-year calendar to serve as a memory aid for the mother to answer the questions; and information about an incentive to participate (one mother who responded to the written survey was selected to receive a $200 gift card to a state-wide grocery chain each month). Details about questions asked in the PRAMS questionnaire that were used in this analysis are included in Appendix A.

Because the series of mailings began at two to four months after delivery, and the data collection cycle could last up to 95 days, mothers responded to the survey two to seven months following the birth of the infant. Although some women were sampled further postpartum than others, all questions asked pertained to behaviors, attitudes, and practices before, during, and after pregnancy, thus giving a variety of information about the prenatal, perinatal, and postnatal time periods, from up to 12 months prior to delivery, to seven months after delivery.

PRAMS Sampling and Weighting Methodology

A stratified systematic sample of 150 to 300 new mothers was selected each month from all eligible Oregon birth certificate records. Women were sampled within six groups, including low birthweight (less than 2500 grams) non-Hispanic white, normal birthweight (equal to or greater than 2500 grams) non-Hispanic white, non-Hispanic

black, non-Hispanic American Indian/Alaskan Native, non-Hispanic Asian/Pacific Islander, and Hispanic, as identified on the birth certificate record of each mother's newborn. Women from the low birth and racial/ethnic minority strata were over-sampled to ensure adequate numbers of responses. The total annual sample sizes have ranged from 1300 to 2500 since PRAMS began in 1998.

Birth certificate data on each mother and infant pair are linked to the mother's responses to the PRAMS questionnaire. This provides PRAMS with additional demographic and medical information that was collected by the state's vital records system. Because the stratified random sampling is done from the collection of the entire state's birth certificate records, the sample of women in the PRAMS database is representative of the entire population of all births in Oregon.

Various weighting strategies were applied to the collected PRAMS data, including sampling weights (applied to the six strata from which respondents were sampled), non-response adjustments, and non-coverage. The non-response weights were used to account for the tendency of women with certain characteristics to have lower response frequencies than others. The CDC found that some of the characteristics that have affected response rates in the past have been marital status, education, parity, age, and first trimester prenatal care initiation.[189] Because PRAMS data are linked with birth certificate files, demographic information was available for all women including those who did not respond, allowing weighting factors to be adjusted for each year's sample of women. The responses of women in categories with lower response rates were given a greater weight than responses of women with higher response weights. For example, an unmarried responding woman receives a greater weight than a married woman. Thus, the

non-response weights are equivalent to the total sample size in a particular defined group divided by the number of respondents. For characteristics for which there were no significant differences within the stratum between respondents and non-respondents, the entire stratum was given a weight equal to the sample size in the stratum divided by the actual number of respondents.[189] For the 2000 PRAMS, parity was the only variable for which a significant difference among Hispanic women was found. Primiparous women were significantly more likely to respond than multiparous women, so they were given a lower weight than the multiparous women. Thus each multiparous woman who *did* respond represents a greater number of women in the overall population.

Lastly, non-coverage weights were applied. These non-coverage weights are necessary due to the possibility of some births not being accounted for in the state's birth certificate records. The files for each year's worth of births are compared to the calendar year birth tape that states provide to the CDC to check for discrepancies and missing files. The most common reason for omitted records is late processing; generally, these are evenly scattered throughout the state and throughout the year, but occasionally they can be clustered by particular hospitals, counties, or times of year. The benefit of applying the non-coverage weights is to bring the total birth estimates from the sample data in line with the known totals from the birth tape. Thus, the non-coverage weight is calculated by dividing the total number of births in the state by the number of births in the PRAMS sampling frame for the same period of time.

The sampling, non-response, and non-coverage weights are multiplied together to generate the final weights to be used in analysis. The weight can be interpreted as the number of women like herself in the state population that each respondent represents.

Because the data was collected on a year-by-year basis, the calculated weights for the year 2000 were different from the calculated weights for 2001. The weights were recalculated by Oregon PHD staff for the combined 2000/2001 dataset. This was done to account for variations in the sampling, non-response, and non-coverage weights of the two separate years.

The final sampling weights for Hispanic women in the 2000/2001 dataset created three distinct groups: 1) primiparous women surveyed in 2000; 2) multiparous women surveyed in 2000; and 3) all women surveyed in 2001. There were 242 primiparous women from 2000, each with a sampling weight of 11.23; this means that each of these women represented 11.23 childbearing Hispanic women in the Oregon population. An additional 349 multiparous women from 2000 had a sampling weight of 12.07, thus each representing 12.07 women in Oregon. Finally, 529 women from 2001 each had a sampling weight of 12.18, thus each representing 12.18 childbearing women in Oregon.

Because of this complex sampling and weighting design, analyzing PRAMS data requires special software that takes into account the weighting scheme. One such software program that does this, and was used in this analysis, is SUDAAN (Survey Data Analysis).[190]

Inclusion/Exclusion Criteria

Of the 3895 Oregon resident women who participated in PRAMS in 2000 and 2001, responses from 68 women whose baby was not alive or not living with their mother at the time of survey were excluded from analysis. Because the main analyses were conducted on Hispanic women only, all remaining non-Hispanic women (n = 2717) subsequently were excluded. Ethnicity was determined through identification of a

mother as Hispanic on her child's birth certificate. If a selected mother had multiple births (twins, triplets, etc.), one infant was randomly selected; the mother was requested to answer all PRAMS questions only about this infant.

Any woman without information on maternal nativity (n = 0) or survey language (n = 62) was excluded from multivariable analysis, because the main variable of interest, acculturation, was determined by these two variables. Missing data on survey language for these 62 women was due a contracted telephone interviewing company that failed to record the language in which the interview was conducted.

Finally, all remaining women who had missing data for breastfeeding at ten weeks were excluded from analysis (n = 37). Therefore the final sample size of women available for all analysis was 1011.

Data Management

The process of linking birth certificate files with PRAMS responses was performed by personnel at the Oregon Public Health Division (PHD).

The de-identified data were provided by the Oregon PHD, Office of Family Health in SPSS (Statistical Package for the Social Sciences) format. All data management was conducted using SPSS Version 13.0 (SPSS, Inc.).[191] Institutional review board (IRB) approval was obtained from the Oregon Health and Science University (OHSU) IRB. Data management techniques included recoding variables (described below) and keeping detailed records of changes and additions to the database. These records were kept as SPSS syntax files so procedures and results could easily be replicated.

Some problems were encountered throughout the course of the analysis of the data. Originally, I had obtained a copy of the 2000-2001 PRAMS dataset that included only the Hispanic women in the study. I began running all analyses on this sub-set of the larger PRAMS dataset. However, upon further inspection, it was noted that sub-setting a complex data set with weighted data is not valid with SUDAAN software. When a complex dataset is sub-setted, entire primary sampling units (PSUs) can be removed; in this case, the five strata other than Hispanic women were all eliminated from the dataset. However, SUDAAN needs the entire design, and thus all PSUs, present in order to estimate variances correctly. The implications of using sub-setting data include inaccurate variance estimation, and possibly invalid hypothesis testing results.[192] Upon this finding, I obtained from the Oregon PHD the full de-identified dataset that included all women in the 2000-2001 PRAMS dataset, and re-ran all of the analyses.

Variable Recoding

Several variables were used in this analysis, including maternal place of birth, survey language, childbearing intention, family income, maternal age, maternal smoking, WIC enrollment, marital status, maternal education, parity, low birthweight, type of delivery, body mass index, first trimester prenatal care initiation, county of residence, and breastfeeding at ten weeks. The dependent variable of interest (breastfeeding at ten weeks) was determined from a series of PRAMS questions relating to breastfeeding. Any woman who had initiated breastfeeding and was still breastfeeding at the time of survey, or had initiated breastfeeding and responded that she breastfed for at least ten weeks or longer (if interviewed after ten weeks) was considered to have breastfed for at least ten weeks. Ten weeks was chosen as the cutoff point because all women were sampled about

two to four months after delivery; thus the majority of women (approximately 99.7%) were able to provide information on their breastfeeding practices at ten weeks.[193] Due to the secondary nature of the data, all identifiable information was removed from the dataset, including the date of the survey. Thus, I was not able to determine exactly how many women were surveyed prior to ten weeks. Table 3 describes the questions, responses, initial variable coding, and recoding that were used to determine breastfeeding at ten weeks. The outcome variable was coded as "0 = no" and "1 = yes" for logistic regression analysis, and as "1 = yes" and "2 = no" for crosstab procedures.

Table 3. PRAMS questions, responses, and coding used to measure prevalence of breastfeeding at ten weeks.

PRAMS question	Possible Responses	Initial Variable Coding	Coding for Breastfeeding at Ten Weeks
Q49. "Did you ever breastfeed or pump breast milk to feed your new baby after delivery"	- Yes →	1 = Yes →	Go to question 50 (N/A)
	- No →	2 = No →	**0 = No**
Q50. "Are you still breastfeeding or feeding pumped milk to your new baby?"	- Yes →	1 = Yes →	**1 = Yes**
	- No →	2 = No →	Go to question 51 (N/A)
Q51. "How many weeks or months did you breastfeed or pump milk to feed your new baby?"	- ____ Weeks or ____Months →	Continuous numbers reported →	**0 = No, if responded ≤ 9 weeks** **1 =Yes, if responded ≥ 10 weeks**
	- Less than 1 week →	222 = Less than 1 week →	**0 = No**

The main independent variable of interest was acculturation; women were categorized into levels of acculturation based on maternal nativity and language in which the survey was completed. Maternal nativity was identified from each newborn's birth certificate; this variable identified the country, state, or territory in which the mother was born. If a woman was born in any country outside the United States, she was considered foreign-born; if she was born in any state or territory of the U.S. (including Puerto Rico), she was considered U.S.-born. Language in which the survey was completed was

recorded by whether the woman returned a Spanish-language survey or an English-language survey, or if the telephone survey was conducted in English or Spanish.

Thus the two variables were combined to create four categories coded as follows: 1) foreign-born women (born outside the U.S.) who completed the survey in Spanish (n=686, 67.9%); 2) foreign-born women who completed the survey in English (n=88, 8.7%); 3) U.S.-born women (born in the U.S.) who completed the survey in Spanish (n=12, 1.2%); and 4) U.S.-born women who completed the survey in English (n=225, 22.2%). Because there was a small number of U.S.-born/Spanish women (n=12), this group was combined with the foreign-born/English group (n = 88) to create a sufficient sample size for an intermediate group. The final acculturation variable then had three categories of women: 1) foreign-born/Spanish (n=686, 67.9%); 2) foreign-born/English & U.S.-born/Spanish (n=100, 9.9%); 3) U.S.-born/English (n=225, 22.2%). Although maternal nativity and language use are considered proxies for acculturation, they aim to quantify some level of acculturation among Hispanic women. Those who completed the survey in Spanish and were foreign-born were considered to have low acculturation for this study. Those who completed the survey in Spanish and were U.S.-born, or who completed the survey in English and were foreign-born were considered to have intermediate acculturation. Lastly, those who completed the survey in English and were U.S.-born were considered to have high acculturation. The terms "low acculturation", "intermediate acculturation", and "high acculturation" will be used throughout the remainder of this paper to refer to the three groups of women described above.

Because childbearing intention, family income, maternal age, maternal smoking, WIC enrollment, marital status, maternal education, parity, low birthweight, type of

delivery, body mass index, prenatal care initiation and geographical residence have all been independently associated with breastfeeding behavior in other literature, it is important to take into account the possible effect that each of these could have on the relationship between breastfeeding and acculturation. These variables and their coding structure are found in Table 4.

Table 4. PRAMS questions and birth certificate variables, responses, and coding for variables used in statistical analysis.

