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# PERICONCEPTIONAL FOLIC ACID USE AMONG HISPANIC WOMEN IN OREGON

by

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A Thesis

Presented to the Department of Public Health and Preventive Medicine

and the Oregon Health & Science University School of Medicine

in partial fulfillment of the requirements for the degree of

Master of Public Health

May 2006

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## **Acknowledgments**

Many thanks to my thesis committee, Ken Rosenberg, Annette Adams and Jennifer Wisdom. They helped shape my ideas, read and re-read this report and kept me on track to completion.

Ken Rosenberg was not only my thesis advisor, but has also been my public health mentor for years and I am grateful for his considerable knowledge in the area of maternal-child health. Without his assistance and others at the Oregon Department of Human Services (DHS), Office of Family Health, this PRAMS project would not have been possible. Special thanks to Al Sandoval from DHS for providing data and information about how PRAMS was collected, to Laura Zukowski for helping a new intern learn the ropes at DHS and the WIC staff at DHS who took an interest in this project.

Annette Adams was not only my advisor for the statistical component of this report, but taught me to use a new statistical program, STATA, that allowed greater flexibility in how, when and where I could analyze data. She shared her office with me for the last six months and made sure that I focused my attention to my original research question. Thank you Annette for making me a STATA convert.

Jennifer Wisdom, in the Department of Public Health and Preventive Medicine, has been supportive to an effort that at times seemed like it would take forever. Her knowledge about this MPH process was invaluable.

I cannot give enough thanks to Katie Riley, from the Department of Public Health and Preventive Medicine, for her interest in me as a student in the department and to Chris Lowe for editing my work.

However much outside support I received, my inner circle of family saw me through my trials and tribulations of getting this project completed. I can't express enough thanks and appreciation to my husband, Zdenek, and my children, Rena, Kyle and Austin.



## **List of Abbreviations**

CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
FDA	Food & Drug Administration
IOM	Institute of Medicine
mg	milligram
MOD	March of Dimes
MRC	Medical Research Council
MV	multivitamin
NTD	neural tube defect
OR	odds ratio
PFA	periconceptional folic acid
PRAMS	Pregnancy Risk Assessment Monitoring System
RDA	Recommended Daily Allowance
US	United States
USDA	United States Department of Agriculture
USPHS	United States Public Health Service

## **Abstract**

### **Background**

Hispanic women have a risk 1.5 to 3 times higher than non-Hispanic White women of having a pregnancy affected by a neural tube defect. There is now substantial evidence that folic acid can reduce the risk of neural tube defects (NTDs). When consumed prior to conception (periconceptionally) and through the first month of pregnancy, supplemental folic acid reduces the risk of NTDs by 40-70%. Hispanic women are at an increased risk to have an NTD-affected pregnancy and Hispanic women have the lowest reported supplemental folic acid consumption of any racial or ethnic group.

### **Methods**

To better understand periconceptional folic acid (PFA) vitamin use by Hispanic women in Oregon, data were analyzed from the 1998-1999 Oregon Pregnancy Risk Assessment Monitoring System (PRAMS). Oregon PRAMS asked women whether they had taken the vitamin folic acid in the month prior to pregnancy. Comparison of the knowledge of folic acid in the prevention of birth defects and use of PFA among Hispanic women and non-Hispanic women was analyzed. Characteristics of Hispanic women who had recently given birth and had reported taking the vitamin supplement folic acid in the month before pregnancy was compared to Hispanic women with recent births who reported not taking PFA daily. Predictors of PFA use by Hispanic mother's place of birth was also evaluated.

## **Results**

Of the 443 Hispanic women surveyed by 1998-1999 PRAMS in Oregon, only 15.7% (weighted) reported taking the vitamin folic acid in the month before pregnancy compared to 35.0% of non-Hispanic women. Among Hispanic women who had recently given birth, in multivariate analysis, knowledge of folic acid (OR 8.71, 95% CI 3.00-24.5), intended pregnancy (OR 2.87, 95% CI 1.39-5.94) and mother's age 30 or older (OR 2.03, 95% CI 1.00-4.09) were significant predictors of PFA use. When evaluated by Hispanic mother's place of birth (United States (US)-born or foreign-born) there was no statistically significant difference between these groups in their PFA use or in their knowledge of the benefits of folic acid in preventing birth defects. Knowledge (OR 5.47, 95% CI 2.05-14.04), pregnancy intention (OR 3.09, 95% CI 1.29-7.36) and early initiation of prenatal care (OR 2.80, 95% CI 1.26-6.24) remained significant predictors of PFA use for foreign-born Hispanics. Knowledge (OR 13.5, 95% CI 1.73-105.81) and mother's age 30 or older (OR 4.77, 95% CI 1.53-14.88) remained significant predictors of PFA use by US-born Hispanic women. Pregnancy intention was not a predictor of PFA use for US-born Hispanics.

## **Conclusion**

Knowledge of the benefits of folic acid remains the most important predictor of PFA vitamin use for Hispanic women. In Oregon, targeting public health interventions to increase knowledge of the benefits of PFA must account for mother's place of birth since almost 70% of the Hispanics in Oregon are foreign-born (mostly from Mexico) and 30% are US-born. Substantial differences exist between these Hispanic groups including their

incomes, education and even the clinics attended for prenatal care. Further research needs to also evaluate the difference in pregnancy intention between the two groups since this can also be an important predictor of PFA use. Increasing our understanding of who chooses to take PFA, where they could receive the public health message and in what language they receive the message will be important information to target our public health interventions.

# **1. Introduction**

## **1.1 Neural Tube Defects**

Neural tube defects (NTDs) are a group of serious brain and spinal cord malformations in the developing fetus that include anencephaly and spina bifida.

Prenatal and birth records from before 1998 suggest that approximately 4,000 pregnancies with these abnormalities were identified each year in the United States resulting in 2500 live or stillbirths of anencephaly or spina bifida.<sup>(1,2)</sup>

Although the etiology of NTDs is unknown, randomized controlled trials have shown a 40-70% decrease in the incidence of these birth defects if 0.4 milligrams (mg) or more of folic acid was ingested daily prior to and during the first weeks of pregnancy.<sup>(3,4,5)</sup> This puts NTDs among the few birth defects for which a primary prevention is possible.

The neural tube is the early foundation of the brain and spinal cord. It is formed in a fetus in the first 23 to 28 days post-conception, usually before a woman knows she is pregnant. Neural development starts as an open tube, but if it does not close completely during embryogenesis, defects in the brain and spinal cord result.

In anencephaly, there is partial or complete absence of the brain and calvarium. This defect is always fatal before or shortly after birth. Spina bifida is a herniation of neural tissue and meninges on the spine. It is compatible with survival, but individuals can be severely handicapped and sometimes suffer from mental retardation. Disabilities of spina bifida can range from chronic

hydrocephalus, lower limb paralysis, bowel or bladder problems, to a minor form causing fewer problems known as spina bifida occulta. Extensive information exists on the classification of neural tube defects and their consequences, but little is known about why the neural tube does not close.<sup>(6)</sup>

Prevalence estimates of 3.6-4.6/10,000 live births from 1985-1994 are believed to underestimate the true prevalence of NTDs because many affected pregnancies are spontaneously or electively aborted.<sup>(6,7)</sup> Active population-based surveillance programs using prenatal diagnosis with ultrasound screening and measurements of maternal serum alpha-fetoproteins have reported NTD rates as high as 7.2-15.6/10,000 live and stillbirths.<sup>(1,6,7)</sup>

There are high personal costs to an individual and family associated with any birth defect. Even in mild cases with early surgical intervention, severe disability may result. It has been estimated in 1998 dollars that one new case of spina bifida costs \$295,000 per individual lifetime.<sup>(8)</sup> With estimates prior to 1998 of 1500 new cases of spina bifida per year, a cumulative lifetime cost of \$489 million for that year's cohort of spina bifida cases can be projected.<sup>(8,9)</sup> Prevention of these birth defects eliminates the economic burden to affected families.

## **1.2 Risk factors for NTDs**

For couples who have had a previous NTD-affected pregnancy, the risk of recurrence in subsequent pregnancies is 3%-5%, but more than 95% of NTDs are the primary occurrence in a family with no previous history of this birth defect. Rates of NTDs vary by population, geography, and selected maternal characteristics. Factors such as socioeconomic status, maternal heat exposure,

maternal obesity, maternal antibodies and genetics have been associated with the occurrence of NTDs.<sup>(3,10,11,12,13)</sup>

The single most important nutritional factor for the prevention of NTDs is a sufficient level of the B-vitamin folic acid in women at the time of conception.<sup>(4,5)</sup> Folate is the naturally occurring water-soluble vitamin found in many foods that is easily denatured by cooking, heat, storage and processing. Folic acid is the synthetic preparation of folate and is not denatured by these methods.

A study by Daley et al. reported an inverse dose-response relationship between red cell folate levels and NTD risk<sup>(14)</sup> and in a study comparing dietary regimens of synthetic folic acid and natural food folates, Cuskelly et al.<sup>(15)</sup> found that higher levels of folate in red cells was achieved only with folic acid vitamin supplementation or with folic acid fortified foods. They found that the cohort of women who ate foods containing the natural folate equivalent of 0.4 mg (such as 10 servings of broccoli) with no supplementation of folic acid, and those women who only received dietary advice to increase consumption of natural folate, did not increase their red cell folate levels to an amount thought adequate to prevent NTDs. Even though 10 servings of broccoli might contain 0.4 mg of folate, the amount of folate absorbed is actually much less. In an Institute of Medicine (IOM) report on dietary recommendations, they assess the bioavailability, or absorption of natural food folates at almost half that of folate's synthetic counterpart, folic acid.<sup>(16)</sup> This makes estimation of the dietary intake of natural food folates difficult because of the varying bioavailability.

### 1.3 Folic acid and NTDs, the evidence

As early as 1964 there were studies that showed an association between a deficiency of folate and human congenital malformations and in 1976, Smithells et al. reported that women with NTD-affected pregnancies had lower levels of serum folate than their unaffected controls.<sup>(3)</sup> Many other observational studies showed similar associations between folic acid and decreased NTDs.<sup>(3,17)</sup>

In 1991, the Medical Research Council (MRC) of the United Kingdom reported the results of a multi-center randomized double blind study of folic acid supplementation for the prevention of NTDs in women with a previously affected child. The data conclusively demonstrated a 71% reduction in the recurrence of NTDs in the cohort of women that took daily doses of 4 milligrams of folic acid before and during the early part of their pregnancy.<sup>(4)</sup> To assess the effect of folic acid on the first occurrence of NTDs, Czeizel et al. conducted a large randomized study with 4,753 women in Hungary that showed a decrease in NTDs in the cohort of women receiving 0.8 milligrams of folic acid periconceptionally. He found 0 cases of NTDs in the cohort of women taking folic acid compared to 6 cases NTDs in the cohort of women not receiving folic acid ( $p=0.029$ ).<sup>(5)</sup>

The preventive effect of folic acid was more recently demonstrated in the largest prospective trial so far involving more than 200,000 women in China from areas of high and low prevalence of NTDs. In those women who took 0.4 mg of folic acid periconceptionally, the study showed a reduction in NTDs of 85% in the high-risk region and a reduction of 41% in the low-risk region.<sup>(18)</sup>



Folic acid supplementation has also been associated with a decrease in other birth defects such as conotruncal heart defects, urinary tract abnormalities, orofacial clefts and imperforate anus among others.<sup>(19,20,21,22,23)</sup> Although the primary outcome of the randomized trial in Hungary was the presence of NTDs, Czeizel also found 42% fewer birth defects overall in the cohort taking folic acid compared to the cohort without folic acid supplementation.<sup>(5)</sup>

The underlying biologic mechanism of folic acid in protecting against NTDs is unknown.<sup>(3)</sup> Folic acid participates in DNA synthesis and acts as a methyl donor in the methylation process of homocysteine to methionine. Some studies suggest that increased maternal homocysteine levels, which increase when methylation to methionine is not occurring, might interfere with neural tube closure.<sup>(24)</sup> Other theories involve replenishment of a nutritional deficiency (poor diet or malabsorption) or physiologically overcoming an enzyme lack with an increased substrate.<sup>(25)</sup> More recently, there are studies showing maternal antibodies to folate receptors and this has been theorized as a reason for an increased need for folic acid in some populations.<sup>(10)</sup>

#### **1.4 Government Recommendations**

Based on the solid evidence of the randomized control trials described above, in 1992 the United States Public Health Service (USPHS) recommended that "all women of reproductive age in the United States who are capable of becoming pregnant consume 0.4 milligrams folic acid per day for the purpose of reducing their risk of having a pregnancy affected with spina bifida or other NTD".<sup>(26)</sup> Since the neural tube starts development before a woman usually

knows that she is even pregnant, and noting that 50% of pregnancies are unplanned, the recommendation included all women of reproductive age, not just those planning pregnancy. Subsequently, in 1998, the Food and Drug Administration (FDA), understanding the importance of decreasing the prevalence of a preventable birth defect, made fortification of enriched flour and grain products mandatory at 140 micrograms of folic acid /100 grams of grain.<sup>(27)</sup> One slice of bread averages about 30-40 grams and provides about 6% to 10% of the daily value percentage of folic acid. The FDA theorized that if someone ate a healthy diet following the United States Department of Agriculture (USDA) Food Pyramid Guide<sup>(28)</sup> and with fortification of enriched grain products, there would be an adequate increase in blood folate levels, but still remaining below the maximum 1 mg of daily folic acid intake that the FDA felt was a safe upper limit for the majority of the population. Increased levels of fortification were rejected by the FDA because some scientists and the FDA believed that grains fortified with more folic acid could mask the hematologic picture of pernicious anemia, a vitamin B-12 deficiency that affects 10-20% of older adults and can lead to irreversible neurologic problems.<sup>(27,29,30)</sup> This assumption of folic acid fortification masking a B-12 deficiency has been contentious since the medical diagnosis of pernicious anemia rarely relies on a hematologic picture.<sup>(31,32)</sup> In fact, nearly 1/3 of patients with a B-12 neurologic disease present without an anemia and almost 1/2 have only a mild anemia to no anemia.<sup>(33)</sup>

## 1.5 Dilemma and controversy

The 1994-1995 Continuing Survey of Food Intakes by Individuals found the average American diet contained about 0.2 mg/day of dietary folate prior to fortification.<sup>(34)</sup> The mandated fortification level of 140 micrograms/100 grams of grain only increased folate levels approximately 0.1 mg/day in the average American diet for a total of 0.3 mg of folate/day in an average diet. This fortified diet level of 0.3 mg/day is below the levels shown to be effective in decreasing NTDs 40-70% as seen in randomized control trials.<sup>(4,5)</sup> Honein reported in 2000 that, since fortification, there has been a decrease in NTDs in the United States overall of 19% compared to pre-fortification prevalence, and the CDC in 2002 reported a 20-30% decline in NTD prevalence compared to pre-fortification levels.<sup>(35,36)</sup> Other countries have seen a similar trend with fortification. Chile has fortified their grains to a level of 240 micrograms/100grams of grain and noticed a 37% decrease in NTDs.<sup>(37)</sup> Many believe there is a direct dose-response relationship between folic acid fortification and decreased NTDs.<sup>(38,39)</sup> The more fortified the grain, the fewer NTDs.

