Research Article

Multivitamins, Folic Acid and Birth Defects: Knowledge, Beliefs and Behaviors of Hispanic Women in North Carolina

Leslie deRosset, Amy Mullenix, and Lei Zhang

ABSTRACT

Background: *Consumption of folic acid prior to conception can prevent up to 70% of neural tube defect (NTD)-affected pregnancies. In 1992, the U.S. Public Health Service (USPHS) issued a recommendation that all women of childbearing age capable of becoming pregnant consume 400 μg of folic acid daily to reduce their risk for a NTD-affected pregnancy. A 26% decrease in the overall NTD rate in the United States was observed between 1995 and 2000, after the fortification of cereal grain products. However, the NTD prevalence for Hispanics remains almost twice that of the general population, both nationally and in North Carolina.* ***Purpose:*** *To measure the baseline knowledge, beliefs and behaviors about multivitamins, folic acid and birth defects of Spanish-speaking Hispanic women ages 18-35 in North Carolina.* ***Methods:*** *Face-to-face oral interviews with Spanish-speaking Hispanic women were conducted by native Spanish-speaking data collectors using a culturally appropriate survey instrument in 12 North Carolina counties.* ***Results:*** *Thirty-three percent of the total respondents (n = 896) reported taking a daily multivitamin. Of those who reported currently planning a pregnancy or trying to become pregnant (n = 134), 22% reported taking a daily multivitamin. Knowledge was highest about birth defects (79%), followed by multivitamins (64%), and then folic acid (54%). Ninety-nine percent of respondents who did not take a daily multivitamin reported they would do so upon the recommendation of their health care provider.* ***Discussion:*** *Multivitamin consumption is low among this group at increased risk, and even lower among those actively attempting or contemplating pregnancy. Health care professionals play a critical role in increasing the knowledge and influencing the behaviors of this population.* ***Translation to Health Education Practice:*** *Folic acid education in all preconception encounters with Hispanic women is critical to address this health disparity and help prevent NTD-affected pregnancies.*

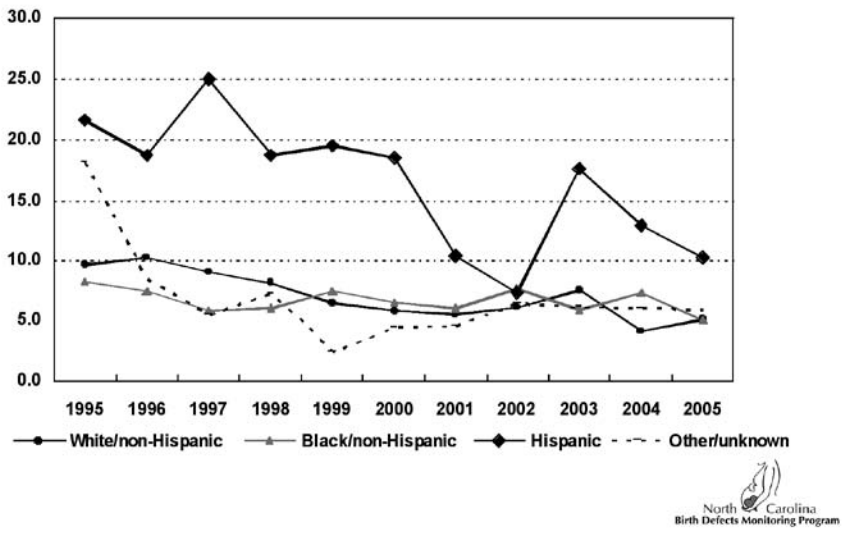
deRosset L, Mullenix A, Zhang L. Multivitamins, folic acid and birth defects: knowledge, beliefs and behaviors of Hispanics in North Carolina. Am J Health Educ. *2009;40(3):155-164. This paper was submitted to the* Journal *on July 30, 2008, revised and accepted for publication on January 21, 2009.*

BACKGROUND

Neural tube defects (NTDs) are serious birth defects of the spine (spina bifida) and brain (anencephaly) that affect approximately 3,000 pregnancies each year in the United States.[1] These defects occur early during pregnancy, often before a woman knows she is pregnant. Folic acid, a B vitamin, can prevent up to 70% of NTDs if consumed daily before conception and in the early weeks of pregnancy.[1] For this reason, the U.S. Public Health Service (USPHS) issued a recommendation in 1992 that all women of childbearing age in the United States capable of becoming pregnant consume 400 μg of folic acid daily to reduce their risk for a NTD-affected pregnancy.[1-3] In 1998, the U.S. Food and Drug Administration mandated that folic acid be added to cereal grain products. A 26% decrease in the NTD rate was observed from the period prior to fortification (1995-1996) to the period following fortification (1999-2000).[1] However, despite this overall national decline, racial/ethnic

Leslie deRosset is the Latino campaign coordinator at the North Carolina Folic Acid Council/March of Dimes, 6504 Falls of Neuse Road, Suite 100, Raleigh, NC 27615; E-mail: lderosset@marchofdimes.com. Amy Mullenix is the statewide campaign coordinator at the North Carolina Folic Acid Council/ March of Dimes, 6504 Falls of Neuse Road, Suite 100, Raleigh, NC 27615. Lei Zhang, is a PhD Candidate at the University of North Carolina, School of Education, Chapel Hill, NC.