Original Variable	Possible Responses	Coding for New Variable	Source
Childbearing Intention	- I wanted to be pregnant sooner - I wanted to be pregnant then - I wanted to be pregnant later - I didn't want to be pregnant then or at any time in the future	1 = Intended 1 = Intended 2 = Mistimed 3 = Unwanted	PRAMS
Family Income (annual family income at the time of survey)	Continuous values reported	1 = ≥ $20,000 2 = < $20,000	PRAMS
Maternal Age at Delivery (years)	Continuous values reported	1 = < 20 2 = 20-29 3 = ≥ 30	Birth Certificate
Smoking Status	- I don't smoke - ____ cigarettes or ____ packs - Less than 1 cigarette a day - I don't know	1 = No 2 = Yes 2 = Yes Missing	PRAMS
WIC enrollment	- I was not on WIC - ____ weeks or ____ months	1 = No 2 = Yes	PRAMS
Marital Status	- Married/Separated - Unmarried/Divorced/ Annulled/Widowed	1 = Married 2 = Not married	Birth Certificate
Maternal Education	Continuous values reported	1 = ≥ 12 years 2 = < 12 years	Birth Certificate
Parity	Continuous values reported	1 = First-born 2 = Not first-born	Birth Certificate
Birthweight	< 2500 grams ≥ 2500 grams	1 = < 2500 grams 2 = ≥ 2500 grams	Birth Certificate
Type of delivery	- Vaginal - Cesarean	1 = Vaginal 2 = Cesarean	Birth Certificate
First Trimester Prenatal are Initiation	- Continuous values: 1-12 weeks - Continuous values: 13-36 weeks - I did not go for prenatal care	1 = Within first trimester 2 = After first trimester 2 = After first trimester	PRAMS
Body Mass Index (prepregnancy)	Values calculated from responses to questions about each woman's height and weight	1 = Under/Normal weight (<25.0) 2 = Overweight (25.0<bmi<30.0) 3 = Obese (bmi > 30.0)	PRAMS
Urban/Rural County of Residence	All counties in Oregon. (See Figure 3)	1 = Rural 2 = Urban	Birth Certificate

Age and income were originally available as continuous variables; however, I chose to recode them into categorical variables. I initially categorized age into groups of women aged less than or equal to 20, 20-34, and greater than 34 years. However, only 16 women in the third category did not breastfeed at 10 weeks; to keep cell sizes at a reliable level, I recoded age again into categories of less than 20, 20-29, and greater than or equal to 30. In PRAMS, cell sizes that are smaller than 30 can yield inaccurate and unreliable results.[194] Because the distribution of family income was highly skewed (Figure 1), this variable was categorized into a dichotomous variable with the approximate mean as the cut point.

Only 27 women had a BMI that was less than 18.5 and therefore considered underweight. Because this was such a small number, the BMI variable was re-categorized into 4 groups, including underweight/normal weight (BMI < 25); overweight ($25 \leq$ BMI < 30); obese (BMI ≥ 30); and missing. Missing responses were coded as a category for analysis because there was such a large number of missing responses (n = 305). Fifty-seven women did not provide their pre-pregnancy weight, and 295 women did not report their height in feet and inches. Body mass index could not be calculated for women who were missing either weight or height data. Because such a large number of women had missing BMI data, the variable was later removed from multivariable analysis.

Descriptive Analysis

Frequency distributions and cross-tabulations were used to report unweighted counts and weighted percents of categories for each independent and dependent variable. Both SPSS Version 13.0[191] and SUDAAN Version 9.0.1[190] were used for this analysis.

Logistic Regression Analysis

Although 1011 women were included sample size, only 943 were included in the final logistic regression analysis due to 68 women having a missing value for at least one of the variables that were included in the final regression model. Imputation of missing values was not used in the analysis to account for those that were dropped from modeling by SUDAAN.

Univariable Logistic Regression Analysis

Univariable (or simple) logistic regression was performed using SUDAAN to assess the relationship between each independent variable and breastfeeding at ten weeks. Odds ratios (ORs), confidence intervals (CIs), and p-values from Wald F statistics were used to determine whether there was a statistically significant association between each explanatory variable and breastfeeding.

Multivariable Logistic Regression Analysis

Multivariable models were built by entering all variables from simple logistic regression and using a backward elimination variable selection procedure as described below. This was performed after assessing the significance of each explanatory variable in a simple logistic regression model. Although some variables did not meet statistical standards to be considered for model-building ($p<0.25$),[195] I chose to include them because of their previously mentioned posited associations with breastfeeding in other literature.

The initial full model contained acculturation, childbearing intention, family income, age, smoking, WIC enrollment, marital status, education, parity, low birthweight, type of delivery, first trimester prenatal care initiation, and county of residence.

Variables were removed one at a time, based on which had the least significant p-value. Any variable with a p-value of less than 0.10 was left in the model; even though some of these were not statistically significant, they appeared to provide valuable information for the model, according to the Hosmer and Lemeshow Goodness-of-Fit test. Wald F-values and p-values for the Hosmer and Lemeshow Goodness-of-Fit test were used to determine if the model was a good fit; the smaller the HL Wald F statistic and the larger the p-value, the better the fit of the model.

After determining a preliminary main effects model, interactions between acculturation and each of the remaining explanatory variables were assessed. An interaction term was considered important if the p-value for the Wald F-statistic was less than 0.10. This final logistic regression model, including main effects and interaction terms, was then used to determine the nature of the relationship between acculturation and breastfeeding at ten weeks.

RESULTS

Sample Characteristics

Data from 1011 Hispanic women who responded to the PRAMS questionnaire in 2000 and 2001 were used in this analysis comprising 25.9% (unweighted) of the total 3895 PRAMS respondents for those years. These 1011 women represent the larger population of childbearing Hispanic women in Oregon from the years 2000 and 2001 whose child was alive and living with her at the time of survey. The majority of women in this sample were foreign-born (76.6%); took the PRAMS survey in Spanish (69.1%); had an intended birth (58.6%); had a family income of less than $20,000 per year at the time of the survey (62.8%); were between the ages of 20 and 29 (61.9%); did not smoke at the time of the survey (93.6%); were enrolled in WIC (75.8%); were married (58.8%); had an educational attainment of less than 12 years (60.3%); had had at least one previous child (61.2%); had a baby with birthweight greater than 2500 grams (95.0%, which was similar to the overall prevalence of 95.2% for all non-Hispanic Oregon women); had a vaginal delivery (79.0%); initiated prenatal care within the first trimester of pregnancy (56.8%, which was quite a bit lower than the overall prevalence of 75.9% among all non-Hispanic Oregon women); had a normal body mass index of 18.5 to less than 25 (40.3%); and resided in an urban county (80.3%) (See Table 9 for all data).

As discussed previously, data from the language in which the survey was completed was systematically missing for some women (n=62). Two different companies were used to perform the PRAMS telephone interviews; one of these companies did not record information on the language in which the interview was conducted. Unfortunately, data was not available on whether a woman returned a mailed

survey or completed a telephone interview; thus, comparisons between responses from the two different interview companies and mail-in surveys could not be made.

Maternal Nativity

Table 5 shows the distribution of the maternal country of birth for all 1120 Hispanic women in the sample.

Table 5. Hispanic women, Oregon PRAMS, 2000 & 2001: Maternal place of birth

Country or State	n	Weighted Percent
Mexico	722	71.4%
Central America	29	2.9%
South America	15	1.5%
Other foreign country	8	0.8%
Oregon	105	10.4%
California	79	7.8%
Elsewhere in the U.S.*	53	5.2%
Total	1011	100%

* Includes Puerto Rico

The majority of the women in this sample were born in Mexico (71.4%); out of all of the foreign-born women, 93.3% were born in Mexico. Other foreign places of birth were Central America, including Costa Rica, El Salvador, Guatemala, Honduras, and Panama; South America, including Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela; and other foreign countries, including Cuba, and Japan. Mothers who were born in the U.S. were born primarily in Oregon (n=105) and California (n=79), with the remainder in other states and U.S. territories (n=53), including 2 women who were born in Puerto Rico. Thus, 774 women (76.6%) in this sample were foreign-born, while 237 women (23.4%) were U.S.-born.

Survey Language

Of the women with non-missing data for survey language, 30.9% completed the survey in English, while 69.1% completed it in Spanish. As stated previously, sixty-two women did not have information collected on the language in which they completed the

survey. The missing survey language data was not differentially distributed according to birth place; 16 U.S.-born women (6.1%) and 46 foreign-born women (5.3%) had missing data on survey language. Women from nearly all geographic regions had one or more women with missing survey language data (Mexico = 44 (5.5%); Central America = 1 (3.0%); South America = 1 (5.6%); other foreign countries = 0 (0%); Oregon = 3 (2.7%); California = 6 (7.1%); other U.S. = 7 (10.9%)). Because the missing data was distributed across nearly all geographic regions and was not limited to one particular group of women, it is unlikely that differential bias has been introduced by missing survey language. Table 6 shows the distribution of survey language among the 1011 women included in analyses.

Table 6. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of survey language

Survey Language	n	Weighted Percent
English	313	30.9%
Spanish	698	69.1%
Total	1011	100%

Acculturation

Table 7 shows the distribution of Hispanic women by level of acculturation. Because there was such a small number of women who were born in the U.S. and took the survey in Spanish (n=12), this group was combined with those who were foreign-born and took the survey in English. These two middle groups combined served as an intermediate category of acculturation for univariable and multivariable analysis; the intermediate acculturation group thus had 100 women (9.9% of the total sample).

Table 7. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of women by level of acculturation

Level of Acculturation	n*	Weighted Percent
Low (Foreign-born/Spanish)	686	67.9%
Intermediate I (Foreign-born/English)	88	8.7%
Intermediate II (U.S.-born/Spanish)	12	1.2%
High (U.S.-born/English)	225	22.2%
Total	1011	100%

Childbearing Intention

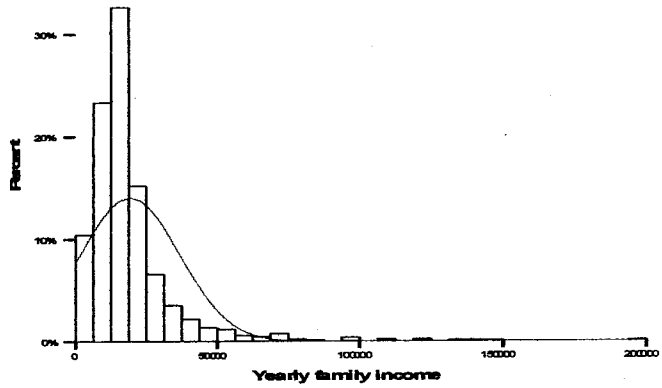
Of the 1011 women in the sample, 144 women (14.2%) "wanted to be pregnant sooner" (intended); 449 (44.5 %) "wanted to be pregnant then" (intended); 318 (31.6%) "wanted to be pregnant later" (mistimed); and 81 (8.1%) "didn't want to be pregnant then or at any time in the future" (unwanted). An additional 16 women (1.6% of the total sample) did not respond to this question. Although the question refers to whether or not the woman wanted to be pregnant, it actually assesses childbearing intention since only women who give birth to a live child are included in the PRAMS survey, rather than women who become pregnant. Thus 593 (59.7%) of the births were intended; 318 (32.1%) were mistimed; and 81 (8.2%) were unwanted.

Family Income

Figure 1 shows the distribution of yearly family income at the time of survey, with a mean yearly family income of $19,469 (SD = 17,610). As a dichotomous variable with the approximate mean as the cut-point, 634 (62.7%) women had a yearly family income of less than $20,000 per year, while 269 (26.7%) had an income of greater than or

equal to $20,000 and 108 women (10.6%) did not respond to the question about family income.