With the current level of fortification insufficient to prevent the maximal number of NTDs, the USPHS as well as the Centers for Disease Control (CDC) and the IOM still recommend that women of reproductive age take supplemental folic acid. Women who are at high risk to have a child with a neural tube defect, such as those who have a NTD themselves, or who have borne a previously affected infant, women who take antiepileptic drugs, or women with diabetes,

should take 4 mg of folic acid daily. Women with a lower risk should take 0.4 mg of PFA daily in addition to a dietary folate intake of 0.2- 0.3 mg per day.<sup>(16)</sup>

A national health objective in Healthy People 2010 is to increase folic acid consumption, measure an increase in red cell folate levels before pregnancy, and to measure a decrease in birth defects.<sup>(40)</sup> For most women, the easiest way to obtain an optimum folic acid blood level prior to pregnancy is to take folic acid in vitamin supplement form or to eat a fortified cereal with 100% the recommended daily allowance (RDA) of folic acid.

## **1.6 Vitamin Supplement Intake**

Adequate fortification of the US food supply could have been the ultimate answer to prevent a majority of NTDs because adequate fortification would not have required any dietary or behavior modification, such as taking a daily vitamin, on the part of the individual. Adequate fortification of grains with folic acid was also the perfect solution for providing PFA for planned and unplanned pregnancies since most women would have received adequate folic acid daily from their fortified diets. With inadequate folic acid fortification of the food supply to prevent the maximal number of NTDs, most public health experts believe that folic acid vitamin supplementation is necessary in women of reproductive age. The 19-30% decrease in the prevalence of NTDs reported by Honein and the CDC seen in the US after fortification was thought to be the result of fortified foods only and not folic acid vitamin use. There was no substantial change or increase in the reported use of folic acid vitamin supplements among women from 1998-2002. Vitamin use remained fairly constant at about 30-35% among the population of reproductive

women 18-44 years of age.<sup>(36)</sup> With such a low percentage of women of reproductive age reporting vitamin use (most multivitamins contain folic acid) and low levels of fortification, reduction in the NTD prevalence has not been what was predicted.

Since the USPHS recommendation in 1992, there have been multiple public health campaigns, most notably by the March of Dimes as well as the CDC, to increase the use of PFA in vitamin form and also increase awareness of folic acid to prevent birth defects. The CDC evaluated changing awareness of the benefits of folic acid and found that although overall awareness had increased since 1992, women with a high school education or less, those who were Black or Hispanic, or women who had had unintended pregnancies were less likely to be aware of a folic acid benefit.<sup>(41,42)</sup> The March of Dimes/Gallup Survey in 2000 found overall use of PFA vitamins occurred in only about 33% of the population of US women of reproductive age.<sup>(43)</sup> The National Health and Nutrition Examination Survey III found that use was lowest among Mexican-Americans, at 19.5%.<sup>(44)</sup>

## **1.7 Hispanics and NTDs**

Hispanic women have an increased risk 1.5-3 times the risk of non-Hispanic Whites of having a pregnancy affected by an NTD.<sup>(45)</sup> In 1994, case control studies along the Texas-Mexico border reported Hispanics to be at an elevated risk for NTDs. “Hispanic mother” was the predictor variable most significantly associated with spina bifida and anencephaly when compared to non-Hispanics.<sup>(46,47)</sup> The high prevalence seen along the Texas-Mexico border of 13.4/10,000 was thought to reflect the higher rate among Hispanics.<sup>(48)</sup> Shaw et

al. in California found similar findings of increased risk among Hispanics compared to non-Hispanic Whites, except that the odds of having an affected infant were only higher in Mexico-born Mexican women, and not US-born Mexican women.<sup>(45)</sup> Socioeconomic differences, nutritional deficiencies in folate, pesticide exposure, and a gene mutation in methyl-tetrahydrofolate reductase, found more prevalent in the Hispanic population, are all currently under investigation as possible reasons for the increased NTD risk.<sup>(11)</sup>

### **1.8 Demographics in Oregon**

Oregon's Hispanic population grew approximately 66% from 1990-2000, to almost 200,000, or 8% of the total population. Since 1989, the number of births to Hispanic women has increased 191% to almost 13.2% of the total births in Oregon in 1998.<sup>(49)</sup> Two Oregon counties, Malheur and Hood River, reported in 1998 that almost 50% of the births in their districts were to Hispanic women.<sup>(49)</sup>

The CDC and the March of Dimes have issued reports that effective interventions for folic acid begin by understanding the target populations to which they are directed.<sup>(50)</sup> Oregon's Hispanic women are an important target for intervention because they represent not only a large and growing share of the births in Oregon, but also because they have been identified as a group at higher risk for NTDs.

Oregon does not have an active birth defects registry and estimating the number of birth defects such as NTDs can be difficult. Shriner's Hospital and Doernbecher Children's Hospital in Portland, Oregon are reported to be carrying the major caseload of people with spina bifida for the state. They report the

number of identified persons in Oregon who currently have spina bifida to be approximately 1600 (personal communication, Shriner's Hospital)

### **1.9 Purpose of study**

This study examines folic acid use by Hispanic women who had recently given birth in Oregon using data from the 1998-1999 Pregnancy Risk Assessment Monitoring System, or PRAMS. The study:

- 1) Compares PFA use and knowledge of Hispanic women with recent births to PFA use and knowledge by non-Hispanic women with recent births.
- 2) Identifies characteristics of Hispanic women with recent births who had taken PFA acid compared to Hispanic women with recent births who had not taken PFA.
- 3) Compares PFA use and characteristics among foreign-born Hispanic women and US-born Hispanic women.
- 4) Makes recommendations for targeted interventions based on these findings to increase the use of folic acid vitamin supplements among Hispanic women.

## **2. Methods**

### **2.1 PRAMS**

This investigation was a cross-sectional study of women who participated in the Oregon Pregnancy Risk Assessment Monitoring System, PRAMS, in 1998-1999. The women who participated in this study had recently given birth and agreed to answer a mailed survey or a telephone interview.

PRAMS is a state-administered, mixed mode surveillance tool that collects data from mailed surveys or telephone interviews on maternal experiences before, during and after pregnancy (see Appendix A: PRAMS Survey questionnaire). It was developed by the Oregon Department of Human Services in 1998 and modeled after the CDC's PRAMS surveys in other states. Oregon joined the national CDC PRAMS system in 2002.

Oregon eligible women who had recently given birth were first identified from their child's birth certificate received at the Oregon Department of Human Services, then stratified by race/ethnicity and randomly selected. Over-sampling for statistical analysis of minority racial and ethnic groups assured adequate representation of minority births in Oregon. Women selected from the birth certificate data were contacted 2 to 6 months postpartum with a pre-survey letter explaining PRAMS and the questionnaire that would follow. Mothers reported as ethnicity Hispanic on the birth certificate were sent questionnaires in Spanish and English. If there was no response from the first mailing, a second mailing was sent. If there is no response from the second mailing, a telephone interview was



attempted. As an incentive to respond, names of the women who participated in the survey were entered into a monthly random drawing to win a \$200 gift certificate at Fred Meyer stores.

Data from the returned PRAMS surveys were collected and compiled by the Oregon Department of Human Services and then linked back to selected demographic and prenatal information from the birth certificates. The birth certificate data was gathered by hospital personnel at the time of birth directly from the parents, the prenatal clinic and hospital records. (see Appendix B: Birth certificate)

All data were de-identified to protect confidentiality of respondents. The Institutional Review Board at Oregon Health and Science University approved this study.

## **2.2 PRAMS Sampling Methods and Stratification**

Using birth data of Oregon from 1997, sampling proportions were calculated to get the needed sampling sizes adequate for representation of the six strata classifications in 1998-1999. Birth certificates were stratified into the categories listed below and a random sample drawn with the sampling ratios:

(Appendix C: Sampling Plan for 1998)

- 1) 1 of every 65 births with normal weights to non-Hispanic White women
- 2) 1 of every 4 births with low weight to non-Hispanic White women
- 3) 1 of every 10 births to Hispanic women
- 4) 9 of every 20 births to non-Hispanic African American women
- 5) 1 of every 4 births to non-Hispanic Asian/Pacific Islanders women

- 6) 1 of every 2 births to non-Hispanic American Indian/Alaskan Native women

### 2.3 Weighting Process

PRAMS data are weighted to estimate how a random sample of women who had recently given birth might answer the survey.<sup>(51)</sup> The PRAMS analysis was weighted for over-sampling, non-response and non-coverage.

The over-sampling weight was the reciprocal of the sampling fraction and restored demographic proportions back into the data set. For example, in non-Hispanic White women with a sampling ratio of  $1/65$ , each non-Hispanic White respondent's over-sampling weight was 65. The weight for each Asian/Pacific Islander respondent was 4. (see 2.2, PRAMS Sampling Methods and Stratification)

The non-response weight was an attempt to compensate for certain maternal characteristics that the CDC had identified as indicators of a woman's relative inclination to respond to the PRAMS survey. The assumption was that a non-responder might have responded in a similar way to other women in her stratum sharing a given indicator. The CDC identified variables of marital status, education, age and 1st trimester prenatal care as indicators of a mother's inclination to respond by a process of Classification and Regression Tree (CART) analysis.<sup>(52)</sup> For women who identified themselves as Hispanic, marital status was the biggest predictor of non-response for the year 1998-1999.

The third weight for non-coverage was the ratio of the actual birth certificate numbers at the end of a year compared with the sample frames used

monthly. There were instances when births from a certain month did not have the birth certificates available for sampling for that month. This was usually randomly distributed, but if late processing occurred, could also have been clustered by areas or certain hospitals. In cases of clustering, the sampling frame of that month was not random and needed adjustment. This weight typically is very small.

These three weights were multiplied together for the final analysis weight and when applied to each respondent could be interpreted as the number of women like herself that each respondent represented. The final analysis weight of each Hispanic respondent ranged from 14.09-16.71.

#### 2.4 Eligibility and Determination of Ethnicity<sup>FS</sup>

Eligible mothers for inclusion in the PRAMS sampling were living in Oregon and had had a live birth in the state of Oregon between August 1, 1998 and August 9, 1999. On the birth certificate a woman could be identified by her race as White, African American, American Indian or Asian/Pacific Islander and also if her ethnicity was Hispanic. A woman identified as Hispanic could be of any race.

For the first analysis, comparing Hispanic mothers and non-Hispanics mothers for the use and knowledge of folic acid, the entire weighted cohort from the 1998-1999 PRAMS was used. Hispanic and non-Hispanic mothers were also analyzed for differences in demographics and behaviors. As noted above, the non-Hispanics included White, African American, Asian/Pacific Islander, and American Indian/Alaskan Native.

For the next analysis of comparing Hispanic women who used PFA to Hispanic women who did not, only Hispanic respondents were analyzed. Certain maternal characteristics, described below, were evaluated in their relationship to PFA use.

For the last analysis, the Hispanic cohort was divided into US-born Hispanics and those who were foreign-born Hispanics. This information was obtained from PRAMS data that had been linked back to the baby's birth certificate. Mothers were asked on the birth certificate (see Appendix B: Birth Certificate, 7d) to name their state of birth or if not born in the US, their country of birth. Only women who were reported as Hispanic were evaluated. All Hispanics who were not born in one of 52 states in the US were considered foreign-born. The US provinces of Guam, Puerto Rico and the Virgin Islands were also considered foreign-born. The differences in US and foreign-born Hispanics were analyzed and predictors of PFA use evaluated. Other studies have shown that US-born and foreign-born women have differing behaviors and attitudes about pregnancy and birth and for this Hispanic cohort it was determined that evaluation of PFA use by mother's place of birth was important.<sup>(45)</sup>

## **2.5 Analytic Outcome Variable**

The outcome of interest was use of periconceptional folic acid defined by the PRAMS question *"Were you taking the vitamin folic acid most days in the month before you became pregnant?"* Response options were "yes", "no" and "I don't know." Responses of "I don't know" and missing responses were excluded from analysis. A total of 32 respondents, or 7.2%, were excluded from this

analysis. The optimum time for the use of folic acid for the prevention of NTDs is during the first 23-28 days after conception. A women usually only knows that she is pregnant when she has missed her next menstruation, approximately 28 days after the start of her last period and 12-14 days after conception. (In a normal 28 day cycle, ovulation usually occurs on days 10-14 and fertilization takes place in the days after this.) Therefore if a woman states that she took PFA, it is assumed that she was taking sufficient PFA in the month before her missed period, a critical time for neural development. The question in the PRAMS survey booklet also alerted the mother of an important time-frame, "*in the month before*" by italicizing those specific words.

## **2.6 Analytic Independent Variables**

Relevant predictor variables were picked *a priori* based on previous research<sup>(45,46,47)</sup> and interest of this analyst. Relevant variables were grouped into demographic data, knowledge and behavior, pregnancy intention, insurance status, and site of care. Variables used from the birth certificate included ethnicity, maternal age, mother's place of birth, mother's education, marital status and parity. (Parity is the number of births a woman has had. In this study parity was described as *first child* or *not first child*.) Birth certificate information was generally obtained directly from the parent and/or extracted from prenatal or hospital records. All other variables came from PRAMS survey questions answered by the new mother.

Mother's place of birth was a predictor variable that was obtained from the baby's birth certificate. Hispanic women gave their US state of birth or their

country of birth and were then divided into the categories of US-born or foreign-born. Two PRAMS respondents had reported Hispanic ethnicity on the birth certificate but had not listed a state or country of birth. The differentiating characteristics of *education less than 9<sup>th</sup> grade* and *ever smoking* were used to see if these two respondents could be described as foreign or US-born. Only 4.2% of US-born Hispanics had education levels less than 9<sup>th</sup> grade and smoking was only prevalent in 4.2% of foreign-born Hispanics. One of these two respondents had less than a 9<sup>th</sup> grade education, so this respondent was included in the foreign-born group. The other respondent had no differentiating characteristics, and was dropped from the analysis of foreign and US-born Hispanics for PFA use.

Most predictor variables were converted into a binary response. Most responses of “*I don't know*” or “*not sure*” were recoded as missing with one exception. The exception was in the question “*How many cigarettes were you smoking in the three months before pregnancy?*” (PRAMS question 34) where a response of “*I don't know*” or “*not sure*” was changed to a “*yes*” response.

The question from PRAMS of “*Have you ever heard or read that taking the vitamin folic acid can help to prevent some birth defects?*” in the analysis is referred to as “Folic acid knowledge.”

Two questions were used to assess pregnancy intention, PRAMS question 5 and question 9 (see Survey). Responses to PRAMS question 5 of pregnancy intention “*Thinking back to just before you became pregnant, how did you feel about becoming pregnant?*”, were recoded to reflect intended pregnancy versus unintended pregnancy. The responses of “*I wanted to get pregnant sooner*” or “*I*

*wanted to be pregnant then*” were coded as “*intended.*” The responses of “*I wanted to be pregnant later*” or “*I did not want to be pregnant then or at any time in the future*” were coded as “*unintended.*” All respondents were given the opportunity to answer this question. This variable was renamed “Pregnancy intention of all respondents.” “*I don’t know*” and missing responses were excluded from analysis. There were 32 (7.2%) excluded respondents from these analyses.