Figure 1. Prevalence of Total Neural Tube Defects by Maternal \Race/Ethnicity, North Carolina, 1995-2005



disparities in NTD rates still exist, with Hispanic women having higher NTD prevalence than other racial/ethnic groups.[2, 4]

Disparities in NTD prevalence also exist in North Carolina. Although the overall NTD prevalence in the state declined following fortification and educational efforts, rates are highest among Hispanic women. In North Carolina, the overall NTD prevalence decreased nearly 40% from 9.95/10,000 live births in 1995/1996 to 6.05/10,000 live births in 2004/2005.[5] The prevalence among Hispanics declined 43% during the same time period, from 19.94/10,000 to 11.54/10,000, but remained almost double that of the overall prevalence (Figure 1).[5] North Carolina's NTD trends parallel NTD prevalence declines and racial/ethnic disparities observed in other states with large Hispanic populations.[5-9]

Folic Acid Consumption and Knowledge

The Healthy People 2010 objective regarding folic acid consumption aims to increase the percentage of all women of childbearing age who consume 400 µg of folic acid daily to 80%.[10] Between 2005 and 2007, the percent of all women of childbearing age who reported consuming a daily vitamin with folic acid increased from 28% to 40%; however, more than half of all women of childbearing age are still not consuming a daily vitamin containing folic acid.[11] Differences exist in the profiles of women who are most likely to consume a vitamin. These women tend to be white, older than age 24, with educational levels greater than high school, and with annual incomes greater than $25,000.[11-13]

Similar to NTD prevalence, racial/ethnic disparities also exist in folic acid consumption. Nationally in 2001 – 2002, 13% of Hispanic women reported daily supplement use of 400 µg of folic acid, compared to 31% of non-Hispanic white women and 14% of non-Hispanic black women.[2] This lower consumption rate among Hispanics is also mirrored in North Carolina, with only 14% of Spanish-speaking Hispanic women ages 18-44 reporting daily consumption of a vitamin with folic acid, compared with 43% of non-Hispanic white women and 33% of non-Hispanic African American women.[14]

In addition to higher NTD prevalence and lower folic acid consumption, Hispanic women are also less likely to have heard of folic acid than women of other races/ethnicities.[11, 15, 16] Nationally, awareness of folic acid has increased to 81%, but Hispanics still have lower awareness than non-Hispanics (71% vs. 82%, respectively).[11]

Hispanic women in North Carolina reflect this disparity in awareness about folic acid, reporting lower levels of knowledge about the importance of folic acid as compared to other racial/ethnic groups.[14, 17] In 2005, 79% of English-speaking Hispanic women in North Carolina were aware of the benefits of taking folic acid compared to 86% of non-Hispanic white women. Similarly, Spanish-speaking Hispanic women in North Carolina were less likely than non-Hispanic white women to be aware of the role folic acid plays in the prevention of some birth defects (52% vs. 62%, respectively).[17]

In addition to racial/ethnic differences observed in folic acid knowledge, differences have also been reported based on other demographic characteristics. Women with greater than high school education; women who identify as white; women who enter prenatal care early; and women who report planned or intended pregnancies have highest reported knowledge about folic acid.[11, 18]

Folic Acid Education

Public health campaigns have been developed at the national, state and local levels to educate all women of childbearing age about the importance of folic acid consumption. Some efforts have targeted all women of childbearing age; others have targeted Hispanics specifically.

One national campaign targeting all women of childbearing age was the *Think Ahead* campaign implemented by the March of Dimes Foundation in the mid-1990s. The primary goal of the campaign was to increase awareness about the importance of taking 400 µg of folic acid daily for the prevention of NTDs. The *Think Ahead* campaign also provided funds for the development of several state folic acid councils.[19] Since the late 1990s, the U.S. Centers for Disease Control and Prevention (CDC) has been developing and disseminating free folic acid materials to health care professionals and the public. Most recently, the CDC completed research to gauge levels of folic acid awareness, knowledge and consumption among different subgroups of Spanish-speaking Hispanic women in the United States. Educational

messages and materials were then developed and disseminated to meet the unique needs of this audience.[20]

In 2001, focus groups were conducted with Hispanic women in three states to study common vitamin myths and consumption barriers.[21] Two commonly identified myths were: the belief that vitamins cause weight gain and the belief that vitamins will fix health problems rather than prevent them. In addition to these myths, Hispanic women have also identified other barriers to folic acid consumption, including the belief that vitamins are only necessary for women actively contemplating pregnancy and the idea that Hispanic women traditionally neglect their personal health because they are focused on taking care of others.[13, 20, 21] Other studies have focused on specific Hispanic health beliefs, such as fatalism, or the belief in "God's will."[13, 20, 21] If Hispanic women view NTD-affected pregnancies as "God's will," fatalism may become a barrier to the consumption of multivitamins and the prevention of NTDs.[13, 21]

