



# SCHS Studies

A Special Report Series by the State Center for Health Statistics  
1908 Mail Service Center, Raleigh, N.C. 27699-1908  
[www.schs.state.nc.us/SCHS/](http://www.schs.state.nc.us/SCHS/)

No. 126

June 2001

## Knowledge and Use of Folic Acid Among North Carolina Women

by

**Robert E. Meyer, PhD**  
**Alison G. Hayes, MS**  
**April J. Morgan, BA**  
**Judith E. Devine, MA**  
**Karen E. Powers, MS**

### ABSTRACT

**Objectives:** In 1992 the Centers for Disease Control and Prevention recommended that all women of reproductive age consume 400 micrograms of folic acid every day in order to reduce their risk of having a pregnancy affected by a neural tube defect. The purpose of this study is to examine the level of folic acid knowledge and intake among North Carolina women who have recently given birth.

**Methods:** Data for this study were obtained from the 1999 North Carolina PRAMS survey, which is an ongoing survey of North Carolina resident women who have delivered a live born infant within the previous three months. The survey ascertains data on the mother's knowledge of folic acid, sources of information on folic acid, and preconceptional intake of multivitamins or folic acid supplements. In this analysis, knowledge and use of folic acid according to selected maternal demographic characteristics are analyzed and compared. Percentages are weighted so that the results are representative of all women who delivered an infant during calendar year 1999.

**Results:** Approximately 77 percent of all women had heard or read about the benefits of folic acid. Just slightly over one-half of all women reported that they had heard about folic acid from their doctor or health care provider. Only about 26 percent of women took folic acid every day prior to pregnancy, according to CDC recommendations. There were marked differences among various sociodemographic groups with respect to knowledge and intake of folic acid. Mothers who were older, better educated, married, and had higher incomes were most likely to have heard about folic acid and to have taken it every day before pregnancy.

**Conclusions:** The percentage of North Carolina women who take folic acid prior to pregnancy is low. Because folic acid is an effective, simple, and inexpensive means of preventing serious birth defects such as anencephaly and spina bifida, it is important that health care providers and the public health community make a concerted effort to teach all women who are capable of becoming pregnant to consume on a daily basis multivitamins containing 400 micrograms of folic acid, in addition to eating a balanced, healthy diet.

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Dr. Meyer, Ms. Hayes, and Ms. Morgan are with the Birth Defects Monitoring Program, State Center for Health Statistics, Division of Public Health. Ms. Devine is with the N.C. PRAMS Program, State Center for Health Statistics, Division of Public Health. Ms. Powers is with the Genetic Health Care Unit, Women's and Children's Health Section, Division of Public Health.



## Introduction

Neural tube defects (NTDs) are severe, and often lethal, congenital malformations involving the spine and central nervous system. The most common forms are spina bifida, anencephaly, and encephalocele. NTDs are among the most commonly occurring preventable birth defects in the United States. Approximately 1 in 500 to 1 in 700 pregnancies are affected with an NTD each year in North Carolina.<sup>1</sup> For reasons not yet understood, the rate of NTDs is higher in the Southeastern states, including North Carolina, than in most other areas of the country. While some specific causes, such as single gene or chromosomal disorders, maternal diabetes, valproic acid use, and hyperthermia, have been identified, for the majority of cases the specific etiology is not known.<sup>2</sup>

It has been well documented that daily preconceptional intake of the B-vitamin folic acid can reduce the risk of NTDs by up to 70 percent.<sup>3-6</sup> Because the neural tube closes by the fourth week after conception, it is important that folic acid be consumed on a regular basis prior to pregnancy. In 1992, following the release of the Medical Research Council's findings from their randomized controlled trial on folic acid, the Centers for Disease Control and Prevention (CDC) recommended that all women of childbearing age consume 400 micrograms (mcg) of folic acid daily in order to decrease their risk of having an NTD-affected pregnancy.<sup>6-7</sup> In 1996 the Food and Drug Administration issued a rule requiring all enriched grain products to be fortified with 140 mcg of synthetic folic acid per 100 g of cereal product.<sup>8</sup> That rule took effect on 1 January 1998. Because the current fortification level has been estimated to increase the average woman's dietary intake of folic acid by only 100 mcg per day (one-fourth of the recommended amount), the CDC, the Institute of Medicine, the March of Dimes, and other groups continue to urge all women capable of becoming pregnant to supplement their usual diet with 400

mcg of synthetic folic acid in the form of a daily multivitamin.<sup>9</sup> The CDC recommendation for women who have already had a pregnancy affected by an NTD is to continue taking 400 mcg of synthetic folic acid every day, and to increase that amount to 4,000 mcg daily at least one month before a subsequent pregnancy is planned, continuing this dosage throughout the first trimester. This amount of folic acid should be obtained through a prescription, not by increasing multivitamin intake.