The other surrogate for pregnancy intention was question 9, “*Why were you or your husband not using any birth control?*” This was preceded by a skip question “*Were you or your partner using any birth control?*” Altogether, 320 of 434 Hispanic women (72.9%) who responded, answered that they were not using birth control at the time they became pregnant. These women were then given a number of responses for an answer to the question on why they were not using birth control:

- I wanted to get pregnant,
- I didn't think I could get pregnant,
- I had been having side effects from birth control,
- I didn't want to use birth control,
- I didn't think I was going to have sex,
- My husband or partner didn't want to use birth control,
- Other reason

Only the first answer, “I wanted to get pregnant”, was recoded as an “*intended pregnancy*”; all other reasons were considered “*unintended pregnancy*.” This variable was renamed “Pregnancy intention of those not on birth control.”

The variable “WIC enrollment during pregnancy” was created from the PRAMS question “*If you were on WIC during pregnancy, how many weeks or months pregnant were you when you had your first visit?*” The answers were given in weeks and months or not enrolled at all. Any time in WIC was recoded as “*enrolled*,” and answers of “not in WIC” were recoded as “*not enrolled*.” Missing and “*I don’t know*” responses were excluded.

The continuous variables of income, age and education were used to compute weighted means, standard errors and ranges for these predictors.

PRAMS question 73a1, *income before pregnancy*, was a continuous variable that was used to develop a 4-category variable that was created by the Oregon State Office of Family Health. This variable was first evaluated for trends associated with income. A binary variable from the PRAMS continuous variable 73a1 with an income cutoff level at \$20,000 was also created. The income of \$20,000 was the approximate average of the mean income levels of US and foreign-born Hispanics.

Age was a continuous variable that when graphed appeared to be normally distributed. There were about 20% of Hispanics below the age of 20 years and 20% above the age of 30 years. This 3-category age variable was evaluated for trends. From that analysis another age variable was created with age 30 years as a



cut-off age. The mean age of 24 years in Hispanics was also used to create a binary variable of less than/greater than 24 years old.

Education was a continuous variable that was divided into different levels that would account for a large number of Hispanics who have less than a 9<sup>th</sup> grade education. In the analysis of Hispanic compared to non-Hispanic and the analysis of Hispanic women who use PFA, education is presented only as demographic data and not evaluated in its relationship to folic acid use. Given the differing types of education levels and countries where education was obtained, it was felt that there could be no direct relationship of education and PFA use without knowing what each country's educational standards were. Education and PFA use was evaluated in the third analysis when Hispanics were divided into groups reflecting mother's place of birth. Since most of the foreign-born were from one country, Mexico, their education level could be compared to each other.

## **2.7 Statistical Analysis**

Data were obtained in SPSS format and transferred to Stata (Stata Corp., College Station, Texas.) using the StatTransfer program. All analyses were conducted using Intercooled Stata version 8.0. Cross-tabulations were performed on unweighted data to ensure cell sizes were adequate to support further analysis. From Pearson chi-square analysis of the weighted data, associations were first evaluated. Crude odds ratios were calculated and variables with p-values of less than 0.1 were analyzed further for associations with the outcome of interest, and were also assessed for confounders. The change-in-point-estimate method was used to evaluate for confounding.<sup>(54)</sup> All results were weighted except when

specified. Statistical significance for the univariate and multivariate analyses was at a p value of less than or equal to 0.05.

## **2.8 Sample Size and Power**

Using the Vanderbilt PowerSampleSize program (<http://biostat.mc.vanderbilt.edu/twiki/bin/view/Main/PowerSampleSize>), a calculation with a set sample size of 443 total Hispanic women and a type 1 error of 0.05 gives this study a power of 89% to predict an odds ratio of 1.5. This assumes that the probability of exposure to folic acid use among Hispanic women is 0.2.<sup>(44)</sup> In the Hispanic cohort analysis of US and foreign-born women, a fixed sample size of 300 foreign-born women could only detect an odds ratio of 1.7 with a power of 93% and a type 1 error of 0.05. A fixed sample of 133 US-born Hispanic women and a type 1 error of 0.05, gives this analysis a power of 86% to detect an odds ratio of 2.0.

### **3. Results**

#### **3.1 Comparison of the characteristics of PFA use and knowledge between Hispanic mothers with recent births and non-Hispanic mothers with recent births in the PRAMS survey from 1998-1999.**

According to Oregon birth certificate records, there were 45,054 births that occurred during the PRAMS 1998-1999 survey period:

- 1) 33,162 births to non-Hispanic Whites with normal birth weight babies
- 2) 1,562 births to non-Hispanic Whites with low birth weight babies
- 3) 6,680 births to Hispanics of any race
- 4) 2,080 births to non-Hispanic Asian/Pacific Islander
- 5) 910 births to non-Hispanic African Americans
- 6) 660 births to non-Hispanic American Indian/Alaskan Native.

For the survey year 1998-1999, a total of 2,919 women were randomly selected and sent surveys and 1,867 responded for a total response rate of 63.9%. Of the 686 Hispanic women sent a survey, 443 (64.5% unweighted) responded. Of the 443 Hispanic women who participated, 305 (68.8% unweighted) responded to the first mailing, 52 (12.0% unweighted) to the second mailing and 86 (19.4% unweighted) were interviewed on the phone. This was comparable to the overall unweighted survey response rate of 63.9% by non-Hispanic groups where 70% responded to the first mailing, 12.5% to the second mailing and 17% were interviewed on the phone.

It was important to evaluate whether Hispanic women differed from the non-Hispanic women who responded to the survey about PFA use. Table 1 shows the results of PFA use and knowledge of folic acid among all the different race categories separately as well as with the category non-Hispanic. Non-Hispanic combined all races not identified ethnically as Hispanic.

**Table 1.** Use and Knowledge of PFA among the different races and ethnicities, PRAMS 1998-1999

	Weighted percents						Odds ratio Weighted (95% CI)	
	White ^	Hispanic **	African American ^	Asian/ Pacific Is. ^	Native American/ Alaska Native ^	Non- Hispanic *	Hispanic Non-Hispanic	referent 2.87 (2.07-3.96)
Folic acid use	35.8	15.7	19.6	30.0	25.4	35.0%	Hispanic Non-Hispanic	referent 2.87 (2.07-3.96)
Folic acid Knowledge	83.2	61.1	62.8	69.7	68.2	81.1%	Hispanic Non-Hispanic	referent 2.85 (2.13-3.80)

\*Non-Hispanic combined White, African American, Asian/Pacific Is, Native American/Alaskan native who were not identified ethnically as Hispanic.

\*\* Hispanic of any race

^ Non-Hispanic

Taking the vitamin folic acid in the month prior to pregnancy was reported by 15.7% of Hispanic women in Oregon as compared to 35.0% of non-Hispanic women. Knowledge of folic acid in preventing birth defects was shown in 61.1% of Hispanics versus 81.1% of non-Hispanics. Non-Hispanic women were 2.85 times more likely to know the benefits of folic acid and 2.87 times more likely to use PFA than Hispanic women.

The mean age of Hispanic women in our study was 24.6 years, (95% CI, 24.2-25.2) with an age range of 13-46 years. The mean age of non-Hispanics was 26.6 (95% CI, 26.2-27.1) with an age range of 14-48 years.

Table 2 shows differences in the demographics and behaviors of Hispanic women compared to non-Hispanic women. Of Hispanic respondents, almost 70% had household incomes before pregnancy of less than \$20,000, versus 30% of non-Hispanics. Hispanics were also more likely to be in households with this income supporting greater than four people, 16.8% versus 7.0% of non-Hispanics. Hispanic women were also less likely to be married, 41.5% compared to 27.3% of non-Hispanics. An education level of less than 9th grade was reported by 26.6 % Hispanics versus 0.7% of non-Hispanics, and only 15.7% of Hispanics had an education beyond high school.

Almost 42% of Hispanic women reported that they received their prenatal care from a local Health Department versus 4.2% of non-Hispanics and only 38% of Hispanics reported insurance before pregnancy compared to 77% of non-Hispanics.

As a group, Hispanics seemed to be less involved than non-Hispanics in the risky behavior of smoking and alcohol use before pregnancy. Only 18.0% of Hispanic women reported ever smoking compared to 42.3% of non-Hispanics, and only 19.4% of Hispanic women reported drinking in the three months before pregnancy versus 56.8% of non-Hispanics.

For all variables evaluated, Hispanics were significantly different from non-Hispanics except in regards to parity, nutrition information received during pregnancy and pregnancy intention.

**Table 2:** Demographic and behavioral characteristics of Hispanic women with recent births compared to non-Hispanic women with recent births, Oregon PRAMS, 1998-1999

(Pearson Chi-sq analysis with significant differences highlighted)					
	HISPANIC		*NON-HISPANIC		
	n <sup>^</sup>	weighted %	n <sup>^</sup>	weighted %	p- value
<b>DEMOGRAPHICS</b>					
Mother's age <sup>BC</sup>					
<=24	223	51.4%	574	37.9%	
>24	220	48.5%	850	62.0%	<0.001
Income <sup>PR</sup>					
<= \$20,000/year	283	69.4%	503	30.5%	
> \$20,000/year	130	30.5%	836	69.4%	<0.001
Income Supports <sup>PR</sup>					
> 4 people	73	16.8%	107	7.0%	
<= 4 people	356	83.2%	1260	92.9%	<0.001
Education <sup>BC</sup>					
<9 <sup>th</sup>	116	26.6%	21	0.7%	
9 <sup>th</sup> -12 <sup>th</sup>	251	57.6%	705	49.6%	
>12 <sup>th</sup>	71	15.6%	688	49.6%	<0.001
Marital Status <sup>BC</sup>					
Not Married	166	41.5%	490	27.3%	
Married	277	58.4%	934	72.6%	<0.001
Parity <sup>BC</sup>					
Firstborn	185	42.6%	636	43.4%	
Not firstborn	258	57.3%	788	56.5%	0.80
<b>INSURANCE</b>					
Insurance before pregnancy <sup>PR</sup>					
No	270	62.2%	297	22.5%	
Yes	167	37.8%	1120	77.5%	<0.001
<b>KNOWLEDGE and BEHAVIOR</b>					
Taking folic acid <sup>PR</sup>					
No	346	84.2%	899	65.0%	<0.001
Yes	65	15.7%	421	35.0%	
Knowledge of folic acid <sup>PR</sup>					
No	167	38.9%	345	18.2%	
Yes	264	61.1%	1068	81.7%	<0.001
Ever Smoked <sup>PR</sup>					
Yes	75	18.0%	559	42.4%	
No	360	82.0%	858	57.6%	<0.001
ETOH * 3 months before pregnant <sup>PR</sup>					
Yes	82	19.4%	655	56.8%	
No	332	80.0%	736	43.1%	<0.001
Knowledge of emergency contraception <sup>PR</sup>					
No	170	40.4%	927	75.2%	
Yes	249	59.6%	478	24.8%	<0.001
Nutrition information during pregnancy <sup>PR</sup>					
No	60	14.2%	157	11.9%	
Yes	361	85.7%	1227	88.0%	0.29
<b>PREGNANCY INTENTION</b>					
Pregnancy intention of all respondents <sup>PR</sup>					
Unintended	167	41.5%	570	39.3%	
Intended	244	58.4%	765	60.6%	0.50

**Table 2 continued:** Demographic and behavioral characteristics of Hispanic women with recent births compared to non-Hispanic women with recent births, Oregon PRAMS, 1998-1999

Initiation of prenatal care <sup>PR</sup>					
>=13 weeks	169	40.5%	354	23.3%	
<13 weeks	251	59.4%	1036	77.7%	<0.001
WIC **enrollment during pregnancy <sup>PR</sup>					
No	95	24.3%	620	57.8%	
Yes	288	75.5%	557	42.1%	<0.001
<b>SITE OF CARE</b>					
Prenatal care site <sup>PR</sup>					
Hospital clinic	73	19.2%	250	12.8%	
Health Department	155	41.7%	88	4.2%	
Private	147	39.0%	958	82.9%	

\*Non-Hispanic respondents include normal and low birth weight White, African American, American Indian, Alaskan Native, Asian, Pacific Islander not identifying themselves as Hispanic

n^ unweighted number of respondents excluding missing and those who did not know or respond

<sup>BC</sup> Birth certificate data

<sup>PR</sup> PRAMS data

ETOH alcohol

WIC\*\* Special Supplemental Nutrition Program for Women, Infants and Children

Income is pre-pregnancy yearly income before taxes

### 3.2 Characteristics of Hispanic mothers with recent births who had taken PFA compared to Hispanic mothers with recent births who had not taken PFA

In univariate logistic regression analysis (Table 3), there were a number of variables that independently predicted PFA use by Hispanic women including knowledge of folic acid, pregnancy intention of all respondents, pregnancy intention of those not taking birth control, mother's age 30 years or older, income greater than \$20,000 per year and early initiation of prenatal care. Although not statistically significant, there was a trend of increased PFA use with increased income.

**Table 3:** Univariate logistic regression, PFA use by selected maternal characteristics of Hispanic women with recent births, Oregon PRAMS, 1998-1999

Characteristic	n unweighted	Folic acid use weighted %	Odds ratio weighted (95% CI) p<= 0.05 highlighted
Total	443	15.8%	-
<b>Demographics</b>			
Mother's place of birth <sup>BC</sup>			
Foreign-born	300	14.6%	referent
US-born	133	17.8%	1.26 (0.71-2.24)
Mother's age <sup>BC</sup>			
less than 20	81	10.7%	referent
20-29	278	14.7%	1.42 (0.62-3.26)
30+	84	23.8%	<b>2.59 (1.04-6.44)</b>
Mother's age <sup>BC</sup>			
Age <30	359	13.9%	referent
Age >=30	84	23.8%	<b>1.93 (1.05-3.55)</b>
Income <sup>PR</sup>			
<=20,000/yr	283	13.2%	referent
>20,000/yr	130	22.2%	<b>1.88 (1.07-3.31)</b>
Income <sup>PR</sup>			
<= \$15,000/yr	218	12.9%	referent
\$15,000 - \$29,999	128	16.4%	<b>1.32 (0.69-2.52)</b>
\$30,000 - \$49,999	49	24.1%	<b>2.14 (0.96-4.78)</b>
50,000 or >	18	29.8%	<b>2.87 (0.92-8.92)</b>
Size of household income supports <sup>PR</sup>			
More than 4 people	73	10.2%	referent
4 or less people	356	16.5%	1.75 (0.75-4.06)
Education <sup>BC</sup>			
Less than 9 <sup>th</sup>	116	16.8%	
9 <sup>th</sup> through 12 <sup>th</sup>	251	14.1%	
>12 <sup>th</sup>	71	21.5%	
Parity <sup>BC</sup>			
First Born	185	16.5%	referent
Not first born	258	15.3%	0.90 (0.52-1.55)
Marital Status <sup>BC</sup>			
Not married	166	15.5%	referent
Married	277	16.0%	1.04 (0.60-1.80)
<b>INSURANCE</b>			
Insurance before pregnancy <sup>PR</sup>			
No	270	13.2%	referent
Yes	167	19.8%	1.55 (0.92-2.68)
Oregon Health Plan anytime during pregnancy <sup>PR</sup>			
No	204	14.9%	referent
Yes	211	16.7%	1.14 (0.65-1.97)
Paid out of pocket for prenatal care <sup>PR</sup>			
Yes	250	17.7%	referent
No	79	9.7%	0.499 (0.21-1.17)



