

# Improving Folic Acid Consumption in Women at Risk for Neural Tube Defects in Florida

Jessica C. Bishop-Royse, MS, Elizabeth Jensen, BA, Melanie Simmons, PhD

## ABSTRACT

Two providers who participated in the Florida VitaGrant program, a site providing early childhood services to primarily Mexican Hispanic families (Site A) and a site providing home visiting services to pregnant women and families with infants (Site B), are presented as alternative models for improving folic acid levels in reproductive aged women in Florida. Site A distributed multivitamins and education in the context of health education provided to women in a group setting, once a month. Site B provided the services primarily through home visits of varying frequency. Folic acid knowledge and consumption were measured at program initiation and at a follow-up date to determine levels of improvements for both sites, by demographic characteristics. Analyses comparing age, race, and ethnicity of women served by Site A were compared to women served by Site B. These programs were then evaluated in-depth with respect to baseline and follow-up levels of folic acid knowledge and consumption of their participants. Site A seemed to be somewhat more effective at improving the knowledge and consumption patterns of its participants than Site B, although both experienced significant improvement overall. Initially, women who received services from Site A reported lower levels of baseline knowledge and multivitamin consumption than Site B clients. However, Site A clients reported higher levels of knowledge and consumption at follow up than Site B clients. The findings suggest that free multivitamin distribution and pre/interconception education can dramatically increase MVC among all participants. Program delivery that takes place in the context of a group setting may be a particularly effective way to reach women at-risk for neural tube defects.

*Florida Public Health Review, 2009; 6, 36-45.*

## Introduction

Public health research has suggested that the diets of pre-conceptional women in the U.S. have deteriorated in the past 30 years (Putnam & Gerior, 1999). This may have important implications for some health diseases and conditions such as neural tube defects (which are thought to occur when maternal levels of folate are not adequate to support early neurological activity). The Centers for Disease Control and Prevention (CDC) have recommended that regardless of their intention to get pregnant, women of childbearing ages should consume an adequate amount of folate, in order to prevent neural tube defects ("Recommendations for folic acid," 1992). Despite the fortification of many foods with folic acid (the synthetic form of folate, a form of B-vitamin), current levels of dietary folate are inadequate for preventing neural tube defects (Watkin, 1998; Werler, Hayes, Louik, Shapiro, & Mitchell, 1999). Because folate is usually added to multivitamins, the CDC has recommended that all women aged 14-45 consume multivitamins containing 0.4 mg (400µg) of folic acid on a daily basis ("Recommendations for folic acid," 1992). Some research has estimated that daily consumption of multivitamins (MVC) that contain folic acid can prevent up to 70% of NTDs (Posner et al., 2006;

Buttriss, 2004; Czeizel & Dudás, 1992; MRC Vitamin Study Research Group, 1991).

Even though folic acid supplements have been found to reduce the risk of neural tube defects (if taken prior to and in the first few weeks of pregnancy), a substantial proportion of women of childbearing age do not consume folic acid enriched supplements (MMWR 2008; Goldberg et al., 2006). Since a large proportion of pregnancies in Florida and the United States are unplanned (Williams et al., 2006), women who are not taking folic acid are placing their unplanned pregnancies at an increased risk for a NTD (Atrash, Johnson, Adams, Cordero, & Howse, 2006). Additionally, other maternal characteristics also seem to be associated with higher occurrence of NTDs, such as young maternal age (aged 14-19), Hispanic ethnicity (Czeizel & Dudas, 1992), Mexican origin (Suarez et al., 2000, Blatter et al., 1994), low socioeconomic status (Blatter, Van der Star, & Roeleveld, 1994; Eichholzer, Tonz, & Zimmerman, 2006; and Wasserman, Shaw, Selvin, Gould, & Syme, 1998) and foreign born nativity status (Correia & Hauser 2007). In Florida, women who are poor, Hispanic, non-Hispanic Black and younger than 25 years old are less likely to be consuming folic acid compared to other groups and

are at increased risk for having a NTD affected pregnancy (Florida BRFSS, 2007).

During the period 1998-2004 in Florida, about one infant in every 2000 live births was born with a neural tube defect (NTD) such as spina bifida and anencephaly (Correa & Hauser, 2007). To reduce the occurrence of neural tube defect affected births, the Florida Department of Health and the March of Dimes Florida Chapter cooperated on a joint project, implementing the Florida VitaGrant Program. This program provided free preconception educational materials and multivitamins to women of childbearing age. The purpose of the VitaGrant Program was to prevent neural tube defect affected births by addressing some of the socio-demographic factors known to be associated with NTDs, through education and multivitamin supplementation, which has been shown to be effective (Smithells, Sheppard, & Schorah, 1976; Slattery & Janerich, 1991; Botto, Moore, Khoury, & Erickson, 1999; Platzman, 1998).

