

Pregnancy Intendedness and the Use of Periconceptional Folic Acid

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ABSTRACT. *Objective.* Periconceptional use of folic acid can prevent birth defects, including at least 50% of neural tube defects. This study used an ongoing surveillance system to explore the association between pregnancy intendedness and women taking periconceptional folic acid.

Methods. Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) surveys a stratified random sample of women after a live birth. In 1998–1999, 1867 women completed the survey (64.0% response rate); responses were weighted for nonresponse. Women were asked whether they took folic acid most days in the month before becoming pregnant.

Results. Overall, 33.2% of women took folic acid most days in the month before becoming pregnant, and 39.9% said that their pregnancy was unintended. Adolescent mothers were less likely to take periconceptional folic acid (9.2%) and more likely to report unintended pregnancy (62.0%) than older women. Overall, women who said that their pregnancy was intended were more likely to report that they had taken periconceptional folic acid (odds ratio: 4.75; 95% confidence interval: 3.16–7.14); after controlling for maternal age and income the odds ratio was 3.70 (95% confidence interval: 2.38–5.56).

Conclusions. Women whose pregnancies were intended were more likely to have been taking periconceptional folic acid than women whose pregnancies were unintended. The importance of fertile women's taking daily multivitamins that contain 400 µg (0.4 mg) of folic acid should be stressed among women who are not contemplating pregnancy, especially adolescents and low-income women. *Pediatrics* 2003;111:1142–1145; *folic acid, pregnancy, birth defect.*

ABBREVIATIONS. NTD, neural tube defect; PRAMS, Pregnancy Risk Assessment Monitoring System.

Neural tube defects (NTDs) are among the most serious and common birth defects. Approximately 4000 pregnancies in the United States are affected each year, one third of which are spontaneously lost or electively terminated.¹

Although the mechanism of action remains unknown, epidemiologic studies have shown that periconceptional use of folic acid can prevent at least 50% of NTDs and may reduce the occurrence of other birth defects.^{1–6} Public health agencies recommend

that all women who are capable of becoming pregnant consume 400 µg of folic acid daily in the form of fortified foods or dietary supplements.^{7,8} Because NTDs occur just 3 to 4 weeks after conception, often before pregnancy is confirmed,^{9,10} and because nearly half of pregnancies in the United States are unplanned,¹¹ it is important that women who are capable of becoming pregnant, regardless of pregnancy intention, take folic acid daily.

Only 1 previous study explored the association between pregnancy intendedness and use of periconceptional folic acid. That study found that women with intended pregnancies were more likely to have reported taking vitamins immediately before pregnancy.¹² In this study, we explore the association between pregnancy intendedness and the use of periconceptional folic acid in a population-based study. This association suggests the need for increasing efforts to encourage all women to take folic acid and prevent unintended pregnancies, with special emphasis on adolescent and low-income women.

METHODS

The Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) is an ongoing population-based survey of postpartum women conducted by the state health department. It was modeled after the multistate PRAMS program supported by the Centers for Disease Control and Prevention since 1987.

Oregon PRAMS surveys Oregon resident mothers 2 to 6 months after a live birth (mean: 106.5 days; standard deviation: 27.2 days). These mothers are identified using a stratified random sample of birth certificates with oversampling of mothers who are Hispanic, American Indian/Alaska Native, Asian/Pacific Islander, and black/African American to ensure reliable estimates for these groups. Mothers who did not respond to a mailed survey received a second mailed survey and telephone follow-up. Responses were then weighted for oversampling, nonresponse, and noncoverage to be representative of all Oregon live births. Details of the Oregon PRAMS methods appear elsewhere (www.ohd.hr.state.or.us/pch/prams/index.cfm).

We analyzed the first year of data from Oregon PRAMS, with monthly cohorts selected November 1998 through October 1999. The infants were born from August 1, 1998, through August 9, 1999. Of the 2919 women selected, 1867 women responded for a response rate of 64.0%. Responses were analyzed using SPSS and SUDAAN. The change-in-estimate method of multivariate modeling was used to evaluate confounding.¹³ All data presented are weighted except as indicated.