<b>Table 3, continued:</b> Univariate logistic regression, PFA use by selected maternal characteristics of Hispanic women with recent births, Oregon PRAMS, 1998-1999			
<b>PREGNANCY INTENTION</b>			
Using birth control before pregnancy <sup>PR</sup>			
No	323	15.8%	referent
Yes	111	15.8%	1.00 (0.53- 1.86)
Pregnancy intention of those not using birth control <sup>PR</sup>			
Unintended	114	11.2%	referent
Intended	189	20.6%	<b>2.04 (1.00-4.17)</b>
Pregnancy intention of all respondents <sup>PR</sup>			
Unintended	167	9.0%	referent
Intended	244	20.9%	<b>2.40 (1.28-4.49)</b>
Initiation of prenatal care <sup>PR</sup>			
>=13 weeks	169	10.6%	referent
<13 weeks	251	19.1%	<b>1.97 (1.06-3.66)</b>
WIC enrollment during pregnancy <sup>PR</sup>			
Not Enrolled	95	15.5%	referent
Enrolled	288	16.1%	1.03 (0.53-2.0)
<b>KNOWLEDGE and BEHAVIOR</b>			
Knowledge folic acid <sup>PR</sup>			
No	167	3.8%	referent
Yes	264	22.5%	<b>7.20 (3.00-17.26)</b>
Emergency contraception knowledge <sup>PR</sup>			
No	249	13.5%	referent
Yes	170	20.1%	1.61 (0.8-2.96)
Smoking ever <sup>PR</sup>			
Yes	75	14.4%	referent
No	360	15.7%	1.1 (0.53-2.31)
Drinking ETOH 3mon prior to pregnancy			
Yes	82	12.7%	referent
No	332	16.9%	1.4 (0.65-3.0)
Nutrition information during pregnancy <sup>PR</sup>			
No	60	10.7%	referent
Yes	361	17.2%	1.86 (0.70-4.92)
<b>SITE of CARE</b>			
Site of prenatal care <sup>PR</sup>			
Hospital Clinic	73	14.7%	0.94 (0.41-2.15)
Health dept	155	16.2%	1.04 (0.54-2.00)
Private	147	15.5%	referent

In the multivariate model for predictors of PFA use that was created from the variables in table 3, only knowledge of folic acid, intended pregnancy and mother's age 30 years or older, remained statistically significant in predicting which Hispanic women might take folic acid (Table 4). The variables of table 3 were also assessed for confounding and in the multivariate model, early initiation of prenatal care and a woman's knowledge of emergency contraception were confounders that were adjusted for in the final model.

**Table 4:** Multivariate logistic regression analysis: Use of PFA by selected maternal characteristics of Hispanic women with recent births, Oregon PRAMS, 1998-1999

Characteristic	Total n	PFA use	Univariate analysis odds ratio	Multivariate analysis, adjusted odds ratio*
	unweighted	weighted %	weighted	weighted
<b>total</b>	<b>443</b>	<b>15.8%</b>		
Folic Acid Knowledge				
Yes	264	22.5%	7.20 (3.00-17.26)	<b>8.71 (3.09-24.5)**</b>
No	167	3.8%	referent	referent
Pregnancy intention of all respondents				
Intended	244	20.9%	2.40 (1.28-4.49)	<b>2.87 (1.39-5.94)**</b>
Unintended	167	9.9%	referent	referent
Mother's Age				
>=30	84	23.8%	1.93 (1.05-3.55)	<b>2.03 (1.00-4.09)**<sup>s</sup></b>
<=30	359	13.9%	referent	referent
Pregnancy intention of those not using birth control				
Intended	189	20.6%	2.04 (1.00-4.17)	
Unintended	114	11.2%	referent	
Income				
>\$20,000/yr	130	22.2%	1.88 (1.07-3.31)	
=<\$20,000/yr	283	13.2%	referent	
Initiation of prenatal care				
Before 13 wks	251	19.1%	1.97 (1.06-3.66)	
13 wks or later	169	10.6%	referent	

\* adjusted for Initiation of Prenatal Care and Knowledge of Emergency Contraception

\*\* p values less than 0.05

<sup>s</sup> confidence interval 1.008-4.093

### 3.3 Comparison of characteristics and use of PFA among foreign-born and US-born Hispanic women

Table 5 provides insight into the nativity status of Hispanic mothers who gave birth in Oregon in 1998-1999. Almost 70% of women reported as Hispanic were foreign-born (309 foreign-born Hispanics/443 total Hispanics, unweighted). Of Hispanics who were foreign-born, 93% (288/309, unweighted) were from Mexico and 7% were from somewhere else, not the US or Mexico. Data collected were from the baby's birth certificate that had been linked to the PRAMS respondent.

**Table 5: Mother's place of birth among all respondents to Oregon PRAMS, 1998-1999**

Mother's place of birthplace as recorded on baby's birth certificate unweighted n		# of unweighted n also reported as Hispanic on baby's birth certificate	
United States	1279	133	US-born
Mexico	288	288	foreign-born
Central America	13	12	foreign-born
South America	5	3	foreign-born
Cuba	2	2	foreign-born
Other nations	270	3	foreign-born
Missing	10 (Mother's place of birth not reported on birth certificate)	1 *	foreign-born
		1 *	unknown foreign or US-born
Total	1867 PRAMS respondents	443	US and foreign-born Hispanics of PRAMS respondents

\* 2 of the respondents listed as Hispanic had no place of birth recorded. When foreign-born was compared to US-born, the respondent with no differentiating characteristics to assign as foreign or US-born (See Methods 2.6) was dropped from the subsequent analysis done in section 3.3

Comparisons between foreign-born and US-born Hispanics were evaluated. The mean age of foreign-born Hispanics was 25.2 years and of US-born Hispanics was 23.3 years (statistically significant difference with  $t=3.39$ ,  $p=0.001$ ). Mean level of education for foreign-born Hispanics was 10.0 grade levels and the mean level of education for US-born Hispanics was 13.2 grade levels (statistically significant difference with  $t=-2.95$ ,  $p=0.003$ ). Mean yearly income of foreign-born Hispanics was \$17,770 and mean yearly income of US-born Hispanics was \$22,008 (statistically significant difference with  $t=-2.16$ ,  $p=0.032$ ).

There were a number of differences in demographic and behavioral characteristic between foreign-born Hispanics and US-born Hispanics. Although not statistically significant, foreign-born Hispanics were less aware of the

knowledge of benefits of folic acid, 58%, and use of folic acid, 14.6% than the US-born Hispanics, 67% and 17.8% respectively (Table 6).

In general, US-born Hispanics were younger than foreign-born Hispanics, 29% with age less than 20 compared to 17% foreign-born Hispanics. US-born Hispanics were less likely to be older than 24 when compared to foreign-born Hispanics (OR=0.57, 95% CI 0.37-0.87), US-born Hispanics were two times more likely to not be married (OR=2.00, 95% CI 1.31-3.04), and 4.5 times more likely to have insurance (OR=4.5, 95% CI 2.94-7.11). They also tended towards riskier behavior, with smoking, 20 times more likely than foreign-born Hispanics (OR=20.67, 95% CI 10.51-40.56) and alcohol use in the three months before pregnancy, 5.5 times more likely than the foreign-born Hispanics (OR=5.56, 95% CI 2.74-11.28). US-born Hispanics were also 20 times more likely to get their care from a private provider or HMO rather than a local health department as compared to foreign-born Hispanics (OR=21.01, 95% CI 10.38-42.53). Only 9.7% of US-born Hispanics received care from a local health department compared to 57.4% of foreign-born Hispanics. When asked about pregnancy intention, only 47.2% of the US-born Hispanics reported an intended pregnancy compared to 62.9% of foreign-born Hispanics (OR=0.52, 95% CI 0.34-0.81).

**Table 6:** Demographic and behavioral characteristics of Hispanic women who were US-born compared to Hispanic women who were foreign-born, Oregon PRAMS, 1998-1999

Characteristic		Foreign-born Hispanic weighted %		US-born Hispanic weighted %	Odds Ratio Weighted (95% CI)  p<=0.05 highlighted
Total (n=unweighted)	n=309		n=133		
<b>DEMOGRAPHICS</b>					
Mother's age <sup>BC</sup>					
Less than 20	47	17.4%	34	29.3%	
20-29	170	60.0%	72	57.4%	
30+	64	22.4%	17	13.2%	
Age <sup>BC</sup>					
24 or younger	138	46.9%	79	60.6%	referent
Older than 24	162	53.0%	54	39.4%	<b>0.57 (0.37-0.87)</b>
Income- <sup>PR</sup>					
<=20,000/yr	208	76.1%	70	56.7%	referent
>20,000/yr	68	23.8%	57	43.2%	<b>2.4 (1.55-3.8)</b>
Income <sup>PR</sup>					
<= \$15,000/yr	153	56.1%	61	49.7%	
\$15,000 - \$29,999	98	35.0%	28	21.7%	
\$30,000 - \$49,999	19	6.6%	27	20.4%	
50,000 or >	6	2.1%	11	8.0%	
Marital Status <sup>BC</sup>					
Married	203	63.8%	68	46.8%	referent
Unmarried	97	36.1%	65	53.1%	<b>2.00 (1.31-3.04)</b>
Parity <sup>BC</sup>					
Firstborn	117	39.9%	65	49.6%	referent
Not firstborn	183	60.0%	68	50.3%	0.67 (0.44-1.02)
Education <sup>BC</sup>					
Less than 9 <sup>th</sup>	110	37.5%	5	4.2%	
9 <sup>th</sup> thru 12 <sup>th</sup>	154	51.7%	91	70.4%	
More than 12 <sup>th</sup>	33	10.7%	35	25.5%	
<b>INSURANCE</b>					
Insurance before pregnancy <sup>PR</sup>					
No	217	73.8%	49	38.1%	referent
Yes	79	26.1%	82	61.8%	<b>4.5 (2.94-7.11)</b>
OHP insurance at any time <sup>PR</sup>					
No	153	34.4%	47	52.3%	referent
Yes	121	64.8%	84	41.9%	<b>2.35 (1.53-3.62)</b>
Pay for care out of pocket <sup>PR</sup>					
Yes	191	86.3%	54	53.2%	referent
No	30	13.7%	47	46.7%	<b>5.53 (3.18-9.62)</b>
<b>PREGNANCY INTENTION</b>					
Pregnancy intention of all respondents <sup>PR</sup>					
Unintended	102	37.1%	63	52.7%	referent
Intended	177	62.9%	60	47.2%	<b>0.52 (0.34-0.81)</b>
Pregnancy intention of those not using birth control <sup>PR</sup>					
Unintended	74	36.7%	38	47.0%	referent
Intended	133	63.2%	47	52.9%	0.65 (0.39-1.09)

<b>Table 6, continued: Demographic and behavioral characteristics of Hispanic women who were US-born compared to Hispanic women who were foreign-born, Oregon PRAMS, 1998-1999</b>					
Initiation of prenatal care <sup>PR</sup>					
13 wks or later	124	44.0%	45	35.2%	referent
less than 13 wks	160	55.9%	84	64.7%	1.44 ( 0.93-2.23)
Prenatal care as early as wanted <sup>PR</sup>					
Yes	254	86.2%	94	71.2%	referent
No	40	13.7%	37	28.7%	2.52 (1.5-4.20)
WIC enrollment during pregnancy <sup>PR</sup>					
No	42	19.2%	39	34.4%	referent
Yes	212	80.7%	71	65.5	0.45 (0.27-0.74)
<b>KNOWLEDGE and BEHAVIOR</b>					
Folic acid use <sup>PR</sup>					
No	239	85.3%	100	82.1%	referent
Yes	41	14.6%	22	17.8%	1.26 (0.71-2.24)
Folic acid knowledge <sup>PR</sup>					
No	119	41.3%	43	32.8%	referent
Yes	170	58.6%	89	67.1%	1.44 (0.93-2.23)
Breastfeeding <sup>PR</sup>					
>= 10 weeks	207	75.6%	70	53.2%	referent
< 10 weeks	64	24.3%	60	46.7%	2.73 (1.74-4.27)
Ever smoked <sup>PR</sup>					
No	281	95.7%	70	51.9%	referent
Yes	12	4.2%	62	48.0%	20.67 (10.51-40.65)
ETOH in 3 months before pregnancy <sup>PR</sup>					
No	251	95.1%	98	77.7%	referent
Yes	13	4.9%	27	22.2%	5.56 ( 2.74-11.28)
<b>SITE of CARE</b>					
Site of prenatal care <sup>PR</sup>					
Hospital Clinic	53	20.8%	15	13.0%	3.7 (1.58-8.67)
Health Depart	142	57.4%	11	9.7%	referent
Private/HMO	56	21.7%	89	77.2%	21.01(10.38-42.53)
Did you ever feel treated differently by health care providers because of your ability to understand English <sup>PR</sup>					
Yes	14	4.9%	2	1.5%	referent
No	262	95.0%	128	98.4%	3.33 (0.73-15.07)

Table 7 shows results from the univariate logistic regression where folic acid use was evaluated by the characteristics of foreign-born Hispanics and US-born Hispanics separately. When Hispanic women were evaluated by their nativity, the predictors of folic acid use varied. For foreign-born Hispanics, only knowledge, pregnancy intention and early initiation of prenatal care remained predictors of PFA use. For US-born Hispanics, knowledge and age 30 years or

older remained predictors of PFA use. There was also a non-significant trend of use of PFA with increased income among US-born Hispanics.