North Carolina Folic Acid Campaign

In response to the high prevalence of NTDs in North Carolina, the North Carolina Chapter of the March of Dimes Foundation, in collaboration with other public health partners, formed the North Carolina NTD Task Force in 1994 (currently called the North Carolina Folic Acid Council). The goal was to increase consumption of folic acid among women of childbearing age in order to decrease NTD prevalence. Ongoing campaign efforts, along with food fortification, have contributed to a nearly 40% decline in NTD prevalence in North Carolina over a ten-year period.[5]

The North Carolina Folic Acid Council (NCFAC) uses a multi-faceted health education campaign targeting both consumers and health care providers (clinical staff, dental hygienists, health educators and outreach workers). Consumers are reached by: regional coordinators working across the state, partnerships with local community organizations (health and non-health), lay health education, and media. Health care providers are reached through office presentations, continuing medical education and professional conferences.

In response to the disparity in NTD prevalence in North Carolina, the NCFAC launched a statewide Spanish-language campaign in 2006 to identify and address those factors that impact folic acid consumption among Hispanic women.

PURPOSE

The primary purpose of this study was to measure the baseline knowledge, beliefs and behaviors about multivitamins, folic acid and birth defects of Spanish-speaking Hispanic women ages 18 - 35 in North Carolina. A secondary purpose was to determine the most effective outreach strategies for reaching Hispanic women in North Carolina.

METHODS

Instrument

Many studies use instruments that are literal translations of English surveys rather than developing culturally adapted instruments in the language of study participants. This study adapted existing state and national surveys to meet the specific needs of the Hispanic community in North Carolina. The March of Dimes National Gallup Poll, the Pregnancy Risk Assessment Monitoring System (PRAMS) survey and the Behavioral Risk Factor Surveillance System (BRFSS) surveys were all used to formulate questions for the North Carolina survey instrument. To ensure that questions were culturally and linguistically appropriate, they were then translated and adapted using the most familiar and commonly accepted Spanish-language terms among Hispanics from Mexico and Central/South America. The survey questions were concise and appropriate for participants with varying literacy levels.

Although it was not possible to conduct a full psychometric analysis of the content validity, a senior survey methodologist conducted a methodological review of the instrument prior to pre-testing and several changes were made. Next, the revised survey instrument and consent form were reviewed by two Hispanic bilingual/bicultural public health professionals followed by two native Spanish-speaking community educators. Based on their review, further adjustments were made to make the instrument more linguistically appropriate. Internal consistency was checked during the editing process and four questions were revised accordingly. Finally, the survey instrument and consent form were pilot tested twice in public places with Spanish-speaking women ages 18 – 35 in a non-selected area of North Carolina.

The final survey instrument included 39 questions (true/false, open-ended and/or closed-ended). Twelve questions assessed the demographic profile of the respondent; 16 measured knowledge or behavior; six asked about the participant's beliefs or attitudes toward multivitamins, folic acid and/or birth defects; and five focused on where the respondent would go for more information about these topics.

Sampling Design

Several levels of sampling were employed to reach the desired number of participants for this study. First, all 100 North Carolina counties were stratified into urban and rural based on U.S. Census definitions. The measurement size for each county was the number of foreign-born Spanish-speaking women ages 18-34 in each county according to the 2000 U.S. Census. This measurement yielded a total of 94,865 potential participants. After excluding counties with too few potential participants and counties with previous exposure to campaign messages, the sampling frame was reduced to 84,310 Spanish-speaking women ages 18-34, a coverage rate of approximately 89% for the first stage of selection. (Note: At the final stage of selection, we screened for women 18-35 years in age rather than 18-34. However, there is no reason to believe that 35-year-old women are distributed throughout the state differently than 18-34 year olds. We believe the coverage estimate is still accurate for our priority population of 18-35 year olds.)

Second, the remaining counties were paired based on their similarities in size of the Hispanic population and divided into urban and rural strata according to the U.S. Census. Using probability proportional to

the combined size of the pair, six pairs of counties were randomly selected for participation (6 urban and 6 rural), resulting in a total of 12 selected counties. From each pair, one of the counties was then randomly assigned as the intervention county (Table 1).

Within the 12 counties selected, public locations such as shopping centers, parks, laundromats, restaurants, churches, flea markets, supermarkets and *tiendas* (stores selling Latin-American items), which were likely to be frequented by a large number and wide cross-section of Hispanic women, were chosen as places to conduct the survey. Locales in each county were chosen by the program staff based on professional referrals, word of mouth, resource guides, the Internet, the local chambers of commerce and the yellow pages.

The final stage of selection was a random intercept sample. This design mirrors a mall intercept sample, providing an opportunity to survey hard-to-reach population in relatively fast and inexpensive manner.[22] Using this method, the Spanish-speaking data collectors approached potential respondents in assigned locations and conducted interviews until the desired number of respondents had been reached. In order to reduce potential duplication of respondents, each county had a team of at least three data collectors conducting surveys simultaneously in different parts of the county. This reduced the possibility that potential respondents could be selected more than once.