The VitaGrant Program focused on increasing preconception health knowledge as well as folic acid awareness and consumption among at-risk and medically underserved women of childbearing age. This was accomplished through preconception education, multivitamin distribution provider training and a statewide media campaign. A unique component of the VitaGrant Program was that culturally appropriate educational materials were distributed to Hispanic women in order to better inform Spanish-speaking program participants of the benefits and importance of taking folic acid. Throughout Florida, over 265 non-profit organizations and agencies joined in the effort to distribute folic acid enriched multivitamins as well as preconception education materials. The partnership of these organizations resulted in the distribution of over half a million bottles of vitamins to program participants.

Presented here are the findings from a process evaluation that assessed the improvement in folic acid consumption and knowledge that occurred for participants at two different sites, a site providing early childhood services to primarily Mexican Hispanic families (Site A) and a site providing home visiting services to pregnant women and families with infants (Site B). This evaluation was conducted using data collected throughout participation in the Florida VitaGrant Program that distributed free multivitamins containing folic acid and provided education and training for women aged 14-45 in Florida during the period 2005-2007.

## Methods

There are several types of data that were generated during the course of the VitaGrant

Program. First, program providers collected information on the distribution of bottles of vitamins. The age, race and ethnicity of women who received vitamins was recorded and compiled into a centralized dataset that provided aggregate statistics to program administrators to determine how well “at-risk” populations were reached by the program. VitaGrant program providers were surveyed about their experiences in conducting this public health improvement effort (combining education with vitamin distribution), which make up the second source of data. VitaGrant clients were interviewed at initiation and then again at follow-up, when they returned for services. Their answers composed the third source of data, which is the focus of this particular investigation.

Each time VitaGrant clients were interviewed, it was with a program provider in the context of a health or social service setting. The instrument contained a variety of measures, which asked about pregnancy history, folic acid knowledge, and folic acid consumption as well as barriers to daily multivitamin consumption (MVC) and demographic measures such as age, ethnicity and race. At baseline, the knowledge item was in the form of a question which was posed to program participants, asking, “Based on what you have heard, seen or read, should a woman take multivitamins *before* her pregnancy or not?” To which the participants answered “Yes,” “No,” “Don’t Know,” and “Maybe.” The “consumption” item is a combination of three other measures; one that asked “Do you currently take multivitamin pills or supplements?” Another interview question asked, “Are any of these a multivitamin?” both of which were answered either “Yes,” “No,” or “Don’t Know/Not Sure.” Finally, a question that asked about the frequency of consumption, “How often do you take this vitamin pill or supplement?” The answer choices for this item were “Times per day \_\_\_\_\_,” “Times per week \_\_\_\_\_,” “Times per month \_\_\_\_\_,” and “Don’t know/Not sure \_\_\_\_\_.”

The survey was changed somewhat at follow-up such that the knowledge item was a checklist of statements that were selected if the participant answered affirmatively. The knowledge item asked, “What have you read, heard or seen about folic acid?” The answer choices provided were: “Prevents birth defects/Neural Tube Defects/Spina Bifida,” “Need is greater in pregnancy,” “Should be taken before pregnancy,” “Good for you/Good to take/Important,” “Important for baby development,” and “Don’t know.” The questions about consumption are as follows: “Are you currently taking the multivitamins provided?” and “How often?” A question about barriers to daily MVC was added to

the follow-up survey, which asked “What are the challenges to taking it every day?” where the participants selected “Can’t remember,” “Pill too big,” “Makes me sick,” “Doesn’t seem important,” and “Other.”

## Site A

### Background

Florida ranks 4<sup>th</sup> among U.S. states with the largest Hispanic populations in the United States (Guzman, 2001). Much of the risk for Hispanics in Florida stems from the fact that the majority are foreign-born Mexican, who have been shown to have increased odds of having neural tube defect births (Correia & Hauser, 2007). It has been suggested that much of the increased risk of neural tube defect births for Hispanics is due to low maternal folate levels, perhaps driven by the diets of foreign-born women. Since up to 70% of neural tube defect births are preventable (Buttriss, 2004; Czeizel & Dudás, 1992, MRC Vitamin Study Research Group, 1991) with adequate levels of maternal folate, it would seem that it is in the best interest of public health practitioners to ensure that Hispanic women have access to an adequate supply of folate.

### Target Population

Site A serves primarily Mexican-Hispanic families residing in and around southeast Florida. Most of the women who received VitaGrant Program services through Site A, had children who received early childhood education services through Site A.

### Program Description

Site A is a non-profit, non-sectarian organization that provides child development services to farm worker families. Mexican-origin women aged 25-29 comprised the majority of women who received services at Site A. Most of the women who received services at Site A interacted with the program daily as their children received childcare services through the site. Additionally, women who received services at Site A attended monthly meetings with other women and program staff where they received education and free multivitamins. Despite the large number of women who had already given birth, most were unaware of the preventative effects of folic acid when they were enrolled in the program.