**Table 7:** Univariate logistic regression: PFA use by US-born Hispanic women and foreign-born Hispanic women by selected maternal characteristics, evaluation by nativity, foreign-born or US-born Hispanic, 1998-1999 Oregon PRAMS

	Foreign-born			US Born		
	n** 309	Folic acid use weighted %	Odds ratio weighted (95% CI) p<=0.05 highlighted	n** 133	Folic acid use weighted %	Odds Ratio Weighted (95% CI) p<=0.05 highlighted
<b>DEMOGRAPHICS</b>						
Mother's Age						
<30	226	13.3%	referent	112	14.4%	referent
>=30	63	19.7%	1.59 (0.75-3.36)	19	44.0%	4.77 (1.53-14.88)
Income <sup>PR</sup>						
<= \$15,000/yr	153	12.7%	referent	61	13.9%	referent
\$15,000 - \$29,999	98	16.8%	1.38 (0.65-2.92)	28	12.4%	0.87 (0.20-3.67)
\$30,000 - \$49,999	19	16.4%	1.34 (0.35-5.16)	27	29.1%	2.54 (0.79-8.14)
50,000 or >	6	16.7%	1.32 (0.14-12.18)	11	41.1%	4.31 (0.98-19.00)
Education						
< 9th	110	16.9%	referent	5	empty	
9 <sup>th</sup> -12 <sup>th</sup>	154	11.6%	0.64 (0.308-1.33)	91	18.9%	
>12th	33	22.9%	1.45 (0.53-3.54)	35	19.5%	
Parity						
Firstborn	109	15.0%	referent	62	18.4%	referent
Not firstborn	180	14.4%	0.95 (0.48-1.89)	69	17.3%	0.92 (0.36- 2.33)
Marital Status						
Unmarried	94	15.5%	referent	65	16.3%	referent
Married	195	14.2%	0.89 (0.44- 1.81)	66	19.6%	1.24 (0.49- 3.16)
<b>INSURANCE</b>						
Insurance before pregnancy						
No	204	13.5%	referent	49	11.0%	referent
Yes	81	15.6%	1.18 (0.56-2.49)	80	22.6%	2.35 (0.79-6.96)
OHP anytime						
No	149	13.0%	referent	46	20.7%	referent
Yes	153	16.4%	1.31 (0.65-2.65)	83	16.8%	0.77 (0.29-2.01)

**Table 7, continued:** Univariate logistic regression: PFA use by US-born Hispanic mothers and foreign-born Hispanic mothers by selected maternal characteristics, evaluation by nativity, foreign-born or US-born Hispanic, 1998-1999 Oregon PRAMS

<b>PREGNANCY INTENTION</b>						
Pregnancy Intention						
Unintended	98	7.3%	referent	60	14.3%	referent
Intended	171	19.7%	<b>3.09 (1.29-7.36)</b>	61	23.3%	1.82 (0.68-4.84)
Pregnancy intention of those not using birth control						
Unintended	72	11.4%	referent	37	11.4%	referent
Intended	129	19.2%	1.84 (0.77-4.39)	45	23.8%	2.42 (0.67- 8.64)
Initiation of prenatal care						
>=13 weeks	118	7.9%	referent	42	16.0%	referent
<13 weeks	155	19.4%	<b>2.80 (1.26-6.24)</b>	85	18.5%	1.19 (0.42-3.38)
Care as early as wanted						
No	40	9.9%	referent	35	21.4%	referent
Yes	243	15.4%	1.65 (0.54-4.97)	94	16.9%	0.74 (0.27-2.04)
WIC enroll						
No	52	10.0%	referent	40	21.9%	referent
Yes	208	15.3%	1.62 (0.59-4.45)	72	18.0%	0.78 (0.28-2.15)
<b>KNOWLEDGE AND BEHAVIOR</b>						
Folic acid knowledge						
No	110	4.5%	referent	42	2.4%	referent
Yes	171	20.8%	<b>5.47 (2.05-14.60)</b>	89	24.9%	<b>13.56 (1.73-105.81)</b>
Knowledge of Emergency contraception						
No	175	12.8%	referent	60	16.1%	referent
Yes	92	20.5%	1.80 (0.90-3.63)	71	19.3%	1.24 (0.48-3.21)
Smoking Ever						
Yes	11	10.6%	referent	60	15.3%	referent
No	272	14.2%	1.41 (0.17-11.56)	71	20.3%	1.41 (0.54-3.62)
ETOH 3 months before						
Yes	13			24	16.9%	referent
No	242		Empty cell	100	18.3%	1.16 (0.33-3.69)
<b>SITE of CARE</b>						
Where did you get most of your prenatal care						
Hosp clinic	53	12.15%	0.82 (0.26-2.60)	19	20.6%	1.4 (0.34-5.91)
Health dept	133	15.6%	1.11 (0.45-2.71)	13	24.7%	1.79 (0.41-7.83)
Private	56	14.3%	referent	80	15.4%	referent

N unweighted respondents, not including missing and "Don't know" responses



## 4. Discussion

### 4.1 Use and knowledge of PFA in Hispanic women compared to non-Hispanic women

The first purpose of this study was to compare Hispanic respondents to non-Hispanic respondents. Only 15.7% of Hispanic women in the PRAMS survey took PFA compared to 35.0% of non-Hispanics. Non-Hispanics were 2.8 times more likely to report PFA use than Hispanics. When PRAMS respondents were separated into race/ethnicities, Hispanics were the least likely of any group to have taken folic acid. Most Hispanic women in the PRAMS survey, almost 85%, had not taken PFA before their recent pregnancy.

A CDC Surveillance Summaries report evaluating year 2000 PRAMS surveys from 19 states (not including Oregon) analyzed selected maternal behaviors for PFA use.<sup>(55)</sup> Of the 19 states, 10 had large enough Hispanic populations to evaluate PFA use as a subpopulation. Respondents were answering the question about multivitamins (MV) “*Were you taking a multivitamin the month before your pregnancy?*” to assess folic acid consumption. The percentage of Hispanics reporting MV use ranged from 11% in Arkansas to 28% reported use in Hawaii. Among non-Hispanic mothers, the average in these 10 states was 35% reported MV use. The report concluded that Hispanic ethnicity, women with a high school education or less and those receiving Medicaid were less likely to report PFA vitamin use before pregnancy. Although there was a difference in how the question of PFA use was asked, the CDC report confirms the findings in Oregon PRAMS 1998-1999, that Hispanic women were less likely to be using PFA.

In this study (Oregon PRAMS 1998-1999), only 61% of the Hispanic mothers reported knowledge of the benefits of folic acid compared to 83% of non-Hispanic mothers. The CDC in 2001 analyzed PRAMS data from 1995-1998 from 13 states (not including Oregon) to measure folic acid awareness.<sup>(42)</sup> The CDC results from the year 1998 show that 62.3% of Hispanic mothers answered “yes” to the following question, “*Have you ever heard or read that taking the vitamin folic acid can help to prevent some birth defects?*” This is similar to Oregon’s findings that 61% of Hispanic mothers reported knowledge of the benefits of folic acid. Knowledge has been shown in this study and in other studies to be a strong predictor of PFA use. Associations to a lack of folic acid knowledge that the CDC found in the PRAMS 1995-1998 analysis were: women with a high school education or less, those entering prenatal care later than the 12<sup>th</sup> week of pregnancy and women with unintended pregnancies.<sup>(42)</sup> In the Oregon 1998-1999 PRAMS survey, about 85% of Hispanic women had a high school education or less and 40% initiated prenatal care after 13 weeks. These factors were both more prevalent among Oregon Hispanic mothers than among Oregon non-Hispanic mothers. There was no statistical difference in pregnancy intention between the Oregon Hispanic and non-Hispanic mothers.

Hispanic women in general seem to have less knowledge of the benefits of folic acid even when other socio-demographic predictors are taken into account. Non-Hispanic White mothers comprised 77% of the population of those with recent births in Oregon in 1998-1999. The comparison of Hispanic mothers specifically to non-Hispanic White mothers in the Oregon PRAMS survey (see

Table 1) was similar to findings by van den Berg et al. of less use and knowledge among Hispanics compared to non-Hispanic Whites. In the study by van den Berg of 7555 mothers in the Boston Massachusetts, Philadelphia Pennsylvania and Toronto Canada area between 1998-2002, van den Berg found that even when controlling for education, age, income, parity and pregnancy intention, Hispanic mothers were still less likely to have a reported awareness of folic acid (OR=0.41, 95% CI 0.34-0.51) and less likely to have taken folic acid (OR= 0.57, 95% CI 0.45-0.72) when compared to non-Hispanic White mothers.<sup>(56)</sup>

The March of Dimes commissioned The Gallup Organization to conduct surveys of women of childbearing age from 1995-2001 to assess their knowledge and behaviors relative to PFA use. This was a broad national random survey of women ages 18-45 who had telephones in their homes. The March of Dimes reported in August of 2001 that the key variables to **not** using folic acid were: age less than 25 years, having not attended college and incomes under \$25,000/year.<sup>(43)</sup> Our study, using the Oregon PRAMS data from 1998-1999, showed that of Hispanic women, 51% were less than age 25 (compared to 38% of non-Hispanics), 70% of Hispanic women reported household incomes less than \$20,000/year (compared to 30% of non-Hispanics), and only 15.7% attended college (compared to 50% of non-Hispanics). The March of Dimes survey further confirms Oregon's 1998-1999 PRAMS experience, as well as other PRAMS surveys from other states, that Hispanic women as a group overall have a greater percentage of their population at risk for not using PFA.

One striking difference between Hispanics and non-Hispanics in the Oregon 1998-1999 PRAMS survey was the site of prenatal care. Of Hispanic women, 42% received their care from local health departments compared to 4.2% of non-Hispanics. Most non-Hispanics, 83%, received their prenatal care from a private practitioner or HMO. This might be a factor of insurance, as Hispanic women were less likely to be insured before pregnancy and not as likely to get care from a private clinic, or possibly their lower incomes, as 69% of Hispanics had pre-pregnancy incomes less than \$20,000. The public health implication of a large majority of Hispanic women receiving their care at a local health department means that interventions can be targeted to a certain type of location. Local health departments can take a lead in spreading the information on PFA. Almost 42% of Hispanic mothers sought prenatal care at a local health department and many continue to receive health care in some form from that site. (33% of Hispanic women take their new baby to a health department for care; data from PRAMS 1998-1999 that is not shown). This makes the local health departments in Oregon a prime initiation point for implementing a folic acid education program that can function as an education center not only at a woman's health care visit, but also at her child's visit.

#### **4.2 Comparison of Hispanic women with recent births who used PFA compared to Hispanic women with recent births who did not use PFA**

In the previous section, Hispanic mothers were shown to be at an increased risk to not be using PFA. But who are the Hispanic women who do use folic acid? In the multivariate analysis of predictors of PFA use in Hispanic

women, those who had a knowledge of the benefits of PFA and whose pregnancies were intended and who were age 30 years or older could be predicted to have taken take folic acid.

Knowledge was a strong predictor of PFA vitamin use among Hispanic women. However, even among those Hispanic women with knowledge of the benefits of PFA, a discrepancy exists between the percentage of Hispanic women who are aware of the benefits of PFA, 61%, and the percentage of these Hispanic women with folic acid awareness that actually consume PFA, 22.5% (see table 3). There must be factors besides knowledge that influence this behavior. Focus groups conducted by the CDC revealed cultural beliefs of some Hispanic women that vitamins caused increased appetites and weight gain that made vitamin consumption less desirable.<sup>(57, 58)</sup> Hispanic women also believed that vitamins were more for men and children. Anecdotally, if Hispanic women are concerned about a child who they believe is underweight, they will often ask a provider for vitamins to help the child gain weight. Hispanic women, concerned about weight, might not want to take daily vitamins specifically because of the belief that it might cause them to gain weight. A study by O'Rourke et al. of Hispanics and vitamin use postpartum,<sup>(59)</sup> found that 91% of Hispanic women reported taking vitamins during pregnancy and 78% thought they were important to take during breastfeeding, but many women stopped using vitamins within months of delivery. Most women perceived the benefit for the baby and not for themselves. O'Rourke's group also stated that Hispanic women were surprised when asked if they took vitamins postpartum (postpartum women are at increased risk to be folic

acid deficient) and the Hispanic women asked O'Rourke's group "Should we be taking vitamins?" This suggests that women might take vitamins if they knew that they were important to take outside of pregnancy for the health of their future babies. The March of Dimes survey of 2001 reported similar findings, that 20% of survey respondents who weren't currently taking a vitamin would take a vitamin if their medical provider had suggested. The March of Dimes survey also found that in 1998, among women 18-45, only 7% knew that folic acid should be taken before pregnancy.<sup>(43)</sup> There are not only cultural beliefs of Hispanics that decrease use of PFA, but it appears that many women still haven't gotten the message that folic acid needs to be taken before pregnancy. If 91% of Hispanic women take vitamins during pregnancy for the health of their unborn child as reported by O'Rourke,<sup>(59)</sup> and if more than 50% of those pregnancies had been planned, as even our study predicts about Hispanic pregnancies, then this should suggest to public health planners that women planning a pregnancy would take a vitamin for the health of their yet-to-be-conceived baby if they knew when to take it. The knowledge of folic acid is there, the knowledge about when to take folic acid is not. Targeted interventions for increasing the knowledge of the benefits of PFA specifically for Hispanic intenders could substantially increase the use of PFA among Hispanic women.

Since knowledge remains the strongest predictor of PFA use among Hispanic women, then increasing the proportion of Hispanic women with this knowledge of the benefits of folic acid is important. Almost 40% of the Hispanic mothers didn't know of the benefits of PFA use compared to 19% of non-

Hispanics. The CDC's Folic Acid Education Program has tried to promote folic acid use by targeting Hispanics with a Spanish language campaign. Private marketing firms that have spent time and money to learn how and where to market to Hispanics have found Spanish radio and television the best ways to market to Hispanics. Using market research data could help direct intervention strategies to improve how a message is delivered to Hispanics.

Special mention needs to be made of WIC enrollment during pregnancy. WIC is a federal program to support the nutrition of women and infants. WIC teaches women about nutrition and healthy eating habits as well as supplying them with food coupons. Of the Oregon Hispanic mothers, 75% were enrolled in WIC during pregnancy. An earlier analysis of the entire cohort of Hispanics and non-Hispanics from the Oregon 1998-1999 PRAMS data found that women who had enrolled in WIC during their pregnancy were less likely to have taken PFA.<sup>(60)</sup> But among Hispanic women in this study, there was no difference in PFA use of those enrolled and not enrolled in WIC. If this was a first pregnancy, mothers were at WIC most likely for the first time. But if this pregnancy was not a first, many Hispanic women might have been enrolled in WIC previously with another pregnancy or child. Before 1998, WIC policy did not promote supplemental vitamin use, even for folic acid; WIC only promoted healthy eating habits (personal communication with WIC, state of Oregon). WIC workers promoted increasing folic acid intake through better diet, which has been shown to be ineffective to prevent NTDs. It is possible that women were given information about NTDs and folic acid thereby increasing knowledge, but only

given dietary advice and not information about vitamins. WIC is now promoting fortified cereal and vitamin use to get enough folic acid to protect against birth defects. Future researchers may be able to use PRAMS data to see whether this change in WIC policy has translated into increased PFA use among WIC clients. WIC might also be able to promote PFA use with vitamins and/or fortified foods more often than other health providers since women in WIC have scheduled visits with their new babies quite often in the first 2 years postpartum. During this postpartum time, while enrolled in WIC and before a Hispanic woman's next pregnancy, the need for multivitamins for the prevention of birth defects can be reinforced.

Pregnancy intention was the second strongest predictor of PFA use in this multivariate model. Pregnancy intention implies planning. Intended pregnancies allow time for pre-conception planning. An intended pregnancy was reported by 58% of Oregon Hispanic mothers and 21% of these mothers were using PFA. Rosenberg et al., in an analysis of the full Oregon cohort from PRAMS 1998-1999 (which included the Hispanic cohort of this study), found that pregnancy intention was a strong predictor of PFA and 45% of the Oregon PRAMS respondents with intended pregnancies were using PFA.<sup>(60)</sup> Hispanics intenders in the Oregon PRAMS survey reported less use of PFA vitamins than the entire overall PRAMS cohort of intenders: 21% use by Hispanic intenders compared to 45% use by the entire cohort of intenders.

Although this study shows that pregnancy intention is a strong predictor of PFA use, 41.5% of Hispanic pregnancies from this analysis were unplanned. The



March of Dimes calls these women the non-contemplators, or the “not me-not now” group.<sup>(61)</sup> Efforts to reach these non-contemplators nationally have been limited and unsuccessful. In 1999, the CDC, along with the March of Dimes, began a national campaign to target unintendeds. In the March of Dimes survey of 2001, among women who were not planning a pregnancy, only 27% reported taking a vitamin containing folic acid, which was down from 32% in the year 2000. Reaching out to the non-contemplators will take more than the possibility of a future pregnancy to convince them to take PFA. This group must feel that taking the vitamin folic acid helps them and helps them now. In fact, the marketing of folic acid to the non-contemplators might need to incorporate benefits to women besides benefit to their unborn, unplanned babies. A woman might be more inclined to take a multivitamin with folic acid everyday if she felt it was in her best interest to do so. The health message of taking a multivitamin (most MVs contain folic acid) rather than promoting only folic acid is an attempt to broaden the message that a non-contemplator might hear.