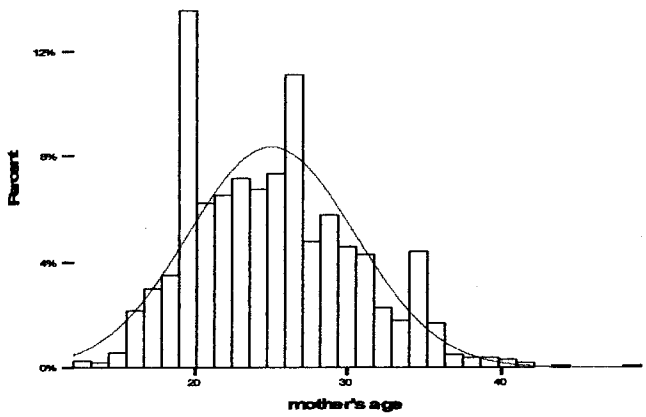
Figure 1. Hispanic women, Oregon PRAMS, 2000 & 2001: Weighted distribution of yearly family income



Maternal Age

Mother's age was approximately normally distributed (Figure 2) with a mean age of 25 years (SD = 5.5). One hundred seventy-five women were under the age of 20 at the time of delivery (17.1%); 625 were aged 20-29 (61.9%); and 211 women were aged 30 or over (21%).

Figure 2. Hispanic women, Oregon PRAMS, 2000 & 2001: Weighted distribution of maternal age



Maternal Smoking

Most of the Hispanic women in this study were non-smokers at the time of the survey (n=947, 93.6%). Forty-eight women (4.8%) did report smoking at the time of the survey, and 16 (1.6%) did not respond to this question.

WIC Enrollment

Of the 1011 women in the sample, 957 provided information on their enrollment in WIC during this pregnancy; 765 (75.8%) were enrolled, 192 (18.9%) were not, and 54 (5.3%) did not respond to the question.

Marital Status

Marital status information was recorded on the woman's birth certificate, thus reflecting her marital status at the time of the baby's birth. Women who were married or separated were considered married (n= 592, 58.8%) for the purposes of this study, and all other women were considered unmarried (n=419, 41.2%). It is unknown whether the unmarried women were divorced, widowed, or never married because the marital status variable in the PRAMS dataset did not specify those categories.

Maternal Education

The majority of women in this sample received less than twelve years of formal education (n = 608, 60.3%). However, because it is common for Mexican-origin women to receive fewer than 12 years of education, I wanted to know if having 0-8 years of education had a different effect on breastfeeding practices than receiving 9-11 years of education. The distribution of years of maternal education (0-8 years, 9-11 years, and 12 or more years) is shown in Table 8.

Table 8. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of number of years of maternal education

Level of Education	N	Weighted Percent
0-8 years	322	32.0%
9-11 years	286	28.3%
12 or more years	386	38.1%
Missing	17	1.6%
Total	1011	100%

Parity

Out of all 1011 women in the sample, 401 (38.8%) women were primiparous (this was her first child), and 610 (61.2%) were multiparous (had at least one previous child).

Low Birthweight

Only 51 women (5.0%) had low birthweight (LBW) babies, while 960 women (945.0%) had babies whose birth weight was greater than or equal to 2500 grams.

Type of Delivery

Seven hundred ninety-nine infants (79.0%) were delivered vaginally, while 212 infants (21.0%) were delivered by cesarean section.

First Trimester Prenatal Care

While 574 women (56.8%) from the sample received prenatal care within the first trimester, 378 (37.4%) received prenatal care after the first trimester or did not receive prenatal care (n=3), and 59 women (5.8%) did not respond to the question on if and when prenatal care was begun.

Body Mass Index

Women who had an underweight or normal body mass index (BMI) numbered the largest group (n=409, 40.3%). Women who were overweight and obese comprised 18.8% (n=190), and 10.6% (n=107) of the sample, respectively. A large number of

women did not report information on weight and/or height (n=305, 30.2%); therefore BMI could not be calculated for these women.

Urban/Rural

More women in this sample lived in an urban county (n=812, 80.3%) than in a rural county (n=199, 19.7%). Figure 3 shows a map of all urban and rural counties in Oregon.

Figure 3. Map of Urban and Rural Counties in Oregon*[196]

* Adapted from http://www.hometownlocator.com/StateMap.cfm?StateCode=OR

Classification as a rural county required that there be no more than 60 people per square mile living in the county; all other counties were considered urban.[196] There were 26 rural counties in Oregon, consisting of Baker, Clatsop, Coos, Crook, Curry, Deschutes,

Douglas, Gilliam, Grant, Harney, Hood River, Jefferson, Josephine, Klamath, Lake, Lincoln, Linn, Malheur, Morrow, Sherman, Tillamook, Umatilla, Union, Wallowa, Wasco, Wheeler. The ten urban counties included Benton, Clackamas, Columbia, Jackson, Lane, Marion, Multnomah, Polk, Washington, and Yamhill.

Association of Maternal/Infant Characteristics With Acculturation

Tables 9a and 9b show the distribution of maternal/infant characteristics by level of acculturation.

Table 9a. Hispanic women, Oregon PRAMS, 2000 & 2001: Maternal and infant characteristics distributed by level of acculturation

Variable	Level of Acculturation			All women	p-value*
	Low	Intermediate	High		
Childbearing Intention					
Intended†	444 (64.6%)	54 (53.8%)	95 (42.1%)	593 (58.6%)	< 0.001
Mistimed	175 (25.6 %)	35 (35.1%)	108 (48.1%)	318 (31.5%)	
Unwanted‡	55 (8.1%)	10 (10.1%)	16 (7.2%)	81 (8.1%)	
Missing*	12 (1.7%)	1 (1.0%)	6 (2.7%)	19 (1.9%)	
Family Income§					
< $20,000	489 (71.3%)	51 (51.0%)	94 (41.8%)	634 (62.8%)	< 0.001
≥ $20,000	120 (17.6%)	38 (38.0%)	111 (49.5%)	269 (26.7%)	
Missing	77 (11.1%)	11 (11.0%)	20 (8.8%)	108 (10.6%)	
Maternal Age					
< 20	93 (13.4%)	26 (25.7%)	56 (24.4%)	175 (17.1%)	< 0.001
20-29	435 (63.4%)	59 (59.3%)	131 (58.5%)	625 (61.9%)	
≥ 30	158 (23.2%)	15 (15.0%)	38 (17.1%)	211 (21.1%)	
Smoking Status‖					
Yes	8 (1.2%)	1 (1.0%)	39 (17.4%)	48 (4.8%)	< 0.001
No	665 (96.9%)	97 (96.9%)	185 (82.2%)	947 (93.6%)	
Missing	13 (1.9%)	2 (2.0%)	1 (0.4%)	16 (1.6%)	
WIC Enrollment#					
Yes	579 (84.4%)	69 (69.2%)	117 (52.2%)	765 (75.8%)	< 0.001
No	75 (10.9%)	24 (24.0%)	93 (41.2%)	192 (18.9%)	
Missing	32 (4.7%)	7 (6.8%)	15 (6.7%)	54 (5.3%)	
Marital Status					
Married	426 (62.3%)	54 (54.3%)	112 (50.0%)	592 (58.8%)	0.002
Not married	260 (37.7%)	46 (45.7%)	113 (50.0%)	419 (41.2%)	

* Missing data is included in the table to show a complete picture of each variable; however, the missing data was not used in crosstabs procedures to calculate p-values for significance.

† Intended includes women who wanted to be pregnant sooner plus women who wanted to be pregnant then.

‡ Unwanted includes women who did not want to be pregnant then or at any time in the future.

§ Annual family income at the time of survey.

‖ Maternal smoking at the time of the survey.

Enrollment in the Women, Infants, and Children program during pregnancy.

Table 9b. Hispanic women, Oregon PRAMS, 2000 & 2001: Maternal and infant characteristics distributed by level of acculturation

Variable	Level of Acculturation			All women	p-value*
	Low	Intermediate	High		
Maternal Education					
0-8 years	306 (44.7%)	10 (10.1%)	6 (2.7%)	322 (32.0%)	< 0.001
9-11 years	204 (29.7%)	32 (31.9%)	50 (22.3%)	286 (28.3%)	
12+ years	161 (23.4%)	658 (58.0%)	167 (74.2%)	386 (38.1%)	
Missing	15 (2.2%)	0 (0.0%)	2 (0.8%)	17 (1.7%)	
Parity					
Primiparous	253 (36.0%)	45 (44.1%)	103 (44.8%)	401 (38.8%)	0.024
Multiparous	433 (64.0%)	55 (55.9%)	122 (55.2%)	610 (61.2%)	
Low Birth Weight**					
Yes	33 (4.8%)	6 (6.0%)	12 (5.3%)	51 (5.0%)	0.822
No	653 (95.2%)	94 (94.0%)	213 (94.7%)	960 (95%)	
Type of Delivery					
Vaginal	552 (80.4%)	74 (73.8%)	173 (77.0%)	799 (79.0%)	0.200
Cesarean	134 (19.6%)	26 (26.2%)	52 (23.0%)	212 (21.0%)	
Prenatal Care Initiation					0.021
Within First Trimester	364 (53.0%)	62 (62.0%)	148 (65.8%)	574 (56.8%)	
After First Trimester	271 (39.6%)	34 (34.0%)	73 (32.5%)	378 (37.4%)	
Missing	51 (7.4%)	4 (4.0%)	4 (1.7%)	59 (5.8%)	
Body Mass Index					
Underweight/Normal	233 (33.8%)	55 (54.8%)	121 (53.7%)	409 (40.3%)	< 0.001
Overweight	111 (16.2%)	20 (20.0%)	59 (26.3%)	190 (18.8%)	
Obese	51 (7.5%)	15 (15.2%)	41 (18.2%)	107 (10.6%)	
Missing	291 (42.5%)	10 (10.0%)	4 (1.8%)	305 (30.3%)	
Urban/Rural††					
Urban	564 (82.2%)	80 (80.0%)	168 (74.6%)	812 (80.3%)	0.038
Rural	122 (17.8%)	20 (20.0%)	57 (25.4%)	199 (19.7%)	

* Missing data is included in the table to show a complete picture of each variable; however, the missing data was not used in crosstabs procedures to calculate p-values for significance.
** Low birth weight defined as < 2500g at the time of birth.
†† Urban or rural county of residence in Oregon.

Eleven of the twelve variables for maternal and infant characteristics were significantly related to acculturation in crosstabs analysis, including childbearing intention, family income, maternal age, smoking status, WIC enrollment, marital status, maternal education, parity, prenatal care initiation, body mass index, and county of residence. However, low birthweight and type of delivery were not significantly related to acculturation. It is interesting to note the major differences between levels of acculturation for some variables. For instance, more than 20% more low acculturation

women had an intended pregnancy than high acculturation women. Perhaps this is a result of the loss of cultural traditions and beliefs at work, where women who are less acculturated are more likely to retain the traditional cultural beliefs that childbearing and childrearing are one of the most important roles that a woman can take on. Smoking behaviors also drastically increased as acculturation increased; other research has shown acculturation to be linked with smoking.[193] Enrollment in WIC decreases by more than 30% as acculturation increases. Years of education received, as noted before, is much lower for low-acculturation women than for intermediate or high-acculturation women. This is likely due to foreign-born women having received much of her schooling in Mexico, where it is common for women to receive fewer years of education. Finally, low-acculturation women had a disproportionately large percentage of the missing data for body mass. Upon further analysis, I discovered that 286 low-acculturation women did not provide information on their height, while only 7 intermediate-acculturation women and 2 high-acculturation women did not respond to this question. Additionally, 49 low-acculturation women did not give their weight, compared to 5 intermediate-acculturation and 3-high acculturation women. In Mexico, the metric system of measurement is commonly used; however, the PRAMS survey asks for a woman to report her weight in pounds and height in feet and inches. Because the majority of the foreign-born/low-acculturation women in this sample were born in Mexico, and thus accustomed to using the metric system, many of them may not have been able to provide their weight in pounds or height in feet and inches; or, perhaps weight and height are not routinely measured in ways that low-acculturation women access health care. Thus, analysis of the body mass index variable is differentially biased, in that the low-

acculturation group had the majority of the missing data. In subsequent years, PRAMS has asked for a woman's weight in pounds or kilograms and height in inches or centimeters.