## Results of the Program Evaluation

### Participation

Most of the 291 women receiving services at Site A were between the ages of 25 and 29 years old (36.77%). Women older than 30 made up about 32% of the clients served, where women younger than 25 comprised about 27%. Over 91 percent of the women served by Site A were Hispanic (the majority of which reported Mexican-Hispanic ethnicity). Non-

Hispanic Whites and Blacks made up 3.44% and 2.75% of the remaining participants.

**Table 1. Demographic Characteristics of Site A Participants**

Site A		
Age	n	%
Less than 25 years old	80	27.49%
25-29	107	36.77%
Older than 30 years old	94	32.30%
Missing	10	3.44%
<b>Total</b>	<b>291</b>	<b>100.00%</b>
Race and Ethnicity	n	%
Non-Hispanic White	10	3.44%
Non-Hispanic Black	8	2.75%
Hispanic (99% Mexican)	267	91.75%
Unknown/missing	6	2.06%
<b>Total</b>	<b>291</b>	<b>100.00%</b>

### Outcomes

**Knowledge.** Table 2 shows that of the women who participated in the VitaGrant program through Site A, only 3.4% overall reported at baseline that they were aware of the preventative effects of folic acid for birth defects. At follow up, this increased to over 91% who indicated that they were aware of the preventative effects of folic acid for birth defects. In terms of age,  $\leq 5\%$  or less of participants in each of the age groups knew that folic acid prevents NTDs. Knowledge increased substantially at follow-up, such that almost 90% of women younger than 25 years, 89% of women ages 25 to 29 years, and about 96% of women age 30 and over reported improved knowledge. Among Hispanic women, 99% of whom were of Mexican-origin, only 3% reported knowledge at baseline. This figure increased to almost 92% at follow-up.

**Consumption of multivitamins (MVC).** At baseline, only 6.2% of Site A clients consumed multivitamins (Table 2). Following education and program participation, this increased to 87.6%. Additionally, women aged 30 and older were more likely to be taking folic acid than their younger counterparts at follow-up. At follow-up, non-Hispanic Whites reported a 200% improvement in folic acid compliance. The improvement in folic acid consumption for non-Hispanic Blacks was also substantial, although the sample size was too small to demonstrate significance. At baseline all reported that they were not currently taking folic acid. At follow up, all non-Hispanic Blacks reported taking folic acid. Whereas Site A was successful in changing the knowledge and behavior of all women who received

services there, Hispanic women, particularly those of Mexican origin were particularly well served.

#### *Barriers*

Of the women who reported less than daily multivitamin consumption at Site A, over 65% said that the size of the pill was a factor in why they didn't take the vitamin everyday (Table 3). Less than 11% of the women with sub-optimal multivitamin consumption reported that they could not remember to take the pill. Unknown and other reasons constituted 20.9% of the reasons that women did not take the pill daily.

Women of all ages were likely to report the size of the pill as a barrier to daily multivitamin consumption, with women aged 25-29 more likely to report this as an issue than their younger and older peers. Remembering to take the pill was also a significant barrier for daily multivitamin consumption for older and younger women (12.5% and 17.6%, respectively), but not for women aged 25-29, only 4.4% of whom reported this as a barrier. For the non-Hispanic Black and White women who received services from Site A, all (n=8) reported the size of the pill as a barrier to daily MVC. Among the Hispanic women served, over 60% reported this as a barrier.

#### *Best Practices*

The Site A model for multivitamin education and distribution was successful at reaching its mostly Mexican-Hispanic participants in large part due to the settings in which Site A clients received services as well as the provision of culturally relevant educational materials. Women who received services at Site A participated in group educational meetings conducted by Spanish-speaking program providers. Additionally, clients interacted with the VitaGrant program on a near daily basis as they sought childcare at the facility that housed Site A services. The provision of culturally specific educational materials contributed greatly to the success of the VitaGrant program at this site.

We suggest that in order to improve daily folic acid consumption among Hispanic women, other intervention programs should pay particular attention to the size of the multivitamins distributed. Distributing free multivitamins and culturally relevant health education materials in the context of a group setting seems to be an effective way to improve the daily folic acid consumption of Hispanic women. Daily interaction with the VitaGrant participants may also improve the folic acid consumption patterns of program participants.

## **Site B**

### *Background*

Although Black women are not considered at high risk for NTDs (Bishop & Keller, 2008) as Mexican-Hispanic women, they have an increased high risk for poor infant health outcomes. Black women have higher rates of preterm and low birth weight births and infant mortality. As such, the VitaGrant sought to reach Black women with preconception education as well as multivitamins in an effort to prevent other poor birth outcomes.