Older age was also a predictor of PFA use in the multivariate analysis of Hispanic women. Almost 24% of Oregon Hispanic mothers 30 years and older were taking PFA. In fact, there was a trend towards increased PFA use with age where 10.7% of women less than 20 years old took folic acid, 14.7% of women 20-29 years old took PFA and 23% of women 30 and older took PFA (see Table 3). In the March of Dimes survey of all women 18-44 years, women 18-24 used PFA less than older women (22% compared with 31% of those women 25-45). In our study, almost 51% of Hispanics were under the age of 25 and only 14% of

them were taking PFA (data from Oregon PRAMS 1998-1999 analysis not shown). Older women are more likely to be married and describe their pregnancy as intended. If they have other children, they might have heard the message about PFA use from health providers during other pregnancies. Older women also might be more inclined to take folic acid in a MV for their own health.

As much as older women with intended pregnancies who had knowledge of the benefits of folic acid could be predicted to be users of folic acid, the younger age group with unintended pregnancies and little knowledge of folic acid could be predicted to not take PFA. Rosenberg et al. found that adolescent unintenders were the least likely to take folic acid.<sup>(60)</sup> They suggest that one avenue to reach young unintenders could be through school health education programs. Adolescent unintenders and young women in general would benefit from school health education messages about PFA and the use of multivitamins.

Local health departments, WIC and schools can be avenues to promote PFA. Another effective avenue for Hispanics is Spanish language radio. Arbitron Research, a marketing company, has found that Hispanics rely on radio more than other groups and listen to radio an average of 22 hours per week.<sup>(62)</sup> If health officials could promote folic acid for women's health the way that oatmeal was promoted for cholesterol, and do this through Spanish radio, far more Hispanic individuals might be reached. Another way to approach Hispanics is through the mothers to their daughters. Hispanic mothers are traditionally the health promoters in the family.<sup>(63)</sup> If a mother believed that her adolescent daughters should take vitamins for their future health and for the health of the adolescent's

yet-to-be-born children, and they were told this by a pediatrician or other health practitioner, many Hispanic mothers might make sure that their daughters took vitamins, thereby incorporating a habit early in adolescent life.

#### **4.3 Comparison of characteristics and PFA use among foreign-born and US-born Hispanics**

Although mother's place of birth, US or foreign-born, was not found to be a predictor of folic acid use, it is important to evaluate the differences in these groups to help shape future intervention strategies. Foreign-born in this study were 93% Mexican, a very specific population. The Pew Hispanic Center has reported that Hispanics do not see themselves as one culture. They come from many different nationalities and report themselves as such. But the Pew group recognized that the biggest difference among all the Hispanics was between the Spanish-speaking immigrants and the English-speaking natives.<sup>(64)</sup> Our study did not know the dominant language of the foreign-born or the US-born, but there were substantial differences between these two populations as far as income, age, pregnancy intention and unhealthy behaviors (see table 6).

Although there was no statistical difference in folic acid use, the predictors of PFA use were different in these two groups. In fact, the predictors of folic acid use for US-born Hispanics (older age, more income and knowledge of benefits of folic acid) match those found for the general US population.<sup>(43)</sup> The predictors of PFA use in foreign-born were knowledge of benefit, pregnancy intention and early initiation of prenatal care in the first trimester. Early initiation of care

actually became a stronger indicator of PFA use in the foreign-born when US and foreign-born were separated for analysis.

Intended pregnancy was a strong predictor of PFA use (OR 2.4) among Hispanic women in this study. But when pregnancy intention was evaluated by mother's place of birth, pregnancy intention was only a predictor of folic acid use in foreign-born but not US-born Hispanic mothers. It was reported by McGlade et al. that among Mexico-born Hispanic women, there is strong cultural approval and support of motherhood.<sup>(65)</sup> A study by Frost and Oslack<sup>(66)</sup> reported that, in a cohort of teens in California, those with intentions to conceive were older, and in Hispanics, usually foreign-born. In their study, foreign-born Hispanic teenagers were almost 7 times more likely than their non-Hispanic White counterparts to have wanted or intended their pregnancy. Frost theorized that this might suggest that in young foreign-born Hispanics this shows an approval of early or younger family formations that is consistent with some aspects of Hispanic cultural norms for foreign-born women. The Hispanic PRAMS 1998-1999 cohort were mostly foreign-born and mostly of Mexican origin which might account for their increased proportions of intended pregnancies.

It might be inappropriate to compare education levels and draw conclusions based on amount of education of the foreign-born and the US-born women. The behavior and attitudes of a US-born Hispanic who drops out of school prior to reaching the 12<sup>th</sup> grade versus a foreign-born Hispanic woman who has achieved the appropriate education that is required of her in her country are probably different even when they fall under the same category of "less than a

high school education.” Our cohort of US-born Hispanic women were more likely to be unmarried, had smoked at some time and had reported drinking alcohol prior to pregnancy. This might be more indicative of an at-risk population that might be harder to convince of the benefits of folic acid more than our foreign-born women of the same education level. Of the foreign-born Hispanics with less than a 9<sup>th</sup> grade education, 16.9% of them took folic acid (compared with 0% in non-Hispanics) and of the foreign born with greater than 12<sup>th</sup> grade education there was 22% use (compared with 19.5% use among non-Hispanics).

The purpose of this comparison of foreign-born Hispanics and US-born Hispanics was to demonstrate that these two Hispanic groups in Oregon each need their own targeted interventions. The local health departments stand out as a place where major intervention can take place to reach Hispanics. About 57% of foreign-born Hispanics attended local health departments for their prenatal care compared to only 9.7% of non-Hispanics. Assuming that, in Oregon, most foreign-born are Spanish-speaking from Mexico, we would tailor an intervention at health clinics in language and culturally appropriate ways.

## 5. Limitations

There were a number of limitations to this study. The first is in regards to the question used to ascertain PFA use. Women were asked if they had taken the vitamin folic acid in the month before pregnancy. Women might have been taking a multi-vitamin (MV) before pregnancy and not realized that folic acid was contained in the vitamin. In fact, in later PRAMS surveys, the question of PFA use was changed to ask about MVs since most MVs contain folic acid. If Hispanic women had been consuming MVs but answered the question about folic acid use “no” because they didn’t realize folic acid was in their MV, it would have shifted our results towards the null. Studies which specifically ask about MV use still report a low use of vitamins among Hispanic women.

Another area of potential bias was in recall. This survey was completed 11 months to 16 months after conception. In a retrospective cohort study there is always the chance of recall bias. Women taking folic acid in the early weeks of pregnancy might have counted this as periconceptional. As a health care provider in obstetrics, I know that many women do not know when they conceived and, as O’Rourke’s group found in their study,<sup>(59)</sup> 91% of women take vitamins in pregnancy. If women said that they were taking vitamins BEFORE pregnancy, but it was really during pregnancy, we would have overestimated our outcome.

There is also the possibility of administration bias because of the mixed mode type of survey, mail and telephone. Mode effects are thought to be stronger in surveys of pregnant women because of the increased social pressure to avoid behaviors, such as smoking, that might harm the baby. In a study by the CDC,

women who responded by mail were more likely to report drinking, homelessness, and smoking than those interviewed by phone. But mail-responders were less inclined to report an unintended pregnancy. State estimates of unintended pregnancies would be 2-13% higher if reported as frequently by mail respondents as by phone respondents.<sup>(66)</sup>

One way to measure reliability is to ask two very similar questions. In the PRAMS question that directly asked about pregnancy intention (PRAMS question 5) there were 411 unweighted responses. In the question asking about birth control use and intention, (question 9) only 320 women could respond because the others had been using birth control and were skipped to another question. (see Methods as to the specific set-up of the questions). When these two questions were correlated there were 45 discordant answers, 9 who answered in question 5 that they had an unintended pregnancy, but answered they wanted to get pregnant in question 9, and 36 Hispanic women who had marked an intended pregnancy in question 5, but unintended in question 9. One must ask if bias occurred by misclassification of pregnancy intention as a predictor of folic acid use. Women would have been misclassified if they were intenders in question 5 but were actually unintenders as question 9 demonstrates. If they didn't take folic acid, and were listed as intenders in question 5, this would have diluted our estimation of intention as a predictor of use and brought our answer closer to the null. This would have made pregnancy intention (using question 5) less of a predictor of folic acid.

Another limitation of our study is that the results cannot be generalized to the Hispanic population of other states. The Hispanic population in Oregon is mostly Mexican. Hispanics from the east coast of the US might be more comprised of Puerto Ricans or Cubans. There are cultural and economic differences between these groups.

A final limitation that needs to be addressed is that this study measured only the use of PFA in vitamin form. Although a woman is assured adequate levels of folic acid with vitamin consumption, if a woman ate a cold cereal daily that had been fortified with 0.4 mg of folic acid per bowl, or ate a fortified grain diet that had a daily total of 0.4 mg of folic acid (she would need to eat four times more grain than predicted by the FDA's assessment, see Introduction 1.5 and 1.6), then she would also be achieving adequate fortified levels of PFA. Since many women are unlikely on a daily basis to be assured of adequate natural folate and enriched grain folic acid from their diets, PFA use by vitamin supplement is still considered by most public health experts to be the most reliable method.



## 6. Conclusions

Specific public health interventions directed at Hispanics to increase the use of PFA are warranted. Hispanics are the largest minority group in the US and Hispanics have higher rates of NTDs than other racial/ethnic groups. This study found that Hispanics not only differed from the non-Hispanic population in maternal characteristics and demographics, but that there were differences amongst Hispanics themselves depending on a mother's place of birth.

Compared to non-Hispanics, many Hispanics received their prenatal care at health departments and hospital clinics. Almost 60% of Hispanic women could be reached if interventions were targeted and tailored to these sites. The time during prenatal and post-natal care could be used to reinforce the need to always use MVs, whether pregnant or not.

This study analyzed predictors of PFA vitamin use among Hispanics and made suggestions about how to increase education and target at-risk segments of the Hispanic population. Decreasing the gap between knowledge of folic acid in the prevention of birth defects and use of PFA in vitamin form would be the aim of any future project. Focusing education at certain sites to reach the target population, educating care providers, and reducing barriers to access to care would be important to any project. Focus groups of Hispanic women in Oregon could help to define barriers to PFA use specific to this population. Since cultural beliefs impact a person's habits, it will also be important to understand what factors influence the use (or non-use) of vitamins among Hispanics.

This study also found that most Hispanics in Oregon are from Mexico. Hispanics in general are not a homogenous group. This information helps to better target the audience that any public health message needs to reach.

There are actually two ways to approach the need for increased PFA use among Hispanic women of reproductive age. The first is by increasing the number of Hispanic women who take a folic acid supplement in vitamin form (or a multivitamin with folic acid) daily and the second approach is to increase folic acid fortification in the food supply.

The second approach is more passive, and many public health officials believe far more attainable to optimize the amount of folic acid a woman gets daily. There should be an increase in the fortification of grains with folic acid to the maximum level so that a normal diet achieves all the folic acid one needs daily just from fortification. Increasing fortification would circumvent the socio-economic, cultural, dietary and behavioral changes that tend to be barriers to supplemental vitamin use.

For Hispanics specifically, one of the issues about fortification would be to increase the fortification of foods specific to Mexican dietary preferences. Although enriched corn flour is fortified with folic acid, corn meal is not. Corn meal, more than corn flour, is a staple in the daily Mexican diet found in tortillas and masa. Increased fortification would be most beneficial to Hispanics if corn products were also mandated to be enriched.

Changing dietary habits of women or changing federal FDA mandates are both uphill battles that warrant active participation by public health professionals if there is to be success.

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7. *Just before* you got pregnant, did you have health insurance through the Oregon Health Plan?
- No
  - Yes
8. When you got pregnant with your new baby, were you or your husband or partner using any kind of birth control?  
**Birth control means the pill, condoms, diaphragm, foam, rhythm, Norplant®, shots (Depo-Provera®), or ANY other way to keep from getting pregnant.**
- No
  - Yes • **Go to Question 10**
9. Why were you or your husband or partner not using any birth control? **Check all that apply.** the birth control I used
- I wanted to get pregnant
  - I didn't think I could get pregnant
  - I had been having side effects from
  - I didn't want to use birth control
  - I didn't think I was going to have sex
  - My husband or partner didn't want to use birth control
  - Other • Please tell us:
- 

**If you were not using birth control when you got pregnant, go to Question 12 on Page 3.**

- 10., *When you got pregnant* what kinds of birth control were you or your partner using?  
**Check all that apply.**
- Pill
  - Condoms
  - Foam, jelly, cream
  - Diaphragm
  - Norplant®
  - Shots (Depo-Provera®)
  - Withdrawal
  - Other • Please tell us:
- 
- Don't know/Not sure



11. Where were you or your partner getting your birth control method(s)?  
**Check all that apply.**
- A family planning clinic (for example, Planned Parenthood)
  - A health department clinic
  - A community health center
  - A private gynecologist
  - A general or family physician
  - A drug store or other store
  - Other • Please tell us: \_\_\_\_\_
  - No place
  - Don't know/Not sure

12. These questions ask about things you knew about birth control **before you got pregnant.**  
**For each thing, please circle N (No) or Y (Yes).**

	No	Yes
a. Did you know there was free or low cost birth control at health departments and Planned Parenthood clinics?	N	Y
b. Had you ever read or heard about emergency birth control (the "morning-after" pill)? <b>This special combination of regular birth control pills is used to prevent pregnancy up to three days after unprotected sex.</b>	N	Y

13. *Before you got pregnant,* did your health insurance cover the cost of birth control?  
**Check the best answer.**
- Yes, it covered all or part of the cost of my birth control method
  - Yes, it covered birth control, but *not the method I wanted*
  - Yes, it covered birth control, but *I didn't use a method*
  - No, it did not cover birth control
  - I didn't have any health insurance
  - Don't know/Not sure
14. Just before you got pregnant, how much did you weigh?      \_\_\_ Pounds  
• I don't know
15. How tall are you without shoes?      \_\_\_ Feet \_\_\_ Inches

The next questions are about the prenatal care you got during your most recent pregnancy.

Prenatal care includes visits to a doctor, nurse, or other health care worker before your baby was born to get check-ups and advice about pregnancy. It may help to look at a calendar when you answer these questions.