Breastfeeding Response Frequencies

Of the 1005 Hispanic women who provided valid responses on breastfeeding questions (e.g. excluding those with missing data), 724 (71.6%) breastfed their baby for at least ten weeks or longer. Table 10 shows the distribution of PRAMS respondents who breastfed for varying lengths of time, based on PRAMS questions and calculated variables from the responses. Women who were still breastfeeding at the time of the survey were included in the group of women who breastfed for 10 or more weeks because nearly all women (99.7%) were surveyed at 10 or more weeks postpartum.[193]

Table 10. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of responses to PRAMS questions regarding breastfeeding practices

Response	n*	Weighted Percent**
Question 49: Did you ever breastfeed or pump breastmilk to feed your new baby after delivery?		
Yes	939	92.9%
No	66	6.5%
Missing	6	0.6%
Total	1011	100%
Question 50: Are you still breastfeeding or feeding pumped milk to your baby?		
Yes	649	64.2%
No	297	29.3%
Missing	65	6.4%
Total	1011	100%
Calculated variable: Did you breastfeed or pump milk to feed your new baby for 10 weeks or more?		
Yes	724	71.6%
No	287	28.4%
Total	1011	100%

*n = number of unweighted respondents;
**weighted percent

Table 11 shows the prevalence of breastfeeding distributed by maternal nativity and survey language. Women who were foreign-born and completed the survey in Spanish were had the highest prevalence of breastfeeding, while those who were U.S.-born and completed the survey in English had the lowest.

Table 11. Hispanic women, Oregon PRAMS, 2000 & 2001: Prevalence of breastfeeding at ten weeks by maternal nativity and survey language

	Spanish	English	Total
Foreign-born	533 (77.7%)	55 (62.7%)	588 (76.0%)
U.S.-born	8 (66.6%)	128 (56.9%)	136 (57.4%)
Total	541 (77.5%)	183 (58.5%)	724 (100%)

Univariable Logistic Regression Analysis

Tables 12a and 12b show the unweighted number of women who were breastfeeding at ten weeks and had each maternal characteristic of interest, the weighted percentage of women in each category who breastfed at ten weeks, the crude odds ratio (OR) and 95% confidence interval (CI) for the association between each characteristic and breastfeeding at ten weeks, and the p-value for each association. Missing data is included in the table to show a complete picture of each variable; however, the missing data were not used in crosstabs procedures to calculate p-values for significance, except in the case of body mass index because there was such a large number of missing responses.

Table 12a. Hispanic women, Oregon PRAMS, 2000 & 2001: Univariable results of any breastfeeding at 10 weeks by maternal characteristics

Characteristic	n*	Any Breastfeeding at 10 Weeks (#, weighted % responding yes)	Odds Ratios (95% CI)	p-value
Total	1011	724 (71.6%)	N/A	N/A
Maternal Nativity				
Foreign-born	774	588 (76.0%)	Referent	
U.S.-born	237	136 (57.4%)	0.42 (0.32 – 0.57)	< 0.001
Survey Language				
Spanish	698	541 (77.5%)	Referent	
English	313	183 (58.5%)	0.41 (0.31 – 0.54)	< 0.001
Acculturation				
Low	686	533 (77.7%)	Referent	
Intermediate	100	63 (63.2%)	0.49 (0.32 – 0.75)	
High	225	128 (56.9%)	0.38 (0.28 – 0.51)	< 0.001
Childbearing Intention				
Intended†	593	440 (74.2%)	Referent	
Mistimed	318	213 (67.0%)	0.70 (0.53 – 0.94)	
Unwanted‡	81	58 (71.6%)	0.87 (0.53 – 1.43)	
Missing	19	13 (68.3%)	0.75 (0.29 – 1.92)	0.055
Family income§				
≥ $20,000	269	196 (73.0%)	1.03 (0.76 – 1.40)	
< $20,000	634	459 (72.4%)	Referent	
Missing	108	69 (64.0%)	0.68 (0.45 – 1.02)	0.839
Maternal Age				
< 20 years	175	100 (57.3%)	0.46 (0.33 – 0.64)	
20-29 years	625	467 (74.7%)	Referent	
> 30 years	211	157 (74.4%)	0.99 (0.70 – 1.39)	< 0.001
Maternal Smoking‖				
Yes	48	21 (43.7%)	0.29 (0.16 – 0.50)	
No	947	691 (73.0%)	Referent	
Missing	16	12 (74.8%)	1.10 (0.37 – 3.28)	< 0.001
WIC Enrollment#				
Yes	765	542 (70.9%)	Referent	
No	192	142 (73.9%)	1.16 (0.83 – 1.64)	
Missing	54	40 (74.2%)	1.18 (0.65 – 2.16)	0.386

* Unweighted number of respondents.
† Intended includes women who wanted to be pregnant sooner plus women who wanted to be pregnant then.
‡ Unwanted includes women who did not want to be pregnant then or at any time in the future.
§ Annual family income at the time of survey.
‖ Maternal smoking at the time of the survey.
Enrollment in the Women, Infants, and Children program during pregnancy.

Table 12b. Hispanic women, Oregon PRAMS, 2000 & 2001: Univariable results of any breastfeeding at 10 weeks by maternal and infant characteristics

Characteristic	n*	Any Breastfeeding at 10 Weeks (#, weighted % responding yes)	Odds Ratios (95% CI)	p-value
Total	1011	724 (71.6%)	N/A	N/A
Maternal marital status				
Married	592	452 (76.3%)	Referent	
Not married	419	272 (65.0%)	0.58 (0.44 – 0.75)	< 0.001
Maternal Education				
0-8 years	322	248 (77.0%)	1.53 (1.11 – 2.11)	
9-11 years	286	199 (69.6%)	1.04 (0.76 – 1.43)	
≥ 12 years	486	265 (68.7%)	Referent	
Missing	17	12 (71.0%)	1.12 (0.40 – 3.10)	0.025
Parity				
Multiparous	610	438 (71.8%)	Referent	
Primiparous	401	286 (71.4%)	0.98 (0.75 – 1.28)	0.876
Low birth weight**				
No	960	690 (71.9%)	Referent	
Yes	51	34 (66.4%)	0.77 (0.44 – 1.37)	0.379
Type of delivery				
Vaginal	799	577 (72.3%)	Referent	
Cesarean	212	147 (69.3%)	0.87 (0.63 – 1.19)	0.382
Prenatal Care Initiation				
Within 1st trimester	574	416 (72.5%)	Referent	
After 1st trimester	378	263 (69.6%)	0.87 (0.66 – 1.14)	
Missing	59	45 (76.4%)	1.23 (0.67 – 2.24)	0.304
Body Mass Index				
Underweight/Normal (bmi<25)	409	286 (69.9%)	Referent	
Overweight (25≤bmi<30)	190	130 (68.6%)	0.94 (0.66 – 1.34)	
Obese (bmi≥30)	107	68 (63.7%)	0.76 (0.49 – 1.16)	
Missing	305	240 (78.7%)	1.59 (1.14 – 2.22)	0.004
Urban/Rural††				
Urban	812	596 (73.4%)	Referent	
Rural	199	128 (64.5%)	0.66 (0.48 – 0.90)	0.010

* Unweighted number of respondents.
** Low birth weight defined as < 2500g.
†† Urban or rural county of residence in Oregon.

Breastfeeding at ten weeks was significantly associated with maternal nativity, survey language, acculturation, maternal age, smoking status, marital status, maternal education, body mass index, and urban/rural county of residence (all $p < 0.05$). Of these variables, acculturation had the strongest association with breastfeeding at ten weeks (Wald Chi-square = 42.32, $p < 0.001$). Compared to low-acculturation Hispanic women, high-acculturation Hispanic women were less likely to breastfeed at ten weeks (OR 0.38,

95% CI 0.28 – 0.51). Women of intermediate acculturation were also significantly less likely to breastfeed at ten weeks (OR 0.49, 95% CI 0.32 – 0.75). The variables for childbearing intention, family income, WIC enrollment, parity, low birthweight, type of delivery, and first trimester prenatal care initiation were not independently associated with breastfeeding at ten weeks in this analysis; however, because they have been found to be related to breastfeeding practices elsewhere, they were included as potential predictors in the model building process.

Multivariable Logistic Regression Model Building

Tables 18 and 19 (Appendix B) show the crude OR and adjusted ORs for each maternal characteristic with breastfeeding at ten weeks when entered into a full model, as well as at each step in the backward elimination model-building process. The deviation of the adjusted ORs from the crude ORs for acculturation ranged from 4% in multivariable model 7, to 20% in multivariable model 2; additionally, the CIs for acculturation remain relatively stable, becoming neither significantly narrower nor wider at each step. The adjusted OR of the final model chosen (multivariable model 10) deviates from the crude OR by only 8%.

Throughout the backward elimination model building process, regardless of which variables were removed, the odds ratio and confidence intervals for acculturation remained relatively stable and similar to the crude odds ratio. Acculturation was significantly associated with any breastfeeding at ten weeks, regardless of which variables were in the model.

Maternal education was removed first because it had the largest non-significant p-value (Wald F = 0.30, p = 0.862). Next I removed childbearing intention (Wald F = 0.51,

p = 0.777), followed by type of delivery (Wald F = 0.01, p = 0.912), and then urban/rural county of residence (Wald F = 0.19, p = 0.663). Additional variables that were removed included (in order): family income (Wald F = 0.37, p = 0.543), initiation of prenatal care (Wald F = 0.25, p = 0.62), low birthweight (Wald F = 1.80, p = 0.18), marital status (Wald F = 2.59, p = 0.108), and finally parity (Wald F = 3.01, p = 0.083). After removing all nine of these variables, the Hosmer and Lemeshow goodness-of-fit statistic showed that the model fit the data relatively well (HL Wald = 0.97, p = 0.461) (refer to MVM 10 in table 12). However, multivariable model 9 showed a better fit for the data (HL Wald = 0.49, p = 0.881); this model included the variable for parity. Even though parity was not statistically significant at the 0.05 level, it was at the 0.10 level, plus it appeared to be contributing important information to the model due to the better fit of the model that included parity than the model that did not. Thus, I chose MVM 9 as the preliminary main effects model. This model included acculturation, maternal age, smoking status, WIC enrollment, and parity. Of these variables three were independently associated with any breastfeeding at ten weeks in univariable logistic regression. However, neither WIC enrollment nor parity were independently associated with any breastfeeding at ten weeks. Upon commencing the multivariable analysis, both of these variables became significantly associated with breastfeeding, adjusting for all other factors. WIC enrollment remained significant throughout the entire model-building process, but parity did not. Table 13 provides a summary of the model building process. See Appendix B to examine the results of the entire model building process.