Data Collectors

The employment and training of native Spanish-speaking data collectors was essential to successful data collection in this study. Sixteen native Spanish-speaking Hispanic women living in North Carolina were trained as data collectors. Data collectors received 10 hours of hands-on training about the survey instrument and protocols during which they learned how to identify and approach potential respondents, avoid selection bias and determine eligibility. During data collection, on-site technical support was also provided to the data collectors by program staff.

Eligibility Criteria

To participate in the study, Hispanic women had to be between the ages of 18 - 35, born in Latin America (Mexico, Central, or South America), Puerto Rico, Spain, the Dominican Republic or Cuba, reside in one of the 12 participating counties and speak Spanish as the primary language in the home. Women who did not meet the eligibility criteria or declined to participate were thanked for their time and offered free folic acid educational materials. The number of women who declined to participate was not recorded. Eligible women that agreed to participate were read aloud a Spanish-language consent form by the data collector. A signed copy of the consent form was provided to participants prior to proceeding with the survey. The questions were read aloud to participants and answers were recorded by the data collectors on paper versions of the survey. Upon completion of the survey, participants received free folic acid educational materials including brochures and a small reminder item, such as a nail file or key chain. The survey took 10 to 15 minutes

Table 1. Randomly Assigned Rural and Urban County Pairs with Intervention (I) and Comparison (C) County Assignments

County (U=Urban; R=Rural)	Pairing	Intervention (I) or Comparison (C)	Total Population	Percent of population eligible for participation
Wake (U)	P1	I	627,846	1.4%
Mecklenburg (U)	P1	C	695,454	1.7%
Onslow (U)	P2	I	150,355	1.7%
Alamance (U)	P2	C	130,800	1.7%
Robeson (U)	P3	I	123,339	1.1%
Davidson (U)	P3	C	147,241	0.8%
Beaufort (R)	P4	I	44,958	0.8%
Davie (R)	P4	C	34,835	0.9%
Vance (R)	P5	I	42,952	1.1%
Hoke (R)	P5	C	33,646	1.8%
Duplin (R)	P6	I	49,063	2.5%
Lee (R)	P6	C	49,040	2.8%

Population estimates are based on the 2000 U.S. Census

to complete. A total of 1,112 participants completed the survey.

Statistical Analysis

Of the total 1,112 completed surveys, 896 (81%) were eligible for analysis. Of the remaining 19% of the surveys ineligible for analyses, most (95%) could not be analyzed because the data collector failed to record a response on one or more of the eligibility questions. The remaining 5% of the surveys were not eligible for analysis because more than 75% of the questions lacked responses.

A power analysis determined that the sample size was sufficient for detecting a small to moderate effect size (0.1 to 0.5) with at least 80% power for all the key analyses. Post-stratification weights were calculated so that they summed to county and urban/rural population totals for the non-English speaking Hispanic population, according to the 2000 U.S. Census data for North Carolina. The use of these weights increases the validity of the results by controlling for coverage bias and correcting errors in population coverage. Frequencies, chi squares, logistic regressions and multivariate analyses were performed by the authors in collaboration with the Odum Institute for Social Sciences Research and Survey Research Unit at the University of North Carolina, Chapel Hill. SPSS version 14, SAS Survey Procedure version 9.1, and STATA version 9 were used. To be considered significant, *P* values had to be equal to or less than 0.05.

Table 2. Demographic Characteristics

Characteristic	N	%
Age		
18 - 24	291	33
25 - 30	327	37
31 – 35	278	31
Country of Origin		
Mexico	709	79
Central America	154	17
South America	16	2
Other Latin American countries	17	2
Emigrated from (Country of Origin)		
Urban area	336	38
Rural area	552	62
Highest Education Completed		
Primary School or less	351	40
Middle School	183	21
High School or greater	347	39
Time in North Carolina		
0 to 5 years	568	64
6 to 10 years	262	30
11 years or longer	55	6
Time in United States		
0 to 5 years	479	54
6 to 10 years	284	31
11 years or longer	125	14

RESULTS

Demographics

Thirty-seven percent of the total respondents were between the ages of 25 – 30 and 79% of the total respondents were from Mexico (Table 2). Sixty-two percent of the total respondents emigrated from a rural area in their home country. Only 39% of the respondents reported having a high school education or greater. Ninety-four percent of the respondents were recent immigrants to North Carolina, having been in the state for 10 years or less. Finally, 85% of the respondents were recent immigrants to the United States as defined by the U.S. Census Bureau (living in the United States for 10 years or less) with 54% having immigrated within the last five years and 31% between six and 10 years ago.