Since the mid-1990s efforts to increase public awareness about the benefits of folic acid have been on the rise at the local, state, and national level. In North Carolina, a statewide folic acid conference was held in 1995 to help raise awareness within the public health and medical communities. This conference led to the development of the North Carolina Folic Acid Council, which helps coordinate and oversee folic acid education activities throughout the state.

In order to help assess trends in the knowledge and use of folic acid among women in North Carolina, the State Center for Health Statistics within the North Carolina Division of Public Health has incorporated additional questions on folic acid into its ongoing Pregnancy Risk Assessment Monitoring System (PRAMS) survey. The purpose of this paper is to provide information to physicians, public health practitioners, and the public about current patterns in the awareness and intake of folic acid as reported on the PRAMS survey. This information will serve as a baseline for tracking our progress in increasing folic acid use among women in the years ahead.

## Methods

Data for this study were obtained from the 1999 North Carolina PRAMS survey. The North Carolina PRAMS program was initiated in 1997, through a cooperative agreement between the State Center for

Health Statistics and the Division of Reproductive Health within the CDC. PRAMS is an ongoing, population-based survey of North Carolina resident women who have recently given birth. The survey is carried out according to strict protocols for data quality, as specified by CDC. Each month, approximately 200 women who are 2 to 3 months postpartum are randomly selected from the North Carolina birth certificate files. Participants are asked to complete a self-administered mailed questionnaire, which collects information on a variety of risk factors for poor pregnancy outcomes, including behavioral and psychosocial risks, access to and use of health care services, and other issues. Non-respondents are contacted by telephone in order to increase the survey response rate. The overall response rate for PRAMS is approximately 75 percent.

The questionnaire used by the North Carolina PRAMS program contains three questions that pertain to folic acid. These are:

- Have you ever heard or read that taking the vitamin folic acid can help prevent some birth defects?
- Where did you hear or read that taking the vitamin folic acid can help prevent some birth defects?
- Before you knew you were pregnant, how frequently did you take either vitamins containing folic acid or multivitamins?

Sample weights were applied to the survey data so that the responses are representative of all North Carolina women who delivered live born infants during calendar year 1999. All percentages reported here are based on the weighted estimates. Ninety-five percent confidence intervals (CIs) based on the weighted responses were generated using SUDAAN software, which is used for analysis of weighted data from complex samples.<sup>10</sup>

## Results

A total of 1,780 women responded to the North Carolina PRAMS survey in 1999, for a total response rate of 73.8 percent. The survey indicated that, overall, 76.8 percent of women who delivered in 1999 had heard or read that taking folic acid can help prevent birth defects (Table 1). However there were marked differences in folic acid awareness according to maternal demographics. Knowledge of folic acid was highest among women ages 25-34 (86.1 percent) and women ages 35 and above (82.9 percent), and lowest among women under 20 years old (60.9 percent). Caucasian women were more likely to have heard or read about folic acid compared to African American women or women of other races (80.8 percent, 67.2 percent, and 56.6 percent, respectively). The difference in knowledge of folic acid by mother's education was quite pronounced. Among women with more than a high school education, 90.3 percent had heard or read about folic acid, compared to only 54.8 percent among women with less than a high school education. Awareness of folic acid also increased with increasing family income, ranging from 63.6 percent for women with annual incomes less than \$16,000, to 91.4 percent among women with incomes of \$40,000 or more. Mothers who were unmarried, who were enrolled in WIC, or who received Medicaid were also less likely to have heard or read about folic acid.

Table 2 shows the percentage of women who had heard or read about folic acid from various sources. Among all women who delivered in 1999, 51.3 percent were told about folic acid by their doctor, nurse, or other clinic staff. Slightly less than one-half of women heard about folic acid through the media (radio, TV, newspaper). About 37 percent of women read about folic acid through brochures or other literature obtained from their health care provider's office, and about 14 percent heard about it through other sources (e.g., friends, family members, coworkers). The percentages add to more than 100 because many women heard about folic acid from more than one source.