Table 13. Hispanic women, Oregon PRAMS, 2000 & 2001: Summary of crude associations with any breastfeeding at ten weeks, full multivariable model, and two final multivariable models

Variable	Crude OR; 95% CI	MVM1* Adjusted OR (95% CI)	MVM9* Adjusted OR (95% CI)	MVM10* Adjusted OR (95% CI)
-2 Log Likelihood	--	857.73	1053.33	1056.13
HL Goodness of Fit	--			
Wald (p-value)		1.03 (p=0.415)	0.49 (p=0.881)	0.97 (p=0.461)
Acculturation				
Low	Referent	Referent	Referent	Referent
Intermediate	**0.49 (0.32 – 0.75)**	**0.40 (0.24 – 0.68)**	**0.45 (0.29 – 0.71)**	**0.45 (0.28 – 0.71)**
High	**0.38 (0.28 – 0.51)**	**0.30 (0.19 – 0.41)**	**0.34 (0.23 – 0.50)**	**0.34 (0.23 – 0.50)**
Maternal Age				
< 20 years	**0.46 (0.33 – 0.64)**	**0.48 (0.31 – 0.76)**	**0.41 (0.28 – 0.61)**	**0.47 (0.33 – 0.68)**
20-29 years	Referent	Referent	Referent	Referent
≥ 30 years	0.99 (0.70 – 1.39)	0.85 (0.56 – 1.29)	0.85 (0.58 – 1.23)	0.80 (0.55 – 1.15)
Maternal Smoking				
Yes	**0.29 (0.16 – 0.50)**	0.59 (0.30 – 1.15)	**0.48 (0.26 – 0.90)**	**0.47 (0.25 – 0.88)**
No	Referent	Referent	Referent	Referent
WIC Enrollment				
Yes	Referent	Referent	Referent	Referent
No	1.16 (0.83 – 1.64)	**1.83 (1.11 – 3.00)**	**1.78 (1.18 – 2.69)**	**1.84 (1.21 – 2.78)**
Parity				
Multiparous	Referent	Referent	Referent	
Primiparous	0.98 (0.75 – 1.28)	**1.62 (1.12 – 2.34)**	1.34 (0.96 – 1.86)	
Marital Status				
Married	Referent	Referent		
Not married	**0.58 (0.44 – 0.75)**	0.76 (0.54 – 1.08)		
Low Birth Weight				
No	Referent	Referent		
Yes	0.77 (0.44 – 1.37)	0.51 (0.25 – 1.04)		
First Trimester Prenatal Care				
Within 1st Trimester	Referent	Referent		
After 1st Trimester	0.87 (0.66 – 1.14)	0.89 (0.64 – 1.24)		
Family Income				
≥ $20,000	1.03 (0.76 – 1.40)	1.15 (0.78 – 1.70)		
< $20,000	Referent	Referent		
Urban/Rural				
Urban	Referent	Referent		
Rural	0.87 (0.66 – 1.14)	0.91 (0.62 – 1.34)		
Type of Delivery				
Vaginal	Referent	Referent		
Cesarean	0.87 (0.63 – 1.19)	0.92 (0.62 – 1.37)		
Childbearing Intention	Referent	Referent		
Intended	**0.70 (0.53 – 0.94)**	0.96 (0.67 – 1.36)		
Mistimed	0.87 (0.53 – 1.43)	1.22 (0.64 – 2.32)		
Unwanted				
Maternal Education				
0-8 years	**1.53 (1.11 – 2.11)**	1.07 (0.67 – 1.71)		
9-11 years	1.04 (0.76 – 1.43)	1.12 (0.74 – 1.69)		
≥ 12 years	Referent	Referent		

* MVM = Multivariable model

Assessment of interactions between acculturation and maternal age, smoking, WIC enrollment, and parity revealed two interesting interactions; one with WIC enrollment ($p = 0.013$) and one with parity ($p = 0.060$). When concurrently including both of these interaction terms in a model, the interactions remained significant for WIC enrollment ($p = 0.017$) and showed a trend towards significance for parity ($p = 0.078$). Among women with low and intermediate levels of acculturation, WIC enrollment had no significant effect on breastfeeding at ten weeks. However, among women with a high level of acculturation, those who were not enrolled in WIC were significantly more likely to breastfeed at ten weeks (OR 3.34: 95% CI 1.86 – 6.00). Similarly, parity had no effect on women with low or intermediate levels of acculturation; yet among women with high levels of acculturation, primiparous women were more likely to breastfeed than multiparous women (OR 2.25; 95% CI 1.24 – 4.11).

Table 14. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of breastfeeding at ten weeks and WIC enrollment, stratified by acculturation*

	Breastfeeding at 10 weeks	Not breastfeeding at 10 weeks	Total	Stratum-Specific ORs
Low acculturation				
Enrolled in WIC	450 (77.7%)	129 (22.3%)	579(100%)	Referent
Not enrolled in WIC	59 (78.8%)	16 (21.2%)	75 (100%)	1.10 (0.62 – 1.98)
Intermediate acculturation				
Enrolled in WIC	43 (62.6%)	26 (37.4%)	69 (100%)	Referent
Not enrolled in WIC	15 (62.5%)	9 (37.6%)	24 (100%)	1.06 (0.40 – 2.82)
High acculturation				
Enrolled in WIC	49 (42.0%)	68 (58.0%)	117 (100%)	Referent
Not enrolled in WIC	68 (72.9%)	25 (27.1%)	93 (100%)	3.34 (1.86 – 6.00)
Total	684 (71.5%)	273 (28.5%)	957 (100%)	

* Values presented are unweighted numbers (weighted percents).

Table 15. Hispanic women, Oregon PRAMS, 2000 & 2001: Distribution of breastfeeding at ten weeks and parity, stratified by acculturation*

	Breastfeeding at 10 weeks	Not breastfeeding at 10 weeks	Total	Stratum-Specific ORs
Low acculturation				
Primiparous	196 (77.5%)	57 (22.5%)	253 (100%)	1.17 (0.78 – 1.74)
Multiparous	337 (77.8%)	96 (22.2%)	433 (100%)	Referent
Intermediate acculturation				
Primiparous	26 (57.9%)	19 (42.1%)	45 (100%)	0.81 (0.34 – 1.91)
Multiparous	37 (67.3%)	18 (32.7%)	55 (100%)	Referent
High acculturation				
Primiparous	64 (62.3%)	39 (37.7%)	103 (100%)	2.25 (1.24 – 4.11)
Multiparous	64 (52.4%)	58 (47.6%)	122 (100%)	Referent
Total	724 (71.6%)	287 (28.4%)	1011 (100%)	

* Values presented are unweighted numbers (weighted percents).

The model used to describe the association between acculturation and breastfeeding in this study includes the categorical variables of acculturation, maternal age, maternal smoking, WIC enrollment, and parity. However, the effect of acculturation on any breastfeeding at ten weeks appears to be modified by WIC enrollment and parity, as demonstrated through the interaction terms and stratum-specific odds ratios.

DISCUSSION

In this population-based sample of Hispanic women in Oregon, increased acculturation was associated with decreased breastfeeding at ten weeks; however, parity and WIC enrollment modified the association between acculturation and any breastfeeding at ten weeks.

Relationship Between Acculturation and Breastfeeding: Comparison with the Literature

The main results of this study are consistent with several other investigations that have assessed the relationship between acculturation and breastfeeding among Hispanic women. The investigators of these studies showed that:

a). acculturation was significantly associated with decreased initiation of breastfeeding among a sample of Hispanic women in a U.S.-Mexico border city (OR 0.66; 95% CI 0.52 – 0.83).[130]

b.) acculturation was also significantly associated with decreased intention to breastfeed among primiparous Hispanic women, and with lower history of breastfeeding among multiparous women.[131]

c). acculturation among Hispanic women was associated with a decrease in ever-breastfeeding (OR 0.23; 95% CI 0.14 – 0.40), even after adjusting for education, age, and income.[132]

d). acculturation was related to a woman's decision to breastfeed, and initiation of breastfeeding ($r = -0.0836$); this was interpreted as only a trend because the level of correlation was low.[134]

While the results of this study using Oregon PRAMS data are consistent with the studies above, they are contradictory to the results of other investigations. Investigators of these studies found that:

a). there was no association between acculturation and breastfeeding initiation among a sample of Puerto Rican women in Connecticut.[152]

b.) in a similar sample of Puerto Rican women in Connecticut, mother's length of residence in the U.S was associated with a decline in breastfeeding initiation (ever vs. never-breastfed) (OR 0.92; 95% CI 0.87 – 0.98), but mother's place of birth was not.[184]

c). acculturation variables, including being born in Mexico, speaking mainly Spanish in the home, and being interviewed in Spanish, were associated with the decision to breastfeed among Mexican-American adolescent mothers ($p < 0.001$) in univariable analysis, but not in multivariable analysis.[185]

This study found that while 71.6% of Hispanic women in Oregon breastfeed at ten weeks, the percent of women who did so declined significantly as acculturation increased. More specifically, after adjusting for other factors, highly acculturated women were 0.34 times as likely to breastfeed than the least acculturated women (95% CI 0.23 – 0.50). Similarly, intermediately acculturated women were 0.45 times as likely to breastfeed (95% CI 0.29 – 0.71).

The Oregon PRAMS data support the findings of the four studies that showed an association between breastfeeding and acculturation among Hispanic women. One common theme between this investigation and three others[130,131,134] that also found an association between acculturation and breastfeeding is the use of a primarily Mexico-

origin or Mexican-American population; the fourth study finding a similar association shared a different common component with this study, in that both utilized a population-based sample of Hispanic women.[132] The only studies that showed findings contradictory to an association between acculturation and breastfeeding were those that sampled Puerto Rican women.[152,184] Although the literature taken as a whole shows mixed results between acculturation and breastfeeding among Hispanic women, there appears to be some consistency regarding the different sub-populations of Hispanic women that are being addressed; namely that the association between acculturation and breastfeeding exists among Mexico-born women, but perhaps not among Puerto Rico-born women.

Why do Highly Acculturated Women Breastfeed Less?

There are several speculated reasons why highly acculturated women breastfeed less than their less acculturated counterparts. One reason is simply defined by what it means to become acculturated or to assimilate into a dominant culture. The majority of Hispanic women in Oregon are of Mexican descent, and the prevalence of ever-breastfeeding in Mexico has been estimated at 92.3% in a national study in 1998-1999.[197] This same survey estimated the median duration of breastfeeding at 8 months, and showed that approximately 70% of mothers were breastfeeding at two and three months postpartum.[197] However, in the United States, breastfeeding estimates for all women range from 65.1% for ever-breastfeeding, to a median duration of breastfeeding between two and three months, according to the 2001 National Immunization Survey.[198] In the western region of the United States, particularly in Oregon, breastfeeding rates have been estimated at higher than the national average. In 2001, approximately 92% of new

Oregon mothers initiated breastfeeding.[199] Additionally, the overall prevalence of breastfeeding at ten weeks in Oregon was 66.5% in 2000 and 65.1% in 2001.[200,201] Unfortunately, no data could be found for the median duration of breastfeeding in Oregon. These comparisons between breastfeeding rates in Mexico, the U.S., and Oregon provide evidence that breastfeeding is less common in the United States than in Mexico, and may be less common in Oregon as well. Thus, immigrant women may be adopting the behavioral patterns of breastfeeding that they observe in the U.S., therefore resulting in decreased initiation and/or duration of breastfeeding.

This idea is supported by the findings of focus groups conducted by Wood, Sasonoff, and Beal in 1998.[145] Many women in these focus groups reported that breastfeeding was more supported in their native country than in the U.S., and that they were more accustomed to mothers breastfeeding in public places. In addition, breastfeeding was seen as more of an expectation in a woman's native country, and that formula-feeding was more expensive there than in the U.S. One mother reported that she felt a lack of support for breastfeeding in the U.S., and even thought that breastfeeding might be illegal in public places in the U.S. Because immigrant women perceive that breastfeeding is less accepted and supported in the U.S. than in her native country, they are likely to adopt the dominant culture's practice of breastfeeding less.

However, not all Hispanic subpopulations are affected by acculturation in the same way. As described in the previous section, Anderson et al. noted that acculturation had no effect on the breastfeeding practices of Puerto Rican women, in contrast to Mexican-origin women.[152] This could be due to possible differences in breastfeeding culture and practices between the country or territory of origin. For example, while the

prevalence of breastfeeding has remained relatively high in most Latin American countries, ranging from 74 to 97% in the early 1980s,[148] during this same time frame, the prevalence of breastfeeding in Puerto Rico was at 38%,[147] already lower than that of the U.S. prevalence of 54%.[148] Because Puerto Rico-origin women were already less likely to breastfeed than other U.S. women, acculturation to U.S. breastfeeding practices would not be likely to cause Puerto Rico-origin women to breastfeed even less.

Another way in which Puerto Rico-born women differ from Mexico-born women is that they do not experience barriers to migration to the U.S as Mexican immigrants do. Because immigration comes before acculturation, it is posited that low-acculturation groups have better health outcomes because of the healthy migrant effect; that is, that the healthiest members of a population self-select for migration,[157] due to the difficult nature of the migration process, particularly in the case of illegal immigration.[202] Because Puerto Ricans do not experience barriers to migration, perhaps there is no self-selection of healthier immigrants. Data from a 1984 study showed that, internationally, immigrants who experience barriers to migration tend to experience lower mortality rates than their non-migrant counterparts from their respective country of origin, while immigrants who do not experience such barriers show no difference in health status.[203] However, contrasting data from a study among Puerto-Rico born mothers did show lower rates of infant mortality among recent immigrants to the U.S. than among non-migrant Puerto Ricans, thus exhibiting a healthy migrant effect.[204] This contradictory literature makes it difficult to reach a conclusion on whether having no barriers to immigration for Puerto Ricans results in a lack of self-selection of healthier immigrants. However, the difference in immigration barriers does provide an additional explanation of how Puerto

Ricans differ from Mexicans. The differing immigration experiences of Puerto Ricans and Mexicans may affect the acculturation process they experience (if they experience it), which in turn could affect their breastfeeding practices.