Multivitamin Consumption

Of those included in the analysis (n = 890), 33% reported taking a daily multivitamin, but only 22% of those who reported actively attempting or planning pregnancy (n = 134) were taking a daily multivitamin. Of those included in the analysis who reported not actively attempting or planning a pregnancy (n = 570), 28% were taking a daily multivitamin. A series of multivariate analyses examined predictors of multivitamin use. Respondents who emigrated from a country other than Mexico (OR = 2.15, CI = 1.22 – 3.81) and were between the ages of 25 – 35 (OR = 2.37, CI = 1.67 – 6.85 and OR = 2.84, CI = 1.37 – 5.87, respectively) had significantly increased odds of taking a daily multivitamin (Table 3). Emigration from a rural area in their country of origin significantly decreased the odds of consuming a daily multivitamin (OR = 0.47, CI = .27 - .82). Educational level, time in the United States and pregnancy status (previously pregnant and currently trying/planning to become pregnant) were not significant predictors of daily multivitamin use.

Among those not taking a daily multivitamin (n=596), the most common reasons reported for not doing so included: no particular reason (34%), don't need a multivitamin (28%), and forgetfulness (22%) (Table

Table 3. Predictors of Daily Multivitamin Use (N = 694)

	OR	CI	P value
Country of origin			
Mexico	1.0	REF	
Other countries*	2.15	1.22 – 3.81	.0.01
Emigrated from (Country of origin)			
Urban area	1.0	REF	
Rural area	.47	.27- .82	0.01
Age			
18 - 24	1.0	REF	
25 - 30	2.37	1.67 – 6.85	0.00
31 - 35	2.84	1.37 -5.87	0.01
Highest education completed			
Primary School or less	1.0	REF	
Middle School	.84	.39 -1.81	0.65
High School or more	1.09	.60 – 1.97	0.78
Pregnancy Status			
Never previously been pregnant	1.0	REF	
Previously pregnant	1.16	.56 – 2.40	0.68
Pregnancy Status			
Not currently planning/trying	1.0	REF	
Yes, currently planning/trying	.79	.39 – 1.60	0.51
Time in the United States			
0 to 5 years	1.0	REF	
6 to 10 years	.73	.41 – 1.30	0.28
11 years or longer	1.05	.53 – 2.21	0.83

*Other countries includes: all respondents from Central and South America as well as Puerto Rico, Cuba, Spain and the Dominican Republic.

Table 4. Reasons Given for Not Consuming a Daily Multivitamin

	N	%
No particular reason	197	34
I do not think I need them	163	28
I forget to take it	127	22
I do not like the side effects	56	10
They cause weight gain	39	7
I do not have information about multivitamins	29	5
I am not planning a pregnancy	29	5
I feel I have a balanced diet	20	4

4). Ninety-nine percent of respondents who did not take a daily multivitamin reported they would do so if their health care provider recommended it. In an open-ended question, 50% of respondents (n = 444) stated they would go to their health care provider to receive additional information about multivitamins and/or folic acid.

Knowledge and beliefs about multivitamins, folic acid and birth defects

To measure knowledge, respondents were asked a series of questions about multivitamins, folic acid and birth defects. Respondents were most likely to report having read, seen, or heard something about birth defects (79%), followed by multivitamins (64%), and then folic acid (54%). Only respondents that answered the knowledge question with an affirmative response went on to specify their knowledge about each of these topics in open-ended questions (Table 5). In the open-ended knowledge questions, 22% gave a general definition of birth defects, while 18% mentioned a connection between birth defects and spina bifida, folic acid, or multivitamins. Fifty-two percent reported that multivitamins were good for their health but only 22% mentioned they should be taken prior to pregnancy. Thirty-six percent reported that folic acid could help prevent birth defects, but again only 21% indicated that folic acid should be taken prior to pregnancy.

In a series of dichotomous true/false questions, 81% of the respondents believed taking folic acid would reduce the risk of women having a baby with a birth defect, but only 29% believed that women planning a pregnancy should take a multivitamin. Forty-four percent believed that a prescription was necessary to buy multivitamins, 46% believed that multivitamins would cause them to gain weight, 68% indicated that multivitamin consumption would increase their appetite and 25% thought that vitamins were expensive.

Significant predictors of multivitamin knowledge included: being from a country other than Mexico, being between the ages of 25 - 30, educational attainment of high school or greater and reporting a previous pregnancy (Table 6). Significant predictors of folic acid knowledge included: educational attainment of high school or greater, reporting a previous pregnancy and currently being pregnant. Educational attainment of middle school or greater as well as residing in the United States between six and 10 years significantly in-

creased the odds of being knowledgeable about birth defects.

DISCUSSION

Despite some limitations, this study offers unique insights into a population that is rarely surveyed in such a comprehensive way. The combination of an anonymous face-to-face survey in Spanish and the use of native Spanish-speaking data collectors produced a high level of participant comfort with the survey, thereby allowing us to survey approximately one percent of the sampling frame.