### *Target Population*

The population consisted of young, interconceptional non-Hispanic Black women residing in west central, Florida. These women are referred for services to Site B based upon the results of a screening tool administered through obstetrical and hospital providers.

### *Program Description*

Site B is a case management agency that focuses on preventing low birth weight, infant mortality and child maltreatment. Site B serves a large proportion of non-Hispanic Black women less than 25 years of age. In general, women who received VitaGrant Program services from this Site were offered services as a part of an array of services provided, primarily through paraprofessionals providing home visits at varying intervals.

## **Results of the Program Evaluation**

### *Participation*

The 161 women who received VitaGrant services through Site B were overwhelmingly young and non-Hispanic Black (Table 4). A substantial proportion of women who received VitaGrant Program services at Site B were younger than 25 years old (47.2%). Women aged 25-29 made up only about 24% and women older than 30 made up just over 26% of those of who received services. Non-Hispanic Black women made up 60.25% of Site B participants, where non-Hispanic Whites and Hispanics made up 26.1% and 8.7%, respectively.

### *Outcomes*

Knowledge. Table 5 shows that participants who received VitaGrant Program services at Site B increased their knowledge that folic acid prevents birth defects dramatically from baseline to follow-up. At baseline, all Site B participants were similarly uninformed about folic acid, such that about 81% did not know that folic acid could prevent birth defects. Women younger than 25 years old and older than 30 were least likely to report awareness that folic acid prevented birth defects (18.4% and 19.0% respectively) than women aged 25-29 who were slightly more likely to be aware of the preventative effects of folic acid for birth defects (20.5%).

Knowledge that folic acid prevents NTDs increased over 183% from baseline to follow-up for all groups of women who received services at Site B. This increase was most substantial for the youngest women (those 24 years old and younger). At program onset, only about 18% of these women reported that they were aware of the preventative effects of folic acid. This increased over 236% at follow-up where over 79% of these women reported knowledge that folic acid prevents birth defects. Women aged 25-29 and over 30 experienced improvements in knowledge by 236.5% and 251%, respectively.

Whereas non-Hispanic Whites reported the highest levels of knowledge at follow-up (81.0% reporting that they were aware that folic acid prevents birth defects), non-Hispanic Blacks showed the greatest overall improvement in knowledge. The increase in knowledge from baseline to follow-up was over 408% for non-Hispanic Blacks, 299.3% for Hispanics and was only 183.2% for non-Hispanic Whites. Whereas the improvement in knowledge for Hispanic women was substantial, they had the lowest level of knowledge at the beginning and end of the program, which underscores the difficulty reaching this high-risk population and the importance of delivering health education in a manner that is culturally specific.

Daily consumption of multivitamins (MVC). At program onset, only 26% of women receiving services at Site B were consuming multivitamins 5-7 days a week, which increased to almost 73% at follow-up (an increase of about 176%). At baseline, the oldest women in the study were most likely to respond that they were taking folic acid 5-7 days a week (47.6%). At follow-up, 66.7% of these women reported routine vitamin consumption (an improvement of only about 40%). Women aged 25-29 were more likely to be consuming multivitamins at baseline and follow-up (25.6% and 76.2% respectively) than women younger than age 25, but their overall level of improvement was less than that of younger women. Women younger than 25 had the lowest levels of baseline daily MVC (15.8%) but experienced the greatest improvements in multivitamin consumption compliance at follow up, an improvement of over 376% to 75.3% reporting that they consumed multivitamins on a daily basis.

Non-Hispanic White women were more than twice as likely (47.6%) to be consuming folic acid 5-7 days a week as non-Hispanic Black (20.6%) and Hispanic women (14.3%) at baseline. At follow up, 76.2% of non-Hispanic Whites, compared to 73.2% of non-Hispanic Blacks and 71.4% of Hispanics reported MVC compliance. Whereas non-Hispanic Whites reported the highest levels of consumption at baseline and follow-up, this increase is only about

60%. This is substantially less than the increase for non-Hispanic Black women (255%) and for Hispanic women (391%), who had the greatest improvement in daily MVC.

#### *Barriers*

The women who reported consuming multivitamins less than 5-7 days a week were most likely to cite failing to remember to do so as a barrier to MVC (57.1%). These women were mostly young and were both non-Hispanic Black and White. The next most often cited reason for non-compliance was the multivitamin pill being too big, which was an issue for 16.5% of the women who reported less than optimal multivitamin consumption. This issue was cited only among women less than 30 years old. Among the non-Hispanic White women who reported noncompliance, 16.7% cited this as a reason. Only 12.7% of non-Hispanic Black women cited this reason for consuming multivitamins less than 5-7 days a week. Hispanic women were twice as likely to report the pill being too big as a reason for non-compliance, as any other reason.