In addition to adopting breastfeeding practices that are common in the U.S, another speculated reason why highly acculturated women breastfeed less is through the loss of important social networks, support, and traditional cultural beliefs. One important concept that has been noted at least in traditional Mexican culture is that of *la familia* (family), incorporating strong relational bonds between members of often large families.[142,143] These strong bonds between family members provide support for upholding traditional Mexican beliefs as well. Childbearing and childrearing are very highly regarded in Mexican culture, and often are the foremost roles for women.[143,145] Female family members, particularly the maternal grandmother, serve as role models for new mothers. Thus when immigrant women leave their family support systems back home, their social network are disrupted, and they may not have the support they need to uphold the traditional Mexican values regarding infant care and breastfeeding.

Not only are female family role models important, but so too are supportive male partners.[132,185,205,206] Women who perceive their partner or the infant's father as supportive of breastfeeding are more likely to breastfeed. However, immigrant men, just as immigrant women, have the potential for losing their closely-connected family bonds when they move to the U.S. When these men are living without the influence of other female and male role models, they may not recognize the importance and value of breastfeeding as readily as they would in their native country.

Many new immigrants create new social networks in the U.S. in order to fulfill the former role of *la familia*.[143] These networks are often established among immigrant women, in order to find *compadres* (friends), to share common circumstances, receive support, and help each other learn about living in the United States.[207] So although immigrants may lose their protective family bonds, the development of other social networks is important to the maintenance of traditional cultural beliefs and practices.[143,208,209] However, as women grow accustomed to living in the U.S., they may no longer have the need for these particular social networks or may have difficulty creating new networks. Without the support of other *compadres,* some women may begin to lose their traditional values regarding childbearing and childrearing, which could result in a decline in breastfeeding.

Work and employment may also play a role in the breastfeeding practices of Hispanic women. Although Hispanic women overall have not been likely to cite their job schedule as a reason not to breastfeed,[132] more highly acculturated women are probably more likely to have a job, which in turn could affect whether or not a woman breastfeeds. Unfortunately, due to the secondary nature of the PRAMS data, this analysis was not able to control for confounding by a woman's employment status because that information is not obtained by the Oregon PRAMS. However, it is unlikely that the effect of acculturation on breastfeeding is solely due to the different work habits of more and less acculturated Hispanic women. PRAMS asks one question related to barriers to breastfeeding: "Did any of these things prevent you from breast-feeding or stop you after you had started?" One possible response that mothers can mark is "I was planning to go to work or school." Unfortunately, this question only addresses barriers experienced by

mothers who stopped breastfeeding, and does not address the employment status or intended status of mothers who were still breastfeeding at the time. Therefore, creating additional questions on future PRAMS questionnaires regarding whether a mother is working, how many hours per week she is working, and when she went back to work, would provide important information on some of the barriers to breastfeeding that Hispanic women might experience.

Infant formula marketing may also play a role in the perceptions that Hispanic women have of breastfeeding in the United States. Although the U.S. ratified the International Code of Marketing of Breastmilk Substitutes[210] in 1994, advertising of infant formula remains a common practice and is not regulated by laws.[211] Such marketing of infant formula ranges from direct advertising to consumers to distribution of free infant formula gift packs from hospitals.[211] If foreign-born Hispanic women are not accustomed to seeing such infant formula marketing, then experiencing it here in the U.S. might give the impression that formula feeding is the norm. As women immigrate and become acculturated, they may become more susceptible to infant formula marketing, which could play a role in their lack of breastfeeding.

The interaction between WIC and acculturation in this analysis raises particular interest, and could provide more insight into the relationship between acculturation and breastfeeding. While the results of this analysis showed that WIC enrollment did not have a significant effect on women with low or intermediate acculturation, those with high acculturation who were enrolled in WIC were significantly less likely to breastfeed than those who were not enrolled in WIC. The interaction between WIC enrollment and acculturation raises the possibility that WIC causes decreased breastfeeding among

women who are highly acculturated. Because this is a cross-sectional study, causality cannot be determined; however, the possibility of causality remains. One possible answer is that WIC provision of free infant formula encourages highly acculturated Hispanic women to stop breastfeeding sooner. The other possible answer is that highly acculturated Hispanic women are more likely to enroll in WIC if they have decided not to breastfeed or to stop breastfeeding and want free infant formula. One question this raises is: why are the breastfeeding practices of highly-acculturated women affected by enrollment in WIC, but not low and intermediately acculturated Hispanic women? What is different about the low- and intermediate-acculturation groups versus the high-acculturation group of Hispanic women? Perhaps the highly-acculturated women have lost their traditional and cultural supports, and are thus more likely to utilize the free infant formula from WIC; or perhaps a language barrier prevents the low/intermediate acculturation groups from fully understanding or being able to utilize the portion of WIC that provides free infant formula.

While it is unknown exactly what causes a highly acculturated woman to choose not to breastfeed or to stop breastfeeding, such a woman who is enrolled in WIC has easier access to free infant formula, which may facilitate putting her decision not to breastfeed into action.

This aspect of being enrolled in WIC is not unique to highly acculturated Hispanic women. Among all non-Hispanic Oregon women in this 2000-2001 PRAMS sample whose baby was alive and living with her at the time of survey, those who were not enrolled in WIC were significantly more likely to breastfeed than those who were enrolled in WIC (OR 2.14; 95% CI 1.61 – 2.86). Thus, women of low or intermediate

acculturation appear to have some protective factor(s) that, even if enrolled in WIC, allow or help them to start and continue breastfeeding, even with free infant formula being readily available. Further research into the interaction between acculturation and WIC enrollment is needed to address this speculation.

The interaction between parity and acculturation sheds light on another difference between highly acculturated women and those with low or intermediate levels of acculturation. Analysis of the entire PRAMS dataset shows that among all non-Hispanic women, parity had no effect on breastfeeding at ten weeks (OR 0.91; 95% CI 0.69 – 1.19). Yet, among highly acculturated Hispanic women, those who were primiparous were 2.25 (1.24 – 4.11) times more likely to breastfeed at ten weeks than multiparous women. Multiparous women were significantly less likely to be in the high acculturation group (55.2%) compared to the low acculturation group (64.0%) ($p = 0.024$). However, no association was seen between the interaction of acculturation and parity and *initiation* of breastfeeding ($p = 0.14$). So why does parity differentially affect the breastfeeding duration of highly acculturated women, but not low or intermediately acculturated women? Perhaps highly acculturated Hispanic mothers have more demands to tend to, such as work; when the mother has more than one child, it can be difficult to juggle the demands of multiple children, work responsibilities, and other home responsibilities. As these demands continue to grow, a highly-acculturated woman may already be in the process of losing any traditional or cultural beliefs and values related to breastfeeding. Thus, highly-acculturated, multiparous women may choose to discontinue or refrain from initiating breastfeeding to ease some of the pressures or demands in her life, whereas for less-acculturated women, that might not be an option to consider. The investigation by

Byrd et al. also found that while significant associations were found between acculturation and breastfeeding in both primiparous and multiparous women, the measures of acculturation and breastfeeding outcomes differed by parity. These differences have been highlighted in the introduction section of this paper. However, to this author's knowledge, no other studies showed such an interaction between parity and acculturation. Further research would need to be done to assess the nature of this unexpected finding. It would be especially beneficial to look at this interaction in the context of a mother's work history, which unfortunately was not available in the PRAMS dataset. It may be that the interaction with parity is showing a proxy for working mothers being less likely to continue breastfeeding at ten weeks.

It would have been difficult to assess the impact of acculturation on earlier U.S. immigrants. Because infant formula wasn't introduced until the early-to-mid 20th century, women before this time did not have the choice to formula feed. In fact, before the 1900s, most babies who could not be breastfed did not survive. Therefore, during the periods when large groups of other immigrants such as the Irish, Italians, and Jews were migrating to the U.S., the effects of acculturation did not impact the decision to breastfeed, mainly because there was not a decision to be made. However, many other groups of immigrants have been coming to the U.S. since the introduction of infant formula. It is unclear, however, what the effect of acculturation has been on the breastfeeding practices of these populations. It is likely that groups who initially have lower rates of breastfeeding than the U.S. would start breastfeeding more as they acculturate, and groups that have higher rates of breastfeeding in their native countries, would adapt to the comparatively lower rates here. Further research with other

populations of immigrants are needed to assess how acculturation affects the breastfeeding practices of other groups of women.

Because acculturation is such a complex issue, and is influenced by many factors, it is difficult to portray the exact or even the most likely reason why highly acculturated Hispanic women breastfeed less. However, the ideas noted suggest possible avenues for further research in order to address the phenomenon at its source.

Limitations & Strengths

This analysis of the Oregon Pregnancy Risk Assessment Monitoring System has several limitations. First of all, misclassification bias may have been introduced into the study design and analysis. The survey utilizes a mixed mode of soliciting responses, the first mode being mail-in surveys, the second mode being telephone interviews. Women who fill out the paper survey may feel a greater sense of confidentiality, therefore may be more willing to provide accurate and truthful answers than their counterparts who answered the telephone interviews.

However, *any* woman participating in the survey may be subject to social-acceptability bias. That is, a woman may be inclined to attempt to please the interviewers or study personnel by providing socially acceptable responses to the questions asked. This type of bias would result in misclassification of a woman's responses. Breastfeeding may be a behavior for which women desire to provide a more socially acceptable response (e.g., that she is still breastfeeding). In this study, if misreporting had occurred equally among women of all levels of acculturation, the results would be subjected to non-differential bias. That is, the results would be drawn toward no association between breastfeeding and acculturation. If women among only one or two

of the levels of acculturation are more apt to provide socially acceptable answers, differential bias may result. In this study, low-acculturation women were probably less likely to give the socially acceptable answer since they may be less aware of what is socially acceptable. Conversely, highly-acculturated women may have been more likely to provide the socially acceptable response that they were breastfeeding even if they were not. These circumstances, however, would only serve to diminish the association that was seen between acculturation and breastfeeding. If this differential bias were present and able to be corrected, we would see a larger number of low acculturation women who did breastfeed, and a larger number of high acculturation women who did not breastfeed, which would increase the association between acculturation and breastfeeding even further. Although differential and non-differential bias cannot be ruled out, the findings are similar to those of other studies in the literature, indicating that any such bias would be small or universal to all other similar studies, which is unlikely due to the wide range of acculturation and breastfeeding measures that were used.

Another possible bias for these results could be due to missing data. In particular, 62 Hispanic women did not have information for the language in which the survey was completed. All 62 of these women completed the survey by telephone. There were two companies who conducted the telephone interviews; the first one failed to record the language in which the survey was completed. It is impossible to determine the level of acculturation of these individuals, since survey language was used to assess acculturation. However, a sensitivity analysis was done to determine what would happen to the results if all 62 of these women had responded in English, compared to if all 62 had responded in Spanish. When the missing data for survey language was coded as having completed the

survey in English, and the logistic regression model with acculturation, maternal age, smoking status, WIC enrollment, parity, and interactions between acculturation with WIC and parity, results remained relatively the similar. The association between acculturation and any breastfeeding at ten weeks changed slightly, but still remained a very strong association. Table 15 shows the odds ratios for the association between breastfeeding at ten weeks and acculturation, and compares results between three models; one that excludes the 62 women with missing survey language, one that assumes each of these women completed the survey in English, and one that assumes each of the women completed the survey in Spanish.