16. *At the time of your first pregnancy test* were you insured for prenatal care? · No  
· Yes  
· Don't know/Not sure
17. If you had insurance for prenatal care *at any time during your pregnancy*, what type? \_\_\_\_\_
18. If you had insurance for prenatal care, was it an employee benefit? · No  
· Yes  
· Don't know/Not sure
19. Did you have to pay out-of-pocket for any of your prenatal care? · No  
· Yes · How much? \_\_\_\_\_  
· Don't know/Not sure
20. Did the Oregon Health Plan pay for any portion of your prenatal care? · No  
· Yes  
· Don't know/Not sure
21. About how many weeks or months pregnant were you when you had your *first* visit for prenatal care? \_\_\_\_\_ Weeks or \_\_\_\_\_ Months  
· I did not go 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).**
22. Did you get prenatal care as early in your pregnancy as you wanted? · No  
· Yes · **Go to Question 24**  
· I did not want prenatal care · **Go to Question 27**

23. Did any of these things keep you from getting prenatal care as early in your pregnancy as you wanted? Check all that apply.
- I couldn't get an appointment earlier in my pregnancy
  - I didn't have enough money or insurance to pay for my visits
  - I didn't know that I was pregnant
  - I had no way to get to the clinic or doctor's office
  - I couldn't find a doctor or a nurse who would take me as a patient
  - I had no one to take care of my children
  - I had too many other things going on
  - Other • Please tell us:
- 

If you did not go for prenatal care, go to Question 27 on Page 6.

- |   | Month of Pregnancy                      | How many visits? |
|---|---|------------------|
| 24. During each month of your pregnancy, about how many visits for prenatal care did you have?<br><b>If you don't know exactly how many, please give us your best guess.</b><br><b>Don't count visits for WIC.</b><br><b>It may help to use the calendar.</b> | First Month                             | _____            |
|   | Second Month                            | _____            |
|   | Third Month                             | _____            |
|   | Fourth Month                            | _____            |
|   | Fifth Month                             | _____            |
|   | Sixth Month                             | _____            |
|   | Seventh Month                           | _____            |
|   | Eighth Month                            | _____            |
|   | Ninth Month                             | _____            |
| 25. Where did you go most of the time for your prenatal visits?<br><b>Don't include visits for WIC.</b><br><b>Check one answer.</b>   | • Hospital clinic                       |                  |
|   | • Health department clinic              |                  |
|   | • Private doctor's office or HMO clinic |                  |
|   | • Other • Please tell us:               |                  |
|   | _____                                   |                  |

26. During any of your prenatal care visits, did a doctor, nurse, or other health care worker talk with you about any of the things listed below?  
**For each thing, please circle N (No), Y (Yes), or DK (Don't Know).**

		No	Yes	Don't Know
a.	What you should eat during your pregnancy	N	Y	DK
b.	How smoking during pregnancy could affect your baby	N	Y	DK
c.	How secondhand smoke could affect your baby after birth	N	Y	DK
d.	Breast-feeding your baby	N	Y	DK
e.	How drinking alcohol during pregnancy could affect your baby	N	Y	DK
f.	Using a seat belt during your pregnancy	N	Y	DK
g.	Birth control methods to use after your pregnancy	N	Y	DK
h.	How using illegal drugs could affect your baby	N	Y	DK
I.	How to keep from getting HIV (the virus that causes AIDS)	N	Y	DK
j.	Getting your blood tested for HIV (the virus that causes AIDS)	N	Y	DK
k.	Physical abuse to women by their husbands or partners	N	Y	DK

27. 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  
 • I don't remember

28. *Before having your baby* who talked to you about immunizations for your newborn baby?  
**Check all that apply.**

- Obstetrician/gynecologist
- Pediatrician
- Midwife
- Health department employ
- Childbirth educator
- WIC
- Other • Please tell us:

29. At any time during your most recent pregnancy did a doctor or midwife suggest that you get a blood test for HIV (the virus that causes AIDS)?

- No
- Yes
- I don't know

30. At any time during your most recent pregnancy, did you have a blood test for HIV (the virus that causes AIDS)?
- No
  - Yes
  - I don't know
31. Have you ever heard or read that taking the vitamin folic acid can help prevent some birth defects?
- No
  - Yes
32. Were you taking the vitamin folic acid most days in *the month before* you became pregnant?
- No
  - Yes
  - I don't know

**The next questions are about smoking cigarettes and drinking alcohol.**

33. Have you smoked at least 100 cigarettes in your entire life?
- No · **Go to Question 40**
  - Yes
34. In the *3 months before* you got pregnant, how many cigarettes or packs of cigarettes did you smoke on an average day? (A pack has 20 cigarettes.)
- \_\_\_ Cigarettes or \_\_\_ Packs
  - Less than 1 cigarette a day
  - I didn't smoke
  - I don't know
35. In the *last 3 months* of your pregnancy, how many cigarettes or packs of cigarettes did you smoke on an average day?
- \_\_\_ Cigarettes or \_\_\_ Packs
  - Less than 1 cigarette a day
  - I didn't smoke
  - I don't know
36. 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
37. During your visits to your doctor or midwife for prenatal care or after the baby was born, did someone ask if you smoked, either by questionnaire or in person?
- Yes, before my baby was born
  - Yes, after my baby was born
  - Yes, both times
  - No

38. During your visits for prenatal care or after the baby was born, did your doctor or midwife ever advise you to quit smoking?
- Yes, before my baby was born
  - Yes, after my baby was born
  - Yes, both times
  - No
39. During your visits for prenatal care or after the baby was born, did your doctor or midwife offer advice or help on how to quit smoking?
- Yes, before my baby was born
  - Yes, after my baby was born
  - Yes, both times
  - No
40. During the *3 months before* you got pregnant, how many alcoholic drinks did you have in an average week? (A drink is: **One glass of wine. One wine cooler. One can or bottle of beer. One shot of liquor. One mixed drink.**)
- I didn't drink then
  - Less than 1 drink a week
  - 1 to 3 drinks a week
  - 4 to 6 drinks a week
  - 7 to 13 drinks a week
  - 14 or more drinks a week
  - I don't know
41. During the *3 months before* you got pregnant, how many times did you drink 5 or more alcoholic drinks at one sitting?
- \_\_\_\_ Times
- I didn't drink then
  - I don't know
42. During the *last 3 months* of your pregnancy, how many alcoholic drinks did you have in an average week?
- I didn't drink then
  - Less than 1 drink a week
  - 1 to 3 drinks a week
  - 4 to 6 drinks a week
  - 7 to 13 drinks a week
  - 14 or more drinks a week
  - I don't know
43. During the *last 3 months* of your pregnancy how many times did you drink 5 or more alcoholic drinks at one sitting?
- \_\_\_\_ Times
- I didn't drink then
  - I don't know

**Pregnancy can be a difficult time for some women. The next questions are about some things that may have happened to you before and during your most recent pregnancy.**

44. This question is about things that may have happened during the *12 months before you delivered* your new baby. This includes the months before you got pregnant. **For each thing, circle N (No) or Y (Yes). It may be helpful to use your calendar.**

	<b>No</b>	<b>Yes</b>
a. A close family member was very sick and had to go into the hospital	N	Y
b. You got separated or divorced from your husband or partner	N	Y
c. You moved to a new address	N	Y
d. You were homeless	N	Y
e. Your husband or partner lost a job	N	Y
f. You lost your job even though you wanted to go on working	N	Y
g. You and your husband or partner argued more than usual	N	Y
h. Your husband or partner said he did not want you to be pregnant	N	Y
I. You had a lot of bills you couldn't pay	N	Y
j. You were involved in a physical fight	N	Y
k. You or your husband or partner went to jail	N	Y
l. Someone very close to you had a bad problem with drinking or drugs	N	Y
m. Someone very close to you died	N	Y

45. Do you feel that you were ever treated differently by health care providers during your prenatal care, labor or delivery because of your:

**For each thing, circle N (No) or Y (Yes).**

	<b>No</b>	<b>Yes</b>
a. Race	N	Y
b. Culture	N	Y
c. Ability to speak or understand English	N	Y
d. Age	N	Y
e. Insurance status	N	Y
f. Neighborhood you lived in	N	Y
g. Religious beliefs	N	Y
h. Sexual orientation or lifestyle	N	Y
I. Marital status	N	Y
j. Desire to have out-of-hospital birth	N	Y

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





51. How many weeks old was your baby the first time you fed him or her anything besides breast milk? **Include formula, baby food, juice, cow's milk, or anything else.**
- \_\_\_ Weeks
- My baby was less than 1 week old
  - I haven't fed my baby anything besides breast milk

**If your baby was not born in a hospital, go to Question 53.**

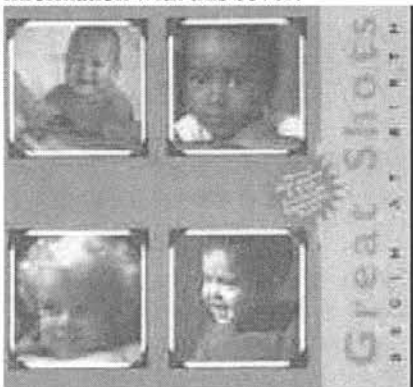
52. This question asks about things that may have happened at the hospital where your new baby was born. **For each thing, circle N (No) or Y (Yes).**

	No	Yes
a. Hospital staff gave you information about breast-feeding	N	Y
b. Your baby stayed in the same room with you at the hospital	N	Y
c. You breast-fed your baby at the hospital	N	Y
d. Hospital staff helped you learn how to breast-feed	N	Y
e. Your baby was fed only breast milk at the hospital	N	Y
f. Hospital staff told you to breast-feed whenever your baby wanted	N	Y
g. The hospital gave you a gift pack with formula	N	Y
h. The hospital gave you a telephone number to call for help about breast-feeding	N	Y
a. Hospital staff gave you information about breast-feeding	N	Y

53. *During your most recent pregnancy, what did you think about breast-feeding your new baby?*
- Check one answer.**
- I knew I would breast-feed
  - I thought I might breast-feed
  - I knew I would not breast-feed
  - I didn't know what to do about breast-feeding

54. Did any of these things prevent you from breast-feeding or stop you after you had started?
- Check all that apply.**
- I am still breast-feeding
  - I didn't want to breast-feed
  - I was planning to go to work or school
  - I tried but my baby didn't breast-feed very well
  - My baby was not with me
  - I think it's better for my baby to be bottle fed
  - I was taking medicine
  - I felt it was the right time to stop
  - My doctor told me to not to breast-feed
- Reason: \_\_\_\_\_
- Other • Please tell us: \_\_\_\_\_

55. *After having your baby,*  
did you see the packet of  
information with this cover?



(The packet is called  
"Great Shots Begin at Birth"  
and it's blue and orange.)

- No, I did not see the packet
- Yes, I saw the packet  
If yes, did you look it over?
  - No • Yes

56. *After your new baby was born,*  
did a doctor, nurse, or other health  
care worker talk with you about  
using birth control?

- No
- Yes

57. About how many hours a day,  
on average, is your new baby  
in the same room with  
someone who is smoking?

- \_\_\_\_ Hours
- My baby is never in the same room with  
someone who is smoking

58. Which of the following statements  
best represents your opinion on  
children's exposure to secondhand  
smoke?

- Second hand smoke is *not harmful* to children
- Secondhand smoke is *not very harmful* to  
children
- Secondhand smoke is *somewhat harmful* to  
children
- Secondhand smoke is *very harmful* to children
- Don't know

59. Is there anyone (else) in your  
household who smokes cigarettes,  
cigars, or pipes?

- No
- Yes

60. Which of the following statements best describes the rules about smoking inside your home:
- No one is allowed to smoke anywhere inside my home
  - Smoking is permitted anywhere inside my home
  - Smoking is not allowed in the baby's room but is allowed in other places in the house
  - Don't know
61. How do you put your new baby down to sleep most of the time? Check one answer.
- On his or her side
  - On his or her back
  - On his or her stomach
62. How often does your new baby sleep in the same bed with you? Check only one.
- Always
  - Almost always
  - Sometimes
  - Never
63. How many times has your baby been to a doctor or nurse for *routine* well baby care? Don't count the times you took your baby for care when he or she was sick.
- \_\_\_\_\_ Times
- My baby hasn't been for routine well baby care
  - **Go to Question 65**
- It may help to use the calendar.**
64. When your baby goes for routine well baby care, where do you take him or her? Check all the places that you use.
- Hospital clinic
  - Health department clinic
  - Private doctor's office
  - Other • Please tell us: \_\_\_\_\_
65. Listed below are some things about child safety. For each, circle N (No) or Y (Yes) or DK (Don't Know).
- |  | No | Yes | Don't Know |
|--|----|-----|------------|
| a. Your infant was brought home from the hospital in an infant car seat      | N  | Y   | DK         |
| b. Your baby always rides in an infant car seat                              | N  | Y   | DK         |
| c. Your home has a working smoke alarm that has been tested in the last year | N  | Y   | DK         |
| d. Any guns, rifles, or other firearms in your home are stored unloaded      | N  | Y   | DK         |
| e. Your hot water heater has been turned down or set to 120° F or below      | N  | Y   | DK         |

**Here are some questions about you after your baby was born.**

66. What is your health insurance coverage *now*?
- Insurance through my employer
  - Insurance through someone else's employer
  - Oregon Health Plan
  - CHAMPUS (Military)
  - Indian Health Care Program
  - Other · Please tell us:
- 
- I don't have any health insurance
  - I don't know
67. Are you or your husband or partner using any kind of birth control *now*?
- Birth control means having your tubes tied, vasectomy, the pill, condoms, diaphragm, foam, rhythm, Norplant®, shots (Depo-Provera®), or ANY other way to keep from getting pregnant.**
- No
  - Yes · **Go to Question 69**
68. What are your reasons for not using any birth control *now*?
- Check all that apply.**
- I am not having sex
  - I want to get pregnant
  - I don't want to use birth control
  - My husband or partner doesn't want to use birth control
  - I don't think I can get pregnant
  - I can't pay for birth control
  - I am pregnant now
  - Other · Please tell us:

**If you are not using any birth control now, go to Question 71.**

69. What kinds of birth control are you or your partner using *now*?  
**Check all that apply.**
- Tubes tied (sterilization)
  - Vasectomy (sterilization)
  - Pill
  - Condoms
  - Foam, jelly, cream
  - Diaphragm
  - Norplant®
  - Shots (Depo-Provera®)
  - Withdrawal
  - Other · Please tell us:
- 
- Don't know/Not sure
70. Where are you or your partner getting your birth control method(s) *now*?  
**Check all that apply.**
- A family planning clinic (for example, Planned Parenthood)
  - A health department clinic
  - A community health center
  - A private gynecologist
  - A general or family physician
  - A drug store or other store
  - Other · Please tell us:
- 
- No place
- Don't know/Not sure
71. Does your health insurance cover the cost of birth control *now*?  
**Check the best answer.**
- Yes, it covers all or a part of the cost of my birth control method
  - Yes, it covers birth control, but *not the method I want*
  - Yes, it covers birth control, but *I don't use a method*
  - No, it does not cover birth control
  - I don't have any health insurance
  - Don't know/Not sure

**Please answer the next questions about family income. It will help us see how income affects the health of Mother's, babies and families. All information will be kept private.**

72. What were the sources of your family income **during the past 12 months?** **Check all that apply.**
- Money from a job or business
  - Aid such as TANF (formerly AFDC), welfare, public assistance, general assistance, food stamps, or SSI
  - Unemployment benefits
  - Child support or alimony
  - Fees, rental income, commissions, interest, dividends
  - Social security, workers' compensation, veteran benefits, or pensions
  - Other · Please tell us:
- 

73. What is your family income, 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.**

a. Family income  
*before you got pregnant:* \$ \_\_\_\_\_ · Weekly or · Monthly or · Yearly

b. Family income now: \$ \_\_\_\_\_ · Weekly or · Monthly or · Yearly

Thank you for giving us your best guesses in Question 73. Now we are going to ask the same questions, but about *monthly* income. Your answers will help us judge health programs that are based on *monthly* income.