#### *Best Practices*

Site B was somewhat successful at achieving behavior change among young non-Hispanic Black women. Overall, knowledge and consumption improved markedly for Site B participants. Timing devices might be an important consideration for improving the multivitamin consumption among non-Hispanic Black women, of which 65.5% reported that remembering to take the multivitamin was a barrier to daily compliance. We also recommend that the size of the vitamin pill be an important consideration for future multivitamin distribution programs, since clients at both sites cited it as an issue in taking multivitamins on a daily basis.

#### **Discussion**

Both service delivery models offered potential for marked improvements in the folic acid knowledge and multivitamin consumption patterns of its participants. However, the improvements in multivitamin knowledge and consumption were substantially higher for the group setting format provided through Site A. At follow up, 91.8% of the women who received services from Site A reported that they were aware that folic acid prevents birth defects, and 87.6% reported taking folic acid 5-7 days a week. Site B clients reported less marked improvements at follow up, where 73.9% reported that they were aware of the preventative effects of folic acid, and 72.7% were taking folic acid daily. Notably, women who received services from Site A (who were mostly Mexican-Hispanic) reported low levels of knowledge and consumption at baseline. Women who received services from Site B were

slightly more likely to report knowledge and daily folic acid consumption (18.6% and 26.1% respectively) at baseline.

The more diffused model of care that Site B clients received may be somewhat less effective at changing folic acid knowledge and consumption behaviors. Although there are strengths to the Site B program, the group setting model may be more effective at changing the folic acid knowledge and consumption patterns of women aged 14-45. Because the goal is to get women consuming multivitamins containing folic acid on a daily basis, it seems that program models that rely on the daily interaction of participants with the program may be most well suited to meet the needs of women who participate in such programs. Whereas Site A's delivery of health care education in conjunction with childcare resulted in client contact on a daily basis, there are other ways to get women in such programs to interact daily with the program. These might include daily text message reminders, emails and other forms of communication that remind women to take their multivitamins. There may also be opportunities for health education messaging to be incorporated into other settings where health education has not traditionally been incorporated, like grocery stores, places of employment or other places frequented routinely by the population being sought to influence.

The limitations to this study are those that are inherent to many program evaluations. Without a control group for comparison to these sites, the time-series data can only say what the total impact of the media campaign, education, and the free multivitamins provision had on participants' knowledge and behavior at follow-up. Consequently, it is impossible to isolate the impact of any of those interventions alone. Selection and reporting bias may have affected the findings. The program participants may have reported behaviors that the program promotes and these findings may overestimate knowledge and consumption of folic acid. Because data were available only for those women that remained in the program at follow-up, it is unknown if women who stayed in the program were more or less compliant than the women who dropped out.

Despite these shortcomings, the high rates of overall improvement in regard to folic acid knowledge and consumption are comparable to other findings in similar projects in Utah and Western North Carolina (Nance, 2007, Major 2007). This suggests that programs that distribute both free multivitamins and preconception education (including information about folic acid) seem to

change the knowledge and multivitamin consumption behaviors of the women who participate. Women who were not contemplating birth seem to have accepted the message that taking multivitamins improves their overall health and reduces their risk for having a neural tube defect affected unplanned pregnancy. It might also suggest that the desire of some women to decrease their risk of NTD affected births is worth the expense of providing free education and multivitamins in health care and social service delivery. Simply put, women will consume multivitamins if they have access to free multivitamins.

There are several strengths to the VitaGrant program. One is that the service delivery occurred in the context of overall health. Multivitamins and preconception educational materials were distributed in health care and social service settings and in many instances as part of a "whole health" framework. It seems that young women and women of Mexican origin, in particular, were served well by the project. In large part this is likely due to the efforts made by program administrators who distributed educational materials that were culturally appropriate to Hispanic women. This may have allowed Site A to better able to educate and change the behavior of Hispanic Women than Site B. The greater improvements for Hispanic women at Site A than at Site B may also be due to the homogeneity of Site A participants and staff as well as the daily interaction that occurred as the child care provider to women receiving VitaGrant services. Although Site B, whose model of service delivery was more diffused and included some home visiting with individual participants, was less successful than Site A in influencing behavior change, the model of distribution offered through the site still provides an effective strategy for risk reduction of neural tube defects.

Preconception intervention programs may wish to seek out providers that offer the best chance for reaching and influencing the population in consideration. Providers that serve a diverse population through a diffuse array of services may not be as effective as those providers offering more intensive services at a higher frequency. Health education that occurs in the context of group setting is an effective strategy for changing the knowledge and behavior patterns of women at risk for poor health outcomes. Those interested in adopting such a program would be well-advised to offer a chewable vitamin alternative. Also, women would benefit from timing devices, which would help women remember to take their multivitamins daily.