Table 16. Hispanic women, Oregon PRAMS, 2000 & 2001: Comparison of 3 models: missing survey language data excluded, missings coded as English, and missings coded as Spanish*

	62 missings excluded (actual results)	62 missings coded as English	62 missings coded as Spanish
Low Acculturation	Referent	Referent	Referent
Intermediate Acculturation	0.45 (0.29 – 0.71)	0.50 (0.34 – 0.74)	0.50 (0.32 – 0.76)
High Acculturation	0.34 (0.23 – 0.50)	0.36 (0.25 – 0.53)	0.36 (0.25 – 0.52)

* Results are shown as odds ratios (95% confidence intervals).

When these two scenarios were done in a logistic regression model with the interaction terms between acculturation with WIC enrollment and parity, similar results were also obtained. The main difference was that the interaction between acculturation and parity became statistically significant when the missing data was coded as Spanish ($p = 0.035$). Because all the results remained relatively similar, and all statistical conclusions were maintained, I am confident that the missing data for 62 women without survey language did not bias the results of this study.

Recall bias also often plays a role in survey data. However, recall bias is not likely to have an effect on the results of this study. All women were surveyed between two and seven months after giving birth, and most answered in months three and four. Because any breastfeeding would have been a fairly recent event, a mother is not likely to have forgotten the details about if and when she breastfed her child. Acculturation is measured by the birth certificate variable of mother's place of birth, and the PRAMS variable for the language in which the survey was completed; therefore, the measure of acculturation is not dependent on each participant's responses, and is not likely to be subject to recall bias.

Bias due to non-response was accounted for in the survey design in the process of weighting the data. Unfortunately, this may not take into account people who couldn't be reached by PRAMS in the first place, resulting in bias due to non-coverage. Such people might include those who don't have an address, speak a different language, don't have a telephone, or are illegal immigrants. Additionally, non-response to individual questions is likely to have influenced the results of the multivariable logistic regression. Women with missing data on variables for the multivariable regression were excluded from the multivariable analysis. There were a few significant differences between those who were included in the final multivariable analysis, and those who were not. Women who said that their childbirth was mistimed were 0.43 times less likely to be excluded than those who had an intended childbirth (95% CI 0.22 – 0.82). Those with a family income of less than $20,000 per year were 0.58 times less likely to be excluded than those with income greater than or equal to $20,000 (95% CI 0.34 – 1.00). Both of these variables were eliminated during the model building process. Even if all of the missing data had been

available, it is unlikely that these differences would have affected the association between acculturation and breastfeeding, because the association between acculturation and breastfeeding remained steady no matter which variables were adjusted for.

While bias due to missing data was likely not a major factor in this analysis, the measurement of acculturation in this study was somewhat limited. Several acculturation-rating instruments exist that include a wide range of questions to assess a person's level of acculturation, but this analysis was limited to the data that was available, namely the variables maternal nativity and survey language. Maternal nativity and language use have both been used many times in the literature as proxy measures for acculturation, which supports this use of these variables to assess acculturation. Limitations in the use of the survey language variable (missing data for 62 women) have already been discussed. However, it is unknown how reliable the measure of maternal nativity is because it was determined by personnel completing the birth certificate of each woman's baby. If each mother was asked her country of birth, then it is likely to be reliable information; but if personnel assumed that a Hispanic woman who spoke English was born in the U.S., or that a mother who spoke Spanish was from Mexico, misclassification could have resulted. Results from the univariable logistic regression show that maternal nativity and survey language were both independently associated with any breastfeeding at ten weeks, which supports the finding of acculturation being associated with breastfeeding. Additional logistic regression models were conducted to assess whether maternal nativity and survey language separately had an effect on breastfeeding at ten weeks. Results showed that both variables were independently associated with breastfeeding at ten weeks ($p < 0.001$) in the main effects model, but the goodness of fit

was better for the model with survey language ($p = 0.85$) than for maternal nativity ($p = 0.44$). Upon assessing the effect of maternal nativity in interactions with WIC enrollment and parity, findings showed a more significant interaction with parity ($p = 0.04$), and a high goodness of fit ($p = 0.89$). Conversely, the model assessing survey language with interactions with WIC and parity showed a non-significant interaction with parity ($p = 0.28$), but a high goodness of fit ($p = 0.97$). One could assume that by combining the maternal nativity and survey language variables, a more robust measurement of acculturation was arrived at compared to using either variable alone.

The intermediate acculturation group also presents some special concerns. In initial analysis, acculturation was categorized into four groups: 1) foreign-born/Spanish (low acculturation); 2) foreign-born/English (intermediate acculturation I); 3) U.S.-born/Spanish (intermediate acculturation II); and 4) U.S.-born/English (high acculturation). The two intermediate groups were combined due to small cell sizes. However, it is possible that women who are born in the U.S. and speak Spanish are drastically different from women who are foreign-born and speak English. Language has consistently been shown as a strong predictor of acculturation, so it is possible that those in the intermediate group who completed the survey in English were more highly acculturated than those who completed the survey in Spanish. Because it is difficult to tease out the differences between the two intermediate groups of women, the interpretation of results on this group is limited. A larger number of women would be needed in order to identify whether the association between acculturation and breastfeeding holds true among this group.

Because PRAMS is a population-based survey, all results are intended to be generalizable to the larger population from which the data was collected. However, adequate sample sizes are necessary to report reliable results. Typically, in PRAMS, estimates that are based on sample sizes smaller than 30 are not reported.[194] In this study, some of the sample sizes for the interaction terms were smaller than 30, namely for the low- and intermediate-acculturation groups. However, the sample sizes were considerably larger for the high-acculturation women, the group for which the findings were most interesting. Thus, while the findings for the interactions between acculturation and WIC enrollment and parity provide valuable insight into the relationship between acculturation and breastfeeding, they should be viewed as results that are hypothesis-generating, and serve as important areas in which further research is needed.

PRAMS uses a cross-sectional study design, therefore causality cannot be determined. While an association between acculturation and any breastfeeding at ten weeks exists, we cannot be certain that acculturation causes women to breastfeed less. Fortunately, the biologic plausibility and the consistency of these study results with those of other studies on acculturation and breastfeeding supports the conclusion that there is a strong and important association between acculturation and breastfeeding, even while adjusting for other socio-demographic factors.

This analysis of Oregon Pregnancy Risk Assessment Monitoring System data has several strengths. The results of this study are consistent, both internally and externally. The association between acculturation and any breastfeeding at ten weeks remained stable from the univariable logistic regression through every step of the multivariable model-building. Even when the missing data for survey language was imputed, the

association remained. These study results are also consistent with the results of other investigations of the association between acculturation and breastfeeding among primarily Mexican-origin women. Even though different measurements of acculturation and breastfeeding have been used throughout the literature, the association is still seen.

In addition, the association between acculturation and any breastfeeding at ten weeks was a strong one; the very significant statistical results suggest that this association is not due to chance. A dose-response relationship is plausible; intermediate acculturation women are significantly less likely to breastfeed at ten weeks than low-acculturation women, but high-acculturation are even less likely to breastfeed. This supports the acculturation hypothesis that as immigrants acculturate they adopt the breastfeeding practices of the dominant culture. In this case, the immigrants as a group, not just as individuals, are breastfeeding less. An even greater percentage of high acculturation women did not breastfeed at ten weeks than intermediate acculturation women.

Public Health Implications

Culturally appropriate prenatal, perinatal, and postnatal care must be promoted for diverse groups of Hispanic women. The association between acculturation and breastfeeding at ten weeks sheds light on the fact that diverse groups of Hispanic women have different breastfeeding practices. While breastfeeding programs exist that target Hispanic women, this analysis of the Oregon PRAMS provides data that perhaps different groups of Hispanic women should be targeted in different ways.

What programmatic activities could be implemented as a result of these findings? Pilot breastfeeding interventions could be designed to develop breastfeeding support

groups that include a combination of low- and high-acculturation women. Thus, women would be able to relate to other women in the group who might be experiencing similar barriers to breastfeeding, but they could also learn ways that other women are able to remain successful at breastfeeding. The influence of other successfully breastfeeding Hispanic women as female role-models may help highly acculturated women retain the traditions and values related to breastfeeding that are central to many Latin American cultures. Other programs that could be implemented would require a special focus on other methods of lactation support for highly acculturated women. These programs would include ways to decrease barriers to breastfeeding, such as ensuring adequate access to breast pumps, or implementing breastfeeding-friendly workplace programs.

In addition, health care providers, lactation consultants and others who regularly work in the realm of breastfeeding need to be aware of the differences in breastfeeding practices among Hispanic women that vary by level of acculturation.[212] Without recognizing the cultural influences that affect a woman's breastfeeding behavior, it will be difficult to address her breastfeeding-related needs. Health care providers can determine a woman's general level of acculturation through asking a few simple questions:[143]

1.) Where were you born?

2.) How long have you lived in the United States?

3.) What language do you predominantly speak?

By assessing a woman's level of acculturation, providers can direct her to culturally appropriate resources, if they exist locally, and can help her address concerns about breastfeeding more appropriately.

The association between acculturation and decreased breastfeeding implicates a community-wide health problem. As the Hispanic population continues to grow, there will be more and more highly acculturated women who are at risk of decreased breastfeeding. If these women do not initiate breastfeeding, or discontinue breastfeeding early, they and their children may be at risk for several health problems.

However, breastfeeding needs to be addressed at more than just the level of highly acculturated Hispanic women, and Hispanic women in general. Breastfeeding needs to be promoted throughout the U.S. to everyone. The posited reason why Hispanic women stop breastfeeding is because they are assimilating into a culture that breastfeeds less, or that they perceive as breastfeeding less. If the nationwide prevalence of breastfeeding can be raised, and if Healthy People 2010 goals can be met for all groups, regardless of race or ethnicity, then highly-acculturated Hispanic women specifically may be more likely to breastfeed. Additionally, if the image of breastfeeding can be portrayed more positively and as a societal norm, women will start to perceive that breastfeeding is supported in the U.S. Programs that sustain health education, coordinate with the media to create positive images of breastfeeding, and provide breastfeeding and dietary information and support in hospitals and the workplace, can improve national trends in breastfeeding and help childbearing immigrant women retain her traditional beliefs, values, and customs related to breastfeeding.[212]

Further research is needed to delve into what it is about acculturation that causes women to breastfeed less. Pilot studies and interventions need to be conducted to see whether culturally appropriate and acculturation-specific programs help highly-acculturated women retain positive breastfeeding behaviors. Further examination of and

research into the interaction between WIC and acculturation is needed to determine whether women who are enrolled in WIC need extra support to maintain breastfeeding. Some argue that by giving out free infant formula, WIC causes women to breastfeed less. The results of this study provide some evidence for this argument, but should only be taken as a hypothesis, as these conclusions are limited by the data set and variables available. A prospective intervention study, rather than a cross-sectional observational study would be more appropriate to determine whether a causal relationship exists. Finally, future research needs to take into account the effect of working on a mother's breastfeeding behaviors.

Conclusions

This study found a significant association between increased acculturation and any breastfeeding at ten weeks. This association is supported by several other investigations that similarly found a relationship between acculturation and breastfeeding practices. Thus, it is important that highly acculturated Hispanic women receive culturally appropriate health care related to breastfeeding.

Breastfeeding interventions and programs in Oregon might benefit from lactation support and peer counseling for highly acculturated Hispanic women. Simultaneously, breastfeeding needs to continue to be promoted as the healthiest option for infant feeding. If the overall prevalence of breastfeeding in Oregon can be raised, and breastfeeding is portrayed as the healthiest and most prevalent feeding option, then highly acculturated Hispanic women might not be at risk of losing their protective cultural traditions and beliefs related to breastfeeding.

Further understanding of the mechanisms by which acculturation causes highly acculturated women to breastfeed less is necessary to provide culturally appropriate care and information. Health care providers, lactation consultants and others need to be aware of the differences between subgroups of Hispanic women.

Because the Hispanic population in Oregon is growing and will become a larger segment of the population in years to come, it is important that Hispanic women receive adequate breastfeeding advice and interventions. This research provides information that can improve breastfeeding promotion programs and health care practices related to breastfeeding, in order to help more babies, mothers, and society reap the many benefits that breastfeeding has to offer.