It has been well-documented that taking a daily multivitamin with folic acid prior to pregnancy can significantly reduce the risk of having a NTD-affected pregnancy and that Hispanics have a significantly higher risk of having a NTD-affected pregnancy than other racial/ethnic groups.[1-4, 7-9] Approximately half of all pregnancies in the United States and in North Carolina are unplanned.[23-25] This study found that one-third of Spanish-speaking women ages 18 - 35 took a daily multivitamin. Although this number is higher than in some other national and state studies,[11, 13, 15] it is still well below the national Healthy People 2010 objective of 80%.[10] Of particular concern is that fewer respondents who were actively attempting or planning a pregnancy (22%) were taking a daily multivitamin than those who were not (28%). In the multivariate analysis, actively attempting or planning a pregnancy did not predict multivitamin use. Clearly these new immigrants have not received adequate education about the importance of folic acid prior to pregnancy, nor have they changed their behavior.

Study results confirm that Spanish-speaking Hispanic women in North Carolina lack awareness about the importance of multivitamins and folic acid. Less than one-quarter of the respondents identified that multivitamins or folic acid (22% and 21%, respectively) should be taken prior to pregnancy and only 20% identified that folic acid was good for the development of the brain and spine of the fetus. The connection between multivitamins, folic acid and birth defects prevention must be strengthened through public health education. Emphasis must also be placed on the importance of folic acid consumption prior to pregnancy.

Table 5. Knowledge of Birth Defects, Multivitamins and Folic Acid

Birth Defects	% Responded (N=688)
Gave a general definition	22
Missing body parts/deformities	18
Mentioned spina bifida/birth defects, multivitamins	18
Caused by alcohol, drugs, smoking	14
Parents don't take care of themselves	6
Multivitamins	**% Responded (N=565)**
Are good for health	52
Should be taken during pregnancy	33
Should be taken before pregnancy	22
Give energy/prevent fatigue	12
Diet Supplement	11
Folic Acid	**% Responded (N=470)**
Prevents birth defects	36
Is good for baby during pregnancy	34
Should be taken before pregnancy	21
Is good for brain/spine development	20
Is good for your health	18

In this study, although 81% believed taking folic acid would reduce the risk of women having a baby with a birth defect, only 33% of the total respondents took a daily multivitamin. This disparity reflects a common disconnect between health beliefs and health behaviors. One alternate explanation for low multivitamin consumption in this study may be that Hispanic women do not recognize multivitamins as an important source of folic acid. In either case, education is needed to help Hispanic women recognize their increased risk, identify multivitamins as an important source of folic acid and provide tools to help them begin and continue a multivitamin habit.

This study also confirms some vitamin myths and consumption barriers among Hispanics found in previous studies,[13,21] such as a prescription is needed to purchase multivitamins and multivitamins cause weight gain. These myths and barriers can create significant challenges to starting a multivitamin habit and may contribute to lower multivitamin consumption among Hispanic women.

Ninety-nine percent of respondents who did not take a daily multivitamin reported they would do so if instructed by their health care provider vs. 88% of all women of childbearing age nationally,[11] demonstrating the high level of respect Hispanic patients have for health care providers. Unfortunately, our survey did not allow us to estimate the percent of women who reported having a regular health care provider; but other state data show that only 29% of Hispanic women in North Carolina report having a regular health care provider compared to 73% of white females and 68% of African American females.[14]

There are five limitations to this study. First, since the survey was limited to North Carolina, the results may not be generalizable to other states. States with similar immigrant populations (i.e., recent immigration, primarily from Mexico) might benefit more from the results than states with more established immigrant populations. Second,

Table 6. Predictors of Knowledge

	Knowledge of Multivitamins N = 833		Knowledge of Folic Acid N = 832		Knowledge of Birth Defects N = 820	
	OR	CI (95%)	OR	CI (95%)	OR	CI (95%)
Country of origin						
Mexico	1.0	Ref	1.0	Ref	1.0	Ref
Other countries*	2.51	1.42 – 4.46	1.57	0.93 – 2.65	1.18	0.62 -2.26
Emigrated from (country of origin)						
Urban area	1.0	Ref	1.0	Ref	1.0	Ref
Rural area	0.66	0.41 – 1.05	1.06	0.67 – 1.68	0.62	0.36 – 1.06
Age of Participant						
18 – 24	1.0	Ref	1.0	Ref	1.0	Ref
25 – 30	2.46	1.48 – 4.10	1.58	0.95 – 2.62	1.59	0.89 – 2.86
31 – 35	1.58	0.91 – 2.74	1.19	0.69 – 2.06	1.75	0.92 – 3.34
Highest education completed						
Primary school or less	1.0	Ref	1.0	Ref	1.0	Ref
Middle school	1.48	0.86 – 2.56	1.62	0.96 – 2.73	1.87	1.03 – 3.42
High school or more	2.35	1.43 – 3.85	3.81	2.26 – 6.43	2.24	1.20 – 4.19
Pregnancy Status						
Never been pregnant	1.0	Ref	1.0	Ref	1.0	Ref
Previously been pregnant	1.74	1.05 – 2.89	2.78	1.60 – 4.82	1.60	0.88 – 2.90
Pregnancy Status						
Not currently pregnant	1.0	Ref	1.0	Ref	1.0	Ref
Currently pregnant	1.66	0.93 – 2.95	2.15	1.23 – 3.77	0.76	0.40 – 1.44
Time in the United States						
0 to 5 years	1.0	Ref	1.0	Ref	1.0	Ref
6 to 10 years	1.38	0.88 – 2.17	1.21	0.77 – 1.91	2.00	1.13 – 3.55
11 + years	1.87	0.92 – 3.83	1.38	0.71 – 2.67	1.06	0.46 – 2.44