**Table 1. Percentage of North Carolina women delivering a live birth who reported having heard or read about folic acid, N.C. PRAMS, 1999.**

Demographic Groups	Total Respondents	YES		
		Number	%	95% C.I.
<b>Total</b>	<b>1759</b>	<b>1338</b>	<b>76.8</b>	<b>74.1-79.4</b>
<b>Age</b>				
<20 years	268	162	60.9	52.4-68.7
20-24 years	459	313	66.4	60.4-71.8
25-34 years	832	704	86.1	82.8-88.9
35+ years	200	159	82.9	74.8-88.8
<b>Race</b>				
White	1182	958	80.8	77.7-83.5
Black	513	340	67.2	60.9-72.9
Other	64	40	56.6	40.0-71.8
<b>Education</b>				
<High School	407	233	54.8	48.1-61.3
High School	581	417	74.0	68.8-78.6
>High School	770	687	90.3	87.4-92.6
<b>Marital Status</b>				
Married	1150	956	82.5	79.5-85.2
Other	609	382	64.1	58.6-69.3
<b>Income</b>				
<\$15,999	516	339	63.6	57.6-69.2
\$16,000-\$24,999	274	201	75.8	68.5-81.9
\$25,000-\$39,999	264	207	78.3	71.1-84.1
\$40,000 or more	532	480	91.4	87.9-93.9
<b>WIC recipient</b>				
No	921	755	83.6	80.2-86.5
Yes	827	572	69.1	64.6-73.2
<b>Medicaid recipient</b>				
No	868	743	85.9	82.6-88.6
Yes	891	595	66.9	62.5-71.1

**Table 2. Percentage of North Carolina women delivering a live birth who reported hearing about folic acid from selected sources, N.C. PRAMS, 1999.**

Demographic Groups	Total Respondents	YES		
		Number	%	95% C.I.
Doctor, nurse, or health clinic staff	1780	912	51.3	48.2-54.3
Information at health care provider's office	1780	646	37.3	34.4-40.3
Media	1780	859	49.7	46.6-52.7
Other	1780	239	13.7	11.8-15.9

**Table 3. Percentage of North Carolina women who reported taking multivitamins containing folic acid on a daily basis prior to pregnancy, N.C. PRAMS, 1999.**

Demographic Groups	Total Respondents	YES		
		Number	%	95% C.I.
<b>Total</b>	<b>1770</b>	<b>1320</b>	<b>26.1</b>	<b>23.5-28.9</b>
<b>Age</b>				
<20 years	270	25	7.6	4.2-13.2
20-24 years	461	60	13.7	10.1-18.4
25-34 years	838	291	35.4	31.3-39.6
35+ years	201	74	40.5	32.0-49.6
<b>Race</b>				
White	1186	362	29.8	26.7-33.2
Black	521	75	14.5	10.6-19.5
Other	63	13	27.7	15.1-45.3
<b>Education</b>				
<High School	411	42	10.6	7.1-15.4
High School	583	101	18.3	14.3-23.1
>High School	775	307	39.6	35.4-43.9
<b>Marital Status</b>				
Married	1159	383	33.1	29.8-36.6
Other	611	67	10.5	7.6-14.4
<b>Income</b>				
<\$15,999	518	53	9.8	6.8-14.0
\$16,000-\$24,999	276	52	25.4	19.1-32.8
\$25,000-\$39,999	267	61	20.2	14.7-27.0
\$40,000 or more	536	242	43.9	38.7-49.1
<b>WIC recipient</b>				
No	922	329	36.0	32.1-40.1
Yes	833	114	14.8	11.9-18.4
<b>Medicaid recipient</b>				
No	874	344	38.5	34.5-42.5
Yes	896	106	12.6	9.8-15.9

As shown in Table 3, 26.1 percent of women who delivered in 1999 took multivitamins or folic acid supplements on a daily basis before becoming pregnant, according to the CDC recommendations. The differences in daily, preconceptional consumption of multivitamins by socio-demographic characteristics were striking. Women ages 35 and above were more than five times as likely to take daily multivitamins as compared to women under 20 years of age (40.5 percent and 7.6 percent, respectively). Women with family incomes of \$40,000 or more were 4.5 times as likely to take daily

multivitamins as women in the lowest income group (43.9 percent and 9.8 percent). Daily multivitamin use increased with increasing education, with mothers having more than a high school education being 3.7 times as likely to consume multivitamins as women with less than a high school education (39.6 percent and 10.6 percent). A three-fold difference in folic acid intake was evident between married and unmarried women (33.1 percent and 10.5 percent), and between Medicaid recipients and non-recipients (12.6 percent and 38.5 percent). Mothers who were not enrolled in WIC were about

twice as likely as WIC participants to consume folic acid preconceptionally, as were Caucasian mothers compared to their African American counterparts.

## DISCUSSION

The findings from this study are both encouraging and discouraging. The fact that nearly 77 percent of all North Carolina women who delivered in 1999 had heard about folic acid is a positive indication that the folic acid message is beginning to get out. Although this percentage is only slightly higher than that reported in the 1998 PRAMS survey (74.1 percent), we are optimistic that awareness of folic acid among women who have given birth is increasing. The estimated percentage of women from the PRAMS survey who had heard about folic acid is considerably higher than that estimated from the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) for that same year (45.4 percent, 95 percent CI 40.7-50.3).<sup>11</sup> This difference is likely due, in large part, to the fact that PRAMS surveys women who have recently completed a pregnancy (and thus were probably more likely to read and/or retain information related to having a healthy baby), while BRFSS covers all women of reproductive age.