APPENDIX A: Original questions from the Oregon Pregnancy Risk Assessment Monitoring System 2000 & 2001 surveys

Table 17. Variables derived from the original PRAMS questions, original question wording, and possible responses

Variable	Original PRAMS Question	Possible Responses
Childbearing Intention	Q5. Thinking back to ***just before*** you got pregnant, how did you feel about becoming pregnant? **Check the best answer. (Feel free to note any reason why you checked doesn't quite fit – but *please* check the best answer.)**	□ I wanted to be pregnant sooner □ I wanted to be pregnant later □ I wanted to be pregnant then □ I didn't want to be pregnant then or at any time in the future
Family Income	Q81b. What is your family income ***now***, before deductions and taxes? **Include ANY income or money you can use (for example, job, TANF [formerly AFDC], child support, etc.). Please give us your best guesses. All information will be kept private.**	$ _____ □ Weekly or □ Monthly or □ Yearly
Smoking Status	Q35. How many cigarettes or packs of cigarettes do you smoke on an average day ***now***?	____ Cigarettes or ____ Packs □ Less than 1 cigarette a day □ I don't smoke □ I don't know
WIC Enrollment	Q26. If you were on WIC (Women, Infants, and Children Nutrition Program) during this pregnancy, how many weeks or months pregnant were you when you had your first visit for WIC?	____ Weeks or ____ Months □ I was not on WIC
First Trimester Prenatal Care Initiation	Q20. About how many weeks or months pregnant were you when you had your ***first*** visit for prenatal care? **Don't count a visit that was only for a pregnancy test or only for WIC (Women, Infants, and Children's Nutrition Program).**	____ Weeks or ____ Months □ I did not go for prenatal care
Body Mass Index (calculated from two separate questions for weight and height)	Q15. ***Just before*** you got pregnant, how much did you weigh? Q16. How tall are you without shoes?	____ Pounds ____ Feet ____ Inches

APPENDIX B: Complete results of multivariable variable selection and model building

Table 18. Hispanic women, Oregon PRAMS, 2000 & 2001: Summary of crude associations and multiple logistic regression models 1 – 3

Variable	Crude OR; 95% CI	MVM1* Adjusted OR (95% CI)	MVM2* Adjusted OR (95% CI)	MVM3* Adjusted OR (95% CI)
-2 Log Likelihood	--	857.73	868.91	885.73
HL† Wald (p-value)	--	1.03 (p=0.415)	0.95 (p=0.482)	0.92 (p=0.506)
Acculturation				
Low	Referent	Referent	Referent	Referent
Intermediate	**0.49 (0.32 – 0.75)**	**0.40 (0.24 – 0.68)**	**0.39 (0.23 – 0.65)**	**0.40 (0.24 – 0.66)**
High	**0.38 (0.28 – 0.51)**	**0.30 (0.19 – 0.41)**	**0.39 (0.18 – 0.45)**	**0.29 (0.19 – 0.44)**
Maternal Age				
< 20 years	**0.46 (0.33 – 0.64)**	**0.48 (0.31 – 0.76)**	**0.50 (0.32 – 0.78)**	**0.50 (0.32 – 0.78)**
20-29 years	Referent	Referent	Referent	Referent
≥ 30 years	0.99 (0.70 – 1.39)	0.85 (0.56 – 1.29)	0.84 (0.55 – 1.26)	0.82 (0.55 – 1.24)
Maternal Smoking				
Yes	**0.29 (0.16 – 0.50)**	0.59 (0.30 – 1.15)	0.61 (0.31 – 1.20)	0.57 (0.30 – 1.10)
No	Referent	Referent	Referent	Referent
WIC Enrollment				
Yes	Referent	Referent	Referent	Referent
No	1.16 (0.83 – 1.64)	**1.83 (1.11 – 3.00)**	**1.79 (1.10 – 2.93)**	**1.81 (1.11 – 2.95)**
Parity				
Multiparous	Referent	Referent	Referent	Referent
Primiparous	0.98 (0.75 – 1.28)	**1.62 (1.12 – 2.34)**	**1.59 (1.10 – 2.29)**	**1.56 (1.09 – 2.24)**
Marital Status				
Married	Referent	Referent	Referent	Referent
Not married	**0.58 (0.44 – 0.75)**	0.76 (0.54 – 1.08)	0.75 (0.53 – 1.06)	0.74 (0.53 – 1.04)
Low Birth Weight				
No	Referent	Referent	Referent	Referent
Yes	0.77 (0.44 – 1.37)	0.51 (0.25 – 1.04)	**0.46 (0.23 – 0.94)**	**0.46 (0.23 – 0.94)**
Prenatal Care				
Within 1st Trimester	Referent	Referent	Referent	Referent
After 1st Trimester	0.87 (0.66 – 1.14)	0.89 (0.64 – 1.24)	0.88 (0.63 – 1.22)	0.89 (0.64 – 1.23)
Family Income				
≥ $20,000	1.03 (0.76 – 1.40)	1.15 (0.78 – 1.70)	1.13 (0.77 – 1.67)	1.12 (0.76 – 1.65)
< $20,000	Referent	Referent	Referent	Referent
Urban/Rural				
Urban	Referent	Referent	Referent	Referent
Rural	0.87 (0.66 – 1.14)	0.91 (0.62 – 1.34)	0.92 (0.62 – 1.35)	0.92 (0.62 – 1.34)
Type of Delivery				
Vaginal	Referent	Referent	Referent	Referent
Cesarean	0.87 (0.63 – 1.19)	0.92 (0.62 – 1.37)	0.93 (0.63 – 1.38)	0.98 (0.66 – 1.45)
Childbearing Intention				
Intended	Referent	Referent	Referent	
Mistimed	**0.70 (0.53 – 0.94)**	0.96 (0.67 – 1.36)	0.99 (0.70 – 1.40)	
Unwanted	0.87 (0.53 – 1.43)	1.22 (0.64 – 2.32)	1.25 (0.65 – 2.38)	
Maternal Education				
0-8 years	**1.53 (1.11 – 2.11)**	1.07 (0.67 – 1.71)		
9-11 years	1.04 (0.76 – 1.43)	1.12 (0.74 – 1.69)		
≥ 12 years	Referent	Referent		

* MVM = Multivariable model; † Hosmer and Lemeshow Goodness of Fit test

Table 19. Hispanic women, Oregon PRAMS, 2000 & 2001: Summary of multiple logistic regression models 4-7

Variable	MVM4* Adjusted OR (95% CI)	MVM5* Adjusted OR (95% CI)	MVM6* Adjusted OR (95% CI)	MVM7* Adjusted OR (95% CI)
-2 Log Likelihood	885.74	885.91	1000.14	1049.41
HL† Wald (p-value)	1.23 (p=0.273)	0.48 (p=0.887)	0.81 (p=0.611)	2.09 (0.027)
Acculturation				
Low	Referent	Referent	Referent	Referent
Intermediate	**0.40 (0.24 – 0.66)**	**0.40 (0.24 – 0.66)**	**0.45 (0.28 – 0.71)**	**0.47 (0.30 – 0.74)**
High	**0.29 (0.19 – 0.44)**	**0.28 (0.18 – 0.44)**	**0.34 (0.23 – 0.51)**	**0.35 (0.24 – 0.52)**
Maternal Age				
< 20 years	**0.50 (0.32 – 0.79)**	**0.50 (0.32 – 0.78)**	**0.43 (0.28 – 0.64)**	**0.44 (0.29 – 0.66)**
20-29 years	Referent	Referent	Referent	Referent
≥ 30 years	0.82 (0.55 – 1.24)	0.82 (0.55 – 1.24)	0.80 (0.55 – 1.18)	0.82 (0.57 – 1.19)
Maternal Smoking				
Yes	0.57 (0.30 – 1.10)	0.57 (0.30 – 1.10)	0.55 (0.29 – 1.02)	**0.51 (0.27 – 0.95)**
No	Referent	Referent	Referent	Referent
WIC Enrollment				
Yes	Referent	Referent	Referent	Referent
No	**1.81 (1.11 – 2.95)**	**1.82 (1.12 – 2.96)**	**1.60 (1.04 – 2.46)**	**1.69 (1.11 – 2.56)**
Parity				
Not firstborn	Referent	Referent	Referent	Referent
Firstborn	**1.57 (1.09 – 2.25)**	**1.58 (1.10 – 2.26)**	**1.44 (1.02 – 2.03)**	1.39 (1.00 – 1.94)
Marital Status				
Married	Referent	Referent	Referent	Referent
Not married	0.74 (0.53 – 1.04)	0.74 (0.53 – 1.04)	0.77 (0.56 – 1.06)	0.77 (0.57 – 1.05)
Low Birth Weight				
No	Referent	Referent	Referent	Referent
Yes	**0.46 (0.23 – 0.94)**	**0.46 (0.23 – 0.93)**	0.64 (0.34 – 1.19)	0.66 (0.36 – 1.21)
First Trimester Prenatal Care				
Within 1st Trimester	Referent	Referent	Referent	
After 1st Trimester	0.89 (0.65 – 1.24)	0.90 (0.65 – 1.24)	0.93 (0.68 – 1.25)	
Family Income				
≥ $20,000	1.12 (0.76 – 1.65)	1.13 (0.77 – 1.65)		
< $20,000	Referent	Referent		
Urban/Rural				
Urban	Referent			
Rural	0.92 (0.63 – 1.34)			
Type of Delivery				
Vaginal				
Cesarean				
Childbearing Intention				
Intended				
Mistimed				
Unwanted				
Maternal Education				
0-8 years				
9-11 years				
≥ 12 years				

* MVM = Multivariable model; † Hosmer and Lemeshow Goodness of Fit test

Table 20. Hispanic women, Oregon PRAMS, 2000 & 2001: Summary of multiple logistic regression models 8-10

Variable	MVM8* Adjusted OR (95% CI)	MVM9* Adjusted OR (95% CI)	MVM10* Adjusted OR (95% CI)
-2 Log Likelihood	1050.98	1053.33	1056.13
HL† Wald (p-value)	0.62 (p=0.764)	0.49 (p=0.881)	0.97 (p=0.461)
Acculturation			
Low	Referent	Referent	Referent
Intermediate	**0.46 (0.29 – 0.74)**	**0.45 (0.29 – 0.71)**	**0.45 (0.28 – 0.71)**
High	**0.35 (0.24 – 0.51)**	**0.34 (0.23 – 0.50)**	**0.34 (0.23 – 0.50)**
Maternal Age			
< 20 years	**0.44 (0.30 – 0.66)**	**0.41 (0.28 – 0.61)**	**0.47 (0.33 – 0.68)**
20-29 years	Referent	Referent	Referent
≥ 30 years	0.82 (0.57 – 1.19)	0.85 (0.58 – 1.23)	0.80 (0.55 – 1.15)
Maternal Smoking			
Yes	**0.52 (0.28 – 0.97)**	**0.48 (0.26 – 0.90)**	**0.47 (0.25 – 0.88)**
No	Referent	Referent	Referent
WIC Enrollment			
Yes	Referent	Referent	Referent
No	**1.69 (1.11 – 2.56)**	**1.78 (1.18 – 2.69)**	**1.84 (1.21 – 2.78)**
Parity			
Not firstborn	Referent	Referent	
Firstborn	1.36 (0.98 – 1.90)	1.34 (0.96 – 1.86)	
Marital Status			
Married	Referent		
Not married	0.78 (0.57 – 1.06)		
Low Birth Weight			
No			
Yes			
First Trimester Prenatal Care			
Within 1st Trimester			
After 1st Trimester			
Family Income			
≥ $20,000			
< $20,000			
Urban/Rural			
Urban			
Rural			
Type of Delivery			
Vaginal			
Cesarean			
Childbearing Intention			
Intended			
Mistimed			
Unwanted			
Maternal Education			
0-8 years			
9-11 years			
≥ 12 years			

* MVM = Multivariable model; † Hosmer and Lemeshow Goodness of Fit test

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