*Other countries includes: all respondents from Central and South America as well as Puerto Rico, Cuba, Spain and the Dominican Republic.

selection bias can occur with random intercept sampling. This technique encourages data collectors to approach as many women as possible that appear to fit the pre-selected criteria. Therefore, some eligible participants might have been overlooked because they did not appear to fit the criteria, while others might have been included or excluded based on personal biases of the data collectors. Additionally, selection bias might have occurred due to the sampling timeframe and locations. Women who did not do their shopping on Saturdays or Sundays (the days when the interviews were conducted), did not shop in public places, and/or did not have access to transportation would not have had the potential to be selected. Third, the response rate was not recorded by the data collectors. Fourth, approximately 20% of the completed surveys were considered ineligible for analyses because they lacked information on eligibility criteria. It is unclear whether women who were excluded for this reason significantly differed from those included in the analysis. Finally, this survey relied on self-reported vitamin use, which could potentially result in an overestimation of the number of women consuming multivitamins or folic acid supplements due to potential for social desirability.

TRANSLATION TO HEALTH EDUCATION PRACTICE

Consistent with national studies, this research found that approximately two-thirds of Spanish-speaking Hispanic women in North Carolina do not take a daily multivitamin with folic acid nor have adequate information about the prevention of birth defects. Even fewer women planning or attempting pregnancy were consuming a daily multivitamin with folic acid. Directly addressing the myths and barriers that Hispanic women hold as part of all preconception health education may help to increase multivitamin consumption. Country of

origin, area in their country of origin, age, educational level, pregnancy status and time in the United States are all related to multivitamin, folic acid or birth defect knowledge as well as to multivitamin consumption; therefore, they should be considered when providing education for Hispanic women.

Multivitamin, folic acid and birth defect education should be incorporated into all non-prenatal care settings and general health education for all Spanish-speaking women of childbearing age because of their increased risk. Health care providers should be prepared at every available opportunity to counsel women prior to pregnancy about this risk and the potential benefits of preconceptional folic acid consumption. Integrating this counseling into all forms of preconception care, including well-woman and sick visits, community outreach efforts, home visits and other programs that provide health education to Hispanic women can positively affect multivitamin consumption and increase knowledge about folic acid and birth defects.

Health care providers play a vital role as influencers for Hispanic women's decisions about multivitamin consumption. Along with obstetricians and gynecologists, general practitioners, pediatricians, nurses, dentists, health educators and outreach workers must be acutely aware of their important role as disseminators of this information. In addition to private providers, public providers should also be aware of their role with Hispanic women, as they are more likely than other racial/ethnic groups to use public health departments, community health centers, or free or low cost clinics.[26, 27] Collaboratively, health care specialists and outreach workers can encourage Hispanic women to identify a regular health care provider, thereby improving consistent care from one year to the next as well as the building of a trusting relationship between patient and health care provider.

Education levels among survey respondents were low. Health education efforts should include pictures, videos and low-literacy brochures. Health education with immigrants can also be successfully conducted in a variety of community settings: English as a Second Language (ESL) classes, church groups, community based Hispanic organizations and public schools.

These recommendations will move us closer to meeting the Healthy People 2010 objective that 80% of all women of childbearing age consume 400 µg of folic acid every day[10] and could significantly reduce the disparity in NTD prevalence.

REFERENCES

1. Spina Bifida and Anencephaly Before and After Folic Acid Mandate, United States, 1995 – 1996 and 1999 – 2000. *MMWR CDC Surveillance Summaries*. 2004; 53;17:362-365.

2. Yang QH, Carter HK, Mulinare J, Berry RJ, Friedman JM, Erickson JD. Race-ethnicity differences in folic acid intake in women of childbearing age in the United States after folic acid fortification: findings from the National Health and Nutrition Examination Survey, 2001 – 2002. *Am J Clin Nutr.* 2007; 85:1409-1416.

3. U.S. Center for Disease Control and Prevention: Recommendations for the use of folic acid to reduce the number of cases of spina bifida and other neural tube defects. *MMWR CDC Surveillance Summaries*. 1992; 41(RR-14).

4. William LJ, Rasmussen SA, Flores A, Kirby, RS, Edmonds LD. Decline in the Prevalence of Spina Bifida and Anencephaly by Race/Ethnicity. *Pediatrics.* 2005; 116:580-586.

5. Mullenix A, Stock J, Meyer R, Major J, Morgan, L. "Prevalence of neural tube defects in North Carolina, 1995/1996 to 2004/2005." Presented at the 11th Annual Meeting of the National Birth Defects Prevention Network, Washington D.C. February 2008.

6. Morgan AJ, Bibeau D. Folic Acid-Related Dietary Preferences and Health Interests of Latino Women Living in North Carolina. North Carolina Department of Health and Human Services, State Center for Health Statistics Studies. April 2004; No. 141.