While a majority of women who delivered babies in 1999 did know about the benefits of folic acid, just slightly more than one-half reported that they had heard about it from their doctor or health care provider. This indicates that there is considerable room for improvement in the number of health care providers who discuss folic acid with their patients. Because folic acid must be consumed prior to pregnancy in order to reduce the risk for NTDs, and because about one-half of all live births are the result of unintended pregnancies, it is imperative that physicians take the time to discuss folic acid with all of their patients who are capable of becoming pregnant, not just those who are contemplating pregnancy. For the woman who is

already pregnant, it is too late. For these reasons, the best opportunity for prevention lies with primary care providers, including general and family practitioners, gynecologists, pediatricians, health department staff, and others who come into frequent contact with reproductive-age women. Every visit with a woman of childbearing age is an opportunity for health care providers to discuss folic acid.

The gap between the percentage of women who knew about folic acid and the percentage who took it on a daily basis before pregnancy is disconcerting. Whereas almost 77 percent of women had heard about the benefits of folic acid, only about 26 percent, or slightly more than one-third of those who had heard about it, reported that they took it everyday before pregnancy as recommended. One likely explanation for this gap between knowledge and use of folic acid is that the PRAMS survey ascertains current knowledge (i.e., 3-4 months postpartum) rather than knowledge prior to pregnancy. As noted above, many of the women in the survey probably learned about folic acid only after becoming pregnant, and thus would not have had a chance to alter their preconceptional behavior. In any case, it is clear that more innovative approaches are needed to move beyond increasing knowledge and towards changing behavior.

The relatively high prevalence of daily folic acid intake among some sociodemographic groups was encouraging, and suggests that folic acid education efforts may be beginning to make a difference among some women—mostly those from more affluent populations. However, this study also demonstrated a pattern of low daily folic acid intake among socioeconomically disadvantaged groups. Not surprisingly, it is this latter population that tends to have the highest rates of NTDs.<sup>12</sup> These findings highlight the need to intensify folic acid education programs aimed at disadvantaged groups. One place to start is within our state's rapidly growing Hispanic community, which has both high rates of NTDs and low rates of multivitamin use.

One of the strengths of using the PRAMS survey to assess folic acid use is that the survey's target population is women who have recently given birth. This is probably the most relevant population to study with regard to assessing the potential impact of folic acid education on neural tube defect prevention. The fact that PRAMS is a relatively large, random, population-based survey means that the results can be generalized to all women who give birth within a given period of time. While other surveys such as BRFSS and the March of Dimes/Gallup survey ascertain information on folic acid knowledge and use among all reproductive-age women, these data may be less relevant to the true population at risk for NTDs (i.e., those women who do become pregnant).

One limitation of the PRAMS survey with respect to this analysis concerns the reliability of information on preconceptional intake of multivitamins. Because the questionnaire is administered 3-4 months after delivery, the ability to accurately recall multivitamin use prior to pregnancy (one year ago for most respondents) is questionable. Too, because most of the respondents in the survey knew about the benefits of folic acid, there may have been a tendency to over-report multivitamin use. Another limitation is that, because PRAMS uses mainly a self-administered written questionnaire, responses from women with limited reading and/or education levels might be less reliable as compared with responses obtained through a telephone or face-to-face interview. Keeping such limitations in mind, data from the PRAMS survey can provide a useful means of tracking trends in folic acid knowledge and use in North Carolina.

This study shows that North Carolina has a long way to go in its effort to promote preconceptional folic acid use among women in our state, particularly those of lower socioeconomic status. The fact that folic acid can prevent a large majority of neural tube defects has been clearly demonstrated in the scientific literature, and evidence is growing that it may also reduce the risk of limb reduction defects,

orofacial clefts, certain cardiac defects, and possibly prematurity/low birth weight. As Stevenson et al.<sup>13</sup> have shown in South Carolina, reducing the rate of neural tube defects by promoting folic acid use among women of reproductive age is an intervention that can work in practice.

Medical and public health professionals both have an obligation to prevent disease that is readily preventable. With regard to folic acid-preventable birth defects, that obligation has not yet been met. While some progress is being made to increase folic acid consumption among certain groups of women, much more work remains to be done. However, that will require considerably more resources than have been available thus far. Until that time comes, the health and well-being of our children and their families will continue to be unnecessarily compromised.

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#### **ACKNOWLEDGEMENT**

*The authors thank Paul Buescher, Casey Czaplinski, and Merry-K Moos for reviewing the manuscript and providing helpful comments and suggestions.*





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