**Table 2. Consumption and Knowledge for Site A Participants**

Site A							
Baseline	Overall	Less than 25	25-29 years	Older than 30	Non-Hispanic	Non-Hispanic	Hispanic
	Total	years old	old	years old	White	Black	
<b>Knowledge that folic acid prevents birth defects</b>							
Does not know if mv/folic acid prevents birth defects	96.6%** n 281	95.00% 76	96.30% 103	100.00% 94	100.00% 10	100.00% 8	97.00% 259
Knows that mv/folic acid prevents birth defects	3.4%** n 10	5.00% 4	3.70% 4	0.00% 0	0.00% 0	0.00% 0	3.00% 8
Total	100.00% n 291	100.00% 80	100.00% 107	100.00% 94	100.00% 10	100.00% 8	100.00% 267
<b>Current daily consumption</b>							
Does not consume multivitamins/folic acid 5-7 days/wk.	93.8%** n 273	95.00% 76	94.40% 101	95.70% 90	60.00% 6	100.00% 8	94.80% 253
Currently consumes multivitamins/ folic acid 5-7 days/wk.	6.2%** n 18	5.00% 4	5.60% 6	4.30% 4	40.00% 4	0.00% 0	5.20% 14
Total	100.00% n 291	100.00% 80	100.00% 107	100.00% 94	100.00% 10	100.00% 8	100.00% 267
Follow-up	Overall	Less than 25	25-29 years	Older than 30	Non-Hispanic	Non-Hispanic	Hispanic
	Total	years old	old	years old	White	Black	
<b>Knowledge that folic acid prevents birth defects</b>							
Does not know if mv/folic acid prevents birth defects	8.2%** n 24	10.30% 8	11.20% 12	4.20% 4	20.00% 2	0.00% 0	8.20% 22
Knows that mv/folic acid prevents birth defects	91.8%** n 267	89.70% 70	88.80% 95	95.80% 92	80.00% 8	100.00% 8	91.80% 245
Total	100.00% n 291	100.00% 78	100.00% 107	100.00% 96	100.00% 10	100.00% 8	100.00% 267
<b>Current daily consumption</b>							
Does not consume multivitamins/folic acid 5-7 days/wk.	12.4%** n 36	15.40% 12	16.80% 18	4.20% 4	0.00% 0	0.00% 0	13.50% 36
Currently consumes multivitamins/ folic acid 5-7 days/wk.	87.6%** n 255	84.60% 66	83.20% 89	95.80% 92	100.00% 10	100.00% 8	86.50% 231
Total	100.00% n 291	100.00% 78	100.00% 107	100.00% 96	100.00% 10	100.00% 8	100.00% 267

\*\*p<0.01, \*p<0.05 for the same indicator comparing baseline to follow-up. About 99% of Hispanics women are of Mexican origin. Age (n=281), missing=10; Race/Ethnicity (n=285), missing=6

**Table 3. Barriers to Compliance to Site A Participants**

Site A							
	Overall	Less than 25	25-29 years	Older than 30	Non-Hispanic	Non-Hispanic	Hispanic
	Total	years old	old	years old	White	Black	
Can't remember	10.40% n 12	17.60% 6	4.40% 2	12.50% 4	0.00% 0	0.00% 0	11.90% 12
Pill too big	65.20% n 75	58.80% 20	73.30% 33	62.50% 20	100.00% 4	100.00% 8	60.40% 61
Makes me sick	1.70% n 2	5.90% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	2.00% 2
Doesn't seem important	1.70% n 2	0.00% 0	4.40% 2	0.00% 0	0.00% 0	0.00% 0	2.00% 2
Other and Unknown Reasons	20.90% n 24	17.60% 6	17.80% 8	25.00% 8	0.00% 0	0.00% 0	23.80% 24
Total	100.00% n 115	100.00% 34	100.00% 45	100.00% 32	100.00% 4	100.00% 8	100.00% 101

Age (n=89), missing=2; Race/Ethnicity (n=87), missing 4

**Table 4. Demographic Characteristics of Site B Participants**

Site B		
Age	n	%
Less than 25 years old	76	47.20%
25-29	39	24.22%
Older than 30 years old	42	26.09%
Missing	4	2.48%
<b>Total</b>	<b>161</b>	<b>100.00%</b>
Race and Ethnicity	n	%
Non-Hispanic White	42	26.09%
Non-Hispanic Black	97	60.25%
Hispanic	14	8.70%
Unknown/missing	8	4.97%
<b>Total</b>	<b>161</b>	<b>100.00%</b>