74. What is your monthly family income, before deductions and taxes? **Include ANY income or money you can use. All information will be kept private.**

- a. Monthly family income *before you got pregnant*
- 659 or below
  - 660 - 879
  - 880 - 1,109
  - 1,110 - 1,219
  - 1,220 - 1,639
  - 1,640 - 2,059
  - 2,060 - 2,469
  - 2,470 - 2,889
  - 2,890 - 3,309
  - 3,310 - 3,729
  - 3,730 or above

- b. Monthly family income *now*
- 659 or below
  - 660 - 879
  - 880 - 1,109
  - 1,110 - 1,219
  - 1,220 - 1,639
  - 1,640 - 2,059
  - 2,060 - 2,469
  - 2,470 - 2,889
  - 2,890 - 3,309
  - 3,310 - 3,729
  - 3,730 or above

75. How many people does this income support? **Count yourself.**

a. Number of people *before you got pregnant* \_\_\_\_\_

b. Number of people *now* \_\_\_\_\_





**Please use the space below for any comments you would like to make about the survey.**

**Thanks again!**

11/98 - 3/99  
prams18p.w pd

# Appendix B: Birth Certificate

**Adventist Health**  
Adventist Medical Center

PLEASE COMPLETE ALL THE WORKSHEET, SIGN AND RETURN TO THE NURSE.  
THANK YOU

Baby's Chart # \_\_\_\_\_  
Mother's Chart # \_\_\_\_\_  
Patient's Phone # \_\_\_\_\_  
Audit # \_\_\_\_\_

## BIRTH CERTIFICATE INFORMATION

Please complete this entire form and check the accuracy of the following: (Please Print)

<b>CHILD</b>	CHILD—NAME First Middle Last			Sex	DATE OF BIRTH (Month, Day, Year)	
	1	2	3a			
	TIME OF BIRTH	DELIVERING DOCTOR				
<b>MOTHER</b>	MOTHER—NAME First Middle Last			MAIDEN SURNAME	DATE OF BIRTH	STATE OF BIRTH (If not in U.S.A. name country)
	7a	7b	7c	7d		
	RESIDENCE—STATE	COUNTY	CITY, TOWN, OR LOCATION	STREET AND NUMBER		
	8a	8b	8c	7d		
	INSIDE CITY LIMITS (Yes or No)	ZIP CODE	MOTHER'S MAILING ADDRESS AND ZIP CODE (If same as above, leave blank)			
	8c	8f	9			
<b>FATHER</b>	FATHER—NAME First Middle Last			DATE OF BIRTH	STATE OF BIRTH (If not in U.S.A. name country)	
	10a			10b	10c	

### SIGNATURE OF PARENT

I certify that the personal information provided on this certificate is correct to the best of my knowledge and belief. (Signature of parent or other informant)

<b>MOTHER</b>	12 OF HISPANIC ORIGIN? (Specify No or Yes) (If yes, specify Cuban, Mexican, Puerto Rican, etc.)	13 Race—(e.g. White, Black, American Indian, etc.) (Specify below)	14 EDUCATION (Highest grade completed) Elementary or Secondary (0-12) College (1-4 or 5-)	15 MOTHER MARRIED? (At birth, conception, or any time between) (Yes or no)	16 HAS A CLOSE RELATIVE OF THIS NEWBORN HAD A HEREDITARY HEARING LOSS THAT EXISTED SINCE CHILDBOOD?
	12a <input type="checkbox"/> No <input type="checkbox"/> Yes Specify	13a	14a	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
<b>FATHER</b>	12b <input type="checkbox"/> No <input type="checkbox"/> Yes Specify	13b	14b	17 APGAR SCORE 17a 1 min. 17b 5 min.	18 BIRTH WEIGHT (Specify units)
<b>PA GIVEN PA REFUSED</b>	19 PREGNANCY HISTORY 19a Now living 19b Now dead	19c DATE OF LAST LIVE BIRTH (Month, Year)	OTHER TERMINATIONS (Spontaneous and induced) 19c Number _____ None <input type="checkbox"/>	19e DATE OF LAST OTHER TERMINATION (Month, Year)	20 CLINICAL ESTIMATE OF GESTATION (Weeks)
	19a Number _____ None <input type="checkbox"/>	19b Number _____ None <input type="checkbox"/>			
<b>SSN VERIF</b>	21 DATE LAST NORMAL MENSES BEGAN (Month, Day, Year)	22a PLURALITY—Single, twin, triplets, etc. (Specify)	22b IF NOT SINGLE BIRTH—Born first, second, third, etc. (Specify)	23 MONTH OF PREGNANCY PRENATAL CARE BEGAN First, second, etc. (Specify)	24 PRENATAL VISITS—Total number (If none, so state)
	25 SITE—PRENATAL CARE (Check all that apply) <input type="checkbox"/> Private Clinic Office <input type="checkbox"/> Co. Health Dept. <input type="checkbox"/> Other Public <input type="checkbox"/> Other	26 PRIMARY FINANCIAL COVERAGE OF THIS DELIVERY <input type="checkbox"/> Insurance <input type="checkbox"/> Self pay <input type="checkbox"/> Public Assistance <input type="checkbox"/> Other			
	27 AT THE TIME OF THIS REPORT WAS NEWBORN ALIVE? <input type="checkbox"/> No <input type="checkbox"/> Yes	28 NEWBORN REQUIRED INTERMEDIATE OR INTENSIVE CARE? <input type="checkbox"/> No <input type="checkbox"/> Yes	29 NEWBORN TRANSFERRED FOR MEDICAL NEED? (If yes, enter name of facility transferred to:)		
	30 Shall abstract of birth certificate be made available for publication or business contract lists? (Check one) <input type="checkbox"/> No <input type="checkbox"/> Yes	31 Social Security Number Requested <input type="checkbox"/> No <input type="checkbox"/> Yes	32 MONTHS MOTHER ON WIC PROGRAM? (0 - 9)	Mother SS#: _____ Father SS#: _____	
<b>33 MEDICAL FACTORS FOR THIS PREGNANCY</b> (Check all that apply)	01 <input type="checkbox"/> Anemia (Hct < 30/Hgb < 10)	02 <input type="checkbox"/> Cardiac disease	03 <input type="checkbox"/> Acute or chronic lung disease	04 <input type="checkbox"/> Diabetes (Chronic)	05 <input type="checkbox"/> Diabetes (Gestational)
	06 <input type="checkbox"/> Genital herpes	07 <input type="checkbox"/> Hydramnios/Oligohydramnios	08 <input type="checkbox"/> Hemoglobinopathy	09 <input type="checkbox"/> Hypertension, chronic	10 <input type="checkbox"/> Hypertension, pregnancy associated
	11 <input type="checkbox"/> Eclampsia	12 <input type="checkbox"/> Incompetent cervix	13 <input type="checkbox"/> Previous infant 4000+ grams	14 <input type="checkbox"/> Previous preterm or small for gestational age infant	15 <input type="checkbox"/> Renal disease
	16 <input type="checkbox"/> Rh sensitization	17 <input type="checkbox"/> Uterine bleeding	18 <input type="checkbox"/> No history available	19 <input type="checkbox"/> None	19 <input type="checkbox"/> Other (Specify) _____
	<b>34 COMPLICATIONS OF LABOR AND OR DELIVERY</b> (Check all that apply)				
	01 <input type="checkbox"/> Febrile (> 100°F. or 38°C.)	02 <input type="checkbox"/> Meconium, moderate/heavy	03 <input type="checkbox"/> Premature rupture of membrane (>12 hours)	04 <input type="checkbox"/> Abruptio placenta	05 <input type="checkbox"/> Placenta Previa
	06 <input type="checkbox"/> Other excessive bleeding	07 <input type="checkbox"/> Seizures during labor	08 <input type="checkbox"/> Precipitous labor (< 3 hours)	09 <input type="checkbox"/> Prolonged labor (> 20 hours)	10 <input type="checkbox"/> Dysfunctional labor
	11 <input type="checkbox"/> Breech/Malpresentation	12 <input type="checkbox"/> Cephalopelvic disproportion	13 <input type="checkbox"/> Cord prolapse	14 <input type="checkbox"/> Anesthetic complications	15 <input type="checkbox"/> Fetal distress
	16 <input type="checkbox"/> None	16 <input type="checkbox"/> Other (Specify) _____			
	<b>35 OTHER FACTORS FOR THIS PREGNANCY</b> (Complete all items)				
a. <input type="checkbox"/> Tobacco use during pregnancy	No <input type="checkbox"/> Yes <input type="checkbox"/>				
b. <input type="checkbox"/> Average number cigarettes per day					
c. <input type="checkbox"/> Alcohol use during pregnancy	No <input type="checkbox"/> Yes <input type="checkbox"/>				
d. <input type="checkbox"/> Average number drinks per week					
e. <input type="checkbox"/> Weight gained during pregnancy _____ lbs.					
f. <input type="checkbox"/> History available	No <input type="checkbox"/> Yes <input type="checkbox"/>				
g. <input type="checkbox"/> Other (Specify) _____					
<b>36 ANTENATAL PROCEDURES</b> (Check all that apply)					
01 <input type="checkbox"/> Amniocentesis	02 <input type="checkbox"/> Toccolysis	03 <input type="checkbox"/> Ultrasound	04 <input type="checkbox"/> No history available	05 <input type="checkbox"/> None	
05 <input type="checkbox"/> Other (Specify) _____					
<b>37 INTRAPARTUM PROCEDURES</b> (Check all that apply)					
01 <input type="checkbox"/> Electronic	02 <input type="checkbox"/> Induction of labor	03 <input type="checkbox"/> Stimulation	04 <input type="checkbox"/> None	05 <input type="checkbox"/> Other (Specify) _____	
<b>38 CONDITIONS OF THE NEWBORN</b> (Check all that apply)					
01 <input type="checkbox"/> Anemia (Hct < 39/Hgb < 13)	02 <input type="checkbox"/> Birth injury	03 <input type="checkbox"/> Fetal alcohol syndrome	04 <input type="checkbox"/> Hyaline membrane disease/RDS	05 <input type="checkbox"/> Meconium aspiration syndrome	
06 <input type="checkbox"/> Assisted ventilation (<30 min.)	07 <input type="checkbox"/> Assisted ventilation (>30 min.)	08 <input type="checkbox"/> Seizures	09 <input type="checkbox"/> None apparent	09 <input type="checkbox"/> Other (Specify) _____	
<b>39 METHOD OF DELIVERY</b> (Check all that apply)					
01 <input type="checkbox"/> Vaginal	02 <input type="checkbox"/> Vaginal birth after previous C-section	03 <input type="checkbox"/> Primary C-section	04 <input type="checkbox"/> Repeat C-section	05 <input type="checkbox"/> Forceps	
06 <input type="checkbox"/> Vacuum					
<b>40 CONGENITAL ANOMALIES OF NEWBORN</b> (Check all that apply)					
01 <input type="checkbox"/> Anencephalus	02 <input type="checkbox"/> Spina bifida/Meningocele	03 <input type="checkbox"/> Hydrocephalus	04 <input type="checkbox"/> Microcephalus	05 <input type="checkbox"/> Other central nervous system anomalies (Specify) _____	
06 <input type="checkbox"/> Heart malformations	07 <input type="checkbox"/> Other circulatory/respiratory anomalies (Specify) _____				
08 <input type="checkbox"/> Rectal atresia/stenosis	09 <input type="checkbox"/> Tracheo-esophageal fistula/Esoophageal atresia	10 <input type="checkbox"/> Omphalocele/Gastrochisis	11 <input type="checkbox"/> Other gastrointestinal anomalies (Specify) _____		
12 <input type="checkbox"/> Malformed genitalia	13 <input type="checkbox"/> Renal agenesis	14 <input type="checkbox"/> Other urogenital anomalies (Specify) _____			
15 <input type="checkbox"/> Cleft lip/palate	16 <input type="checkbox"/> Polydactyl/Syndactyl/Adactyl	17 <input type="checkbox"/> Club foot	18 <input type="checkbox"/> Diaphragmatic hernia	19 <input type="checkbox"/> Other musculoskeletal/inguinal anomalies (Specify) _____	
20 <input type="checkbox"/> Down Syndrome	21 <input type="checkbox"/> Other chromosomal anomalies (Specify) _____				
22 <input type="checkbox"/> None apparent	22 <input type="checkbox"/> Other (Specify) _____				

# Appendix C: Sampling Plan

Oregon PRAMS sampling plan (updated)						
Population of annual births (1997)						
	Hispanic	White	Amer Ind/ Black	AK Nat	API	Total
LBW	308	1782	99	43	131	2363
NBW	5424	32167	810	648	1732	40781
Total	5732	33949	909	691	1863	43144
Population proportions						
	Hispanic	White	Black	AK/AN	API	Total
LBW	0.71%	4.1%	0.23%	0.10%	0.30%	5.5%
NBW	12.6%	74.6%	1.9%	1.5%	0.30%	94.5%
Total	13.3%	78.7%	2.1%	1.6%	4.3%	
Initial allocation						
	Hispanic	White	Black	AK/AN	API	Total
LBW	21	400	44	25	28	518
NBW	379	400	356	375	372	1882
Total	400	800	400	400	400	2400
with Finite Population Correction (except in Hispanic & White/NBW)						
	Hispanic	White	Black	AK/AN	API	Total
LBW	21	327	30	16	23	418
NBW	379	400	248	238	306	1570
Total	400	727	278	254	329	1988
(FPC is Usually applied when the sampling fraction exceeds 1 in 10)						
Expected response rate						
	Hispanic	White	Black	AK/AN	API	Total
LBW	70%	70%	70%	70%	70%	70%
NBW	70%	80%	70%	70%	70%	70%
Inflated sample sizes based on these response rates						
	Hispanic	White	Black	AK/AN	API	Total
LBW	31	467	43	23	33	596
NBW	541	500	354	340	438	2172
Total	571	967	397	362	471	2768
Resulting sample fractions						
	Hispanic	White	Black	AK/AN	API	Total
LBW	10%	26.2%	43.7%	52.4%	25.3%	25%
NBW	10%	1.55%	43.7%	52.4%	25.3%	5%
Total	10%	2.85%	43.7%	52%	25%	6%
Sample fractions expressed as common fractions						
	Hispanic	White	Black	AK/AN	API	
LBW	1/10	1/4	9/20	1/2	1/4	
NBW	1/10	1/65	9/20	1/2	1/4	
Sample fractions expressed as decimals						
	Hispanic	White	Black	AK/AN	API	
LBW	0.100	0.250	0.450	0.500	0.250	
NBW	0.100	0.0154	0.450	0.500	0.250	
Resulting sample sizes						
	Hispanic	White	Black	AK/AN	API	Total
LBW	31	446	45	22	33	575
NBW	542	495	365	324	433	2159
Total	573	940	409	346	466	2734
						228 <== monthly
Expected yield (responses)						
	Hispanic	White	Black	AK/AN	API	Total
LBW	22	312	31	15	23	403
NBW	380	396	255	227	303	1561
Total	401	708	286	242	326	1963
<i>Unknown race &amp; other included in White stratum.</i>						