7. March of Dimes Launches National Folic Acid Education Campaign Targeted to Hispanic Women. *March of Dimes.* 2001. Available at: http://search.marchofdimes.com. Accessed February 15, 2008.

8. Feuchtbaum LB, Currier RJ, Riggle S, Roberson M, Lorey FW, Cunningham GC. Neural Tube Defect Prevalence in California (1990 – 1994): Eliciting Patterns by Type of Defect and Maternal Race/Ethnicity. Genet Test. 1999. 3;3 :265-272.

9. Prevalence of Neural Tube Defects and Folic Acid Knowledge and Consumption – Puerto Rico, 1996 – 2006. *MMWR CDC Surveillance Summaries*. 2008; 57;1:10-13.

10. U.S. Department of Health and Human Services (HHS). Healthy People 2010. 2nd ed. 2000. Available at: http://www.health.gov/healthypeople. Accessed March 30, 2008.

11. Improving Preconception Health: Women's Knowledge and Use of Folic Acid. March of Dimes Folic Acid Surveys. Conducted by: The Gallup Organization. December 2007. Available at: http://www.marchofdimes.com/peristats/pdfdocs/2007FA_report.pdf. Accessed April 15, 2008.

12. Balluz LS, Kieszak SM, Philen RM, Mulinare J. Vitamin and Mineral Supplement Use in the United States, Results from the Third National Health and Nutrition Examination Survey. *Arch Family Medicine.* 2000; 9:258-262.

13. Jasti S, Siega-Riz AM, Bentley ME. Supplement Use in the Context of Health Disparities: Cultural, Ethnic and Demographic Determinants of Use. *J Nutr*. 133: 2010S – 2013S, 2003;7.

14. Behavioral Risk Factor Surveillance System (BRFSS). North Carolina Department of Health and Human Services, State Center for Health Statistics. 2006. Available at: http://www.schs.state.nc.us/SCHS/brfss/2006/nc/female/fday1844.html. Accessed May 3, 2008.

15. Kannan S, Menotti E, Scherer HK, Dickinson J, Larson K. Folic Acid and the Prevention of Neural Tube Defects: A Study of Awareness Among Latina Women of Childbearing Age Residing in Southeast Michigan. *Health Promot Pract.* 2007; 8 (1): 60 – 68.

16. Chacko MR, Anding R, Kozinetz CA, Grover JL, Smith PB. Neural Tube Defects: Knowledge and Preconceptional Prevention Practices in Minority Young Women. *Pediatrics.* 2003; 112:536-542.

17. Pregnancy Risk Assessment Monitoring System (PRAMS). North Carolina Department of Health and Human Services, State Center for Health Statistics. 2005. Available at: http://www.schs.state.nc.us/SCHS/prams/2005/FOLIC.html. Accessed November 10, 2007.

18 Ahluwalia IB, Lyon DK. Are women with recent live births aware of the benefits of folic acid? *MMWR CDC Surveillance Summaries.* 2001; 50(RR06): 3 – 14.

19. Daniel KL. Observations from the CDC: Using health communications research to reduce birth defects. *J Womens Health.* 1999; 8:19 – 22.

20. Prue CE, Flores AL, Panissidi P, Lira A. But I've already had a healthy baby: Folic acid formative research with Latina mothers. *J Womens Health.* 2008;17:1257-1268.

21. March of Dimes Birth Defects Foundation, Hispanic Women's Health Initiative, January 16, 2001. White Plains, NY.

22. Rice R, Hancock L. The mall intercept: A social norms marketing research tool. *The Report on Social Norms.* 2005;4:4-7.

23. Finer LB, Henshaw SK. Disparities in Rates of Unintended Pregnancy in the United States, 1994 and 2001. *Perspectives on Sexual and Reproductive Health.* 2006; 38(2):90 -96. Available at: http://www.guttmacher.org/pubs/psrh/full/3809006.pdf. Accessed: January 12, 2009.

24. Pregnancy Risk Assessment Monitoring System (PRAMS). North Carolina Department of Health and Human Services, State Center for Health Statistics. 2006. Available at: http://www.schs.state.nc.us/SCHS/prams/2006/PREG_TRY.html.Accessed: January 12, 2009.

25. DCR Report: Section A: Unplanned Pregnancy in the United States among all women. The National Campaign to prevent teen and unplanned pregnancy. Available at: http://www.thenationalcampaign.org/resources/dcr/. Accessed: January 12, 2009.

26. Racial and Ethnic Health Disparities in North Carolina: Report Card. North Carolina Department of Health and Human Services, Office of Minority Health and Health Disparities, State Center for Health Statistics. Available at: http://www.schs.state.nc.us./SCHS/pdf/ ReportCard2006. pdf. Accessed October 23, 2007.

27. Salganicoff A, Ranji UR, Wyn R. Women and Health Care: A National Profile. The Kaiser Family Foundation Report. 2005. Available at: http: www.kff.org/womenshealth/whp07075pkg.cfm. Accessed October 23, 2007.