**Table 5. Consumption and Knowledge for Site B participants**

Site B							
	Overall Total	Less than 25 years old	25-29 years old	Older than 30 years old	Non-Hispanic White	Non-Hispanic Black	Hispanic
<b>Baseline</b>							
<b>Knowledge that folic acid prevents birth defects</b>							
Does not know if mv/folic acid prevents birth defects	81.4%**	81.60%	79.50%	81.00%	71.40%	85.60%	85.70%
n	131	62	31	34	30	83	12
Knows that mv/folic acid prevents birth defects	18.6%**	18.40%	20.50%	19.00%	28.60%	14.40%	14.30%
n	30	14	8	8	12	14	2
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
n	161	76	39	42	42	97	14
<b>Current daily consumption</b>							
Does not consume multivitamins/folic acid 5-7 days/wk.	73.9%**	84.20%	74.40%	52.40%	52.40%	79.40%	85.70%
n	119	64	29	22	22	77	12
Currently consumes multivitamins/ folic acid 5-7 days/wk.	26.1%**	15.80%	25.60%	47.60%	47.60%	20.60%	14.30%
n	42	12	10	20	20	20	2
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
n	161	76	39	42	42	97	14
<b>Follow-up</b>							
<b>Knowledge that folic acid prevents birth defects</b>							
Does not know if mv/folic acid prevents birth defects	26.1%**	20.50%	31.00%	33.30%	19.00%	26.80%	42.90%
n	42	15	13	14	8	26	6
Knows that mv/folic acid prevents birth defects	73.9%**	79.50%	69.00%	66.70%	81.00%	73.20%	57.10%
n	119	58	29	28	34	71	8
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
n	161	73	42	42	42	97	14
<b>Current daily consumption</b>							
Does not consume multivitamins/folic acid 5-7 days/wk.	27.3%**	24.70%	23.80%	33.30%	23.80%	26.80%	28.60%
n	44	18	10	14	10	26	4
Currently consumes multivitamins/ folic acid 5-7 days/wk.	72.7%**	75.30%	76.20%	66.70%	76.20%	73.20%	71.40%
n	117	55	32	28	32	71	10
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
n	161	73	42	42	42	97	14

\*\*p<0.01, \*p<0.05 for the same indicator comparing baseline to follow-up. Age (n=157), missing=4; Race/Ethnicity (n=153), n=8

**Table 6. Barriers to Compliance for Site B Participants**

Site B	Overall Total	Less than 25 years old	25-29 years old	Older than 30 years old	Non-Hispanic		
					White	Black	Hispanic
Can't remember	57.10%	71.80%	41.70%	46.20%	50.00%	65.50%	25.00%
n	52	28	10	12	12	36	2
Pill too big	16.50%	17.90%	33.30%	0.00%	16.70%	12.70%	50.00%
n	15	7	8	0	4	7	4
Makes me sick	2.20%	0.00%	0.00%	7.70%	0.00%	3.60%	0.00%
n	2	0	0	2	0	2	0
Doesn't seem important	8.80%	0.00%	8.30%	23.10%	8.30%	10.90%	0.00%
n	8	0	2	6	2	6	0
Other and Unknown Reasons	15.40%	10.30%	16.70%	23.10%	25.00%	7.30%	25.00%
n	14	4	4	6	6	4	2
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
n	91	39	24	26	24	55	8

**References**

Atrash, H.K., Johnson, K., Adams, M., Cordero, J.F., & Howse, J. (2006). Preconception care for improving perinatal outcomes: The time to act. *Maternal and Child Health Journal, 10*, S3-S11.

Bishop, J.C., & Keller, U. (2008). *Birth outcomes and neural tube defects in the United States before and after folic acid fortification*. Presentation at the 73<sup>rd</sup> Annual Meeting of the Population Association of America, New Orleans, LA.

Blatter, B.M., Star, M.v.D, & Roeleveld, N. (1994). Review of neural tube defects: Risk factors in parental occupation and the environment. *Environmental Health Perspectives, 102*(2), 140-145.

Botto, L.D., Moore, C.A., Khoury, M.J., & Erickson, J.D. (1999). Neural tube defects. *The New England Journal of Medicine 341*(20), 1509-1519.

Buttriss, J. (2001). Strategies to increase folate/folic acid intake in women: An overview. *Nutrition Bulletin, 29*, 234-244.

Correia, J.A., & Hauser, K. (2007). Neural tube defects among U.S. and foreign born Hispanics living in Florida. *The Florida Birth Defects Registry*.

Czeizel AE, & Dudás I. (1992). Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation. *New England Journal of Medicine 327*, 1832-1835.

Eichholzer, M., Tonz, O., & Zimmerman, R. (2006). Folic acid: A public health challenge. *The Lancet, 367*, 1352-1361.

Florida BRFSS (Behavioral Risk Factor Surveillance System). (2007). Florida 2006 Module Variables Report Behavioral Risk Factor Surveillance System. Retrieved March 2, 2007 from [http://www.doh.state.fl.us/Disease\\_ctrl/epi/brfss/CD](http://www.doh.state.fl.us/Disease_ctrl/epi/brfss/CD)

[C Summary Pages/2006Modules/Module9-Folic Acid.pdf](#)

Goldberg, B.B., Alvarado, S., Chavez, C., Chen, B.H., Dick, L.M. Felix, R.J., et al. (2006). Prevalence of periconceptional folic acid use and perceived barriers to the post gestation continuance of supplemental folic acid: Survey results from a teratogen information service. *Birth Defects Research, 76*(A), 193-199.

Guzman, B. 2001. The Hispanic population. census 2000 brief. Retrieved April 10, 2008 from <http://www.census.gov/prod/2001/pubs/c2kbr01-3.pdf>.

Major, J. (2007). *Evaluation of Long-Term Vitamin Use among Participants in a Western North Carolina Multivitamin Distribution Program*. Presented at the 12<sup>th</sup> Annual Maternal and Child Health Epidemiology Conference.

MRC Vitamin Study Research Group. (1991). Prevention of neural tube defects: results of the Medical Research Council Vitamin Study. *Lancet, 338*, 131-137.

Nance, AE. (2007). *WIC Vitamin Pilot Project to Enhance Folic Education in Utah, 2000-2003*. Presented at the Second National Summit on Preconception Health and Health Care.

Oakley, G.P (1993). Folic acid preventable spina bifida and anencephaly. *Journal of the American Medical Association, 269*, 1292-1293.

Platzman, A. (1998). Folic acid: Once overlooked, now a nutrient on the brink of stardom. *Environmental Nutrition, 21*(1), 1-2.

Putnam, J., & Gerrior, S. (1999). *Trends in the U.S. food supply. America's eating habits*. USDA-ERS Agriculture Information Bulletin.

Recommendations for the use of Folic Acid to Reduce the Number of Cases of Spina Bifida and other Neural Tube Defects. (1992). *Morbidity and Mortality Weekly Report*, 41: (No RR-14).

Recommendations to Improve Preconception Health and Health Care--United States. (2006). *Morbidity and Mortality Weekly Report* 55(RR06) 1-23.

Slattery, M.L., & Janerich, D.T. (1991). The epidemiology of neural tube defects: A review of dietary intake and related factors as etiologic agents. *American Journal of Epidemiology*, 133(6), 526-540.

Smithells, R.W., Sheppard, S., Schorah, C.J. (1976). Vitamin differences and neural tube defects. *Archives of the Diseases of Childhood*, 51, 944-950.

Suarez, L., Hendricks, K.A., Cooper, S.P., Sweeney, A.M., Hardy, R.J., & Larsen, R.D. (2000). Neural tube defects among Mexican Americans living on the U.S.-Mexico border: Effects of folic acid and dietary folate. *American Journal of Epidemiology*, 152(11), 1017-1023.

Use of supplements containing folic acid among women of childbearing age – United States, 2007. (2008). *Morbidity and Mortality Weekly Report*, 57(01), 5-8.

Wasserman, C.R., Shaw, G.M., Selvin, S., Gould, J.B., & Syme, S.L. (1998). Socioeconomic status, neighborhood social conditions and neural tube defects. *American Journal of Public Health*, 88(11), 1674-1680.

Watkins, M.L. (1998). Efficacy of folic acid prophylaxis for the prevention of neural tube defects. *Mental Retardation and Developmental Disabilities Research Reviews*, 4, 282-290.

Werler, M.M., Hayes, C., Louik, C., Shapiro, S., & Mitchell, A. (1999). Multivitamin supplementation and risk of birth defects. *American Journal of Epidemiology*, 150(7), 675-682.

Williams, J.L., Abelman, S.M. Fassett, E.M. Stone, C.E., Petrini, J.R., Damus, K., & Mulinare, J. (2006). Health care provider knowledge and practices regarding folic acid, United States, 2002-2003. *Maternal and Child Health Journal*, 10, S67-S72.

Jessica C. Bishop-Royse ([jbishop@fsu.edu](mailto:jbishop@fsu.edu)) and Melanie Simmons ([msimmons@fsu.edu](mailto:msimmons@fsu.edu)) are with the Florida State University Center for Demography and Population Health, Tallahassee, FL. Elizabeth Jensen ([ecjensen@email.unc.edu](mailto:ecjensen@email.unc.edu)) is currently with the Gillings School of Public Health at the University of North Carolina-Chapel Hill but was with the March of Dimes in Tallahassee, FL when this paper was written. This paper was submitted to the *FPHR* on March 9, 2009, revised and resubmitted, and accepted for publication on April 24, 2009. Copyright 2009 by the *Florida Public Health Review*.