Periconceptional folic acid use was assessed by asking mothers, "Were you taking the vitamin folic acid most days in the month before you became pregnant?" Pregnancy intendedness was assessed by asking, "Thinking back to *just before* you got pregnant, how did you feel about becoming pregnant?" The pregnancy was considered intended when the woman said that she wanted to be pregnant either then or sooner. The pregnancy was considered unintended when the woman said that she wanted to be pregnant later (ie, mistimed) or not at any time in the future (ie, unwanted). Respondents also had the option to answer, "I don't know." Because PRAMS respondents all have had a recent live birth,

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Received for publication Oct 2, 2002; accepted Dec 4, 2002.

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TABLE 1. Periconceptional Folic Acid Intake by Maternal Characteristics

Characteristic	<i>n</i> *	Taking Folic Acid (Weighted)	Bivariate OR (95% CI)	Multivariate OR† (95% CI)
Total	1629	33.2%	—	—
Pregnancy intention				
Intended‡	948	45.3%	4.75 (3.16–7.14)	3.70 (2.38–5.56)
Unintended§	681	14.8%	Referent	Referent
Family income				
≥\$30 000	635	48.4%	4.09 (2.84–5.89)	2.94 (2.00–4.35)
<\$30 000	936	18.7%	Referent	Referent
Maternal age				
≥20 y	1388	36.5%	5.67 (2.77–11.59)	2.33 (1.05–5.26)
<20 y	241	9.2%	Referent	Referent
Maternal smoking#				
No	1214	38.7%	2.48 (1.59–3.88)	
Yes	390	20.3%	Referent	
Insurance before pregnancy				
Any	1122	40.9%	4.76 (3.02–7.49)	
None	477	12.7%	Referent	
WIC**				
No	857	44.4%	3.66 (2.52–5.31)	
Yes	772	17.9%	Referent	
Maternal marital status				
Married	1080	40.4%	3.86 (2.51–5.95)	
Not married	549	14.9%	Referent	
Maternal education				
12+ y	1217	36.4%	2.69 (1.72–4.21)	
<12 y	398	17.8%	Referent	
Maternal race/ethnicity				
White††	613	37.0%	3.03 (2.17–4.17)	
Black††	185	19.6%	1.25 (0.82–1.89)	
Hispanic	382	16.3%	Referent	
AI/AN††	189	25.4%	1.75 (1.19–2.56)	
Asian/PI††	260	31.4%	2.33 (1.64–3.33)	

OR indicates odds ratio; CI, confidence interval; AI, American Indian; AN, Alaska Native; PI, Pacific Islander.

* Unweighted number of respondents (excluding those who did not know or did not respond).

† Covariates remaining in the final multivariate model after removing insignificant covariates.

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

§ Unintended includes women who wanted to be pregnant later (mistimed) plus women who did not want to be pregnant then or at any time in the future (unwanted).

|| Annual family income before pregnancy.

Maternal smoking in the 3 months before pregnancy.

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

†† Non-Hispanic.

information is available regarding pregnancy intendedness for live births but not for terminations or fetal deaths.

We used information from the birth certificate for maternal age, education, marital status, race/ethnicity, and enrollment in the Women, Infants and Children program during pregnancy. Other variables, including pregnancy intendedness, periconceptional folic acid use, family income, smoking, and insurance, were derived from the PRAMS survey.

We excluded from the analysis those who answered, “I don’t know,” to questions about pregnancy intention (5.7%) and periconceptional folic acid use (5.4%). We also excluded those with missing values (1.1% and 1.6%, respectively). These exclusions resulted in a final sample size of 1629.

RESULTS

We found that 33.2% of women had taken periconceptional folic acid and 39.9% of women had unintended pregnancies. In bivariate analysis, women whose pregnancies were intended were more likely to have been taking periconceptional folic acid than women whose pregnancies were unintended (odds ratio: 4.75; 95% confidence interval: 3.16–7.13). This association decreased slightly but remained strong in the multivariate analysis; women whose pregnancies were intended were 3.70 times more likely to have

taken periconceptional folic acid than those who had not (95% confidence interval: 2.38–5.56; Table 1). Also significant in the multivariate analysis was that adolescents and low-income mothers were less likely to take folic acid than older and higher-income mothers.

Additional examination of folic acid use by pregnancy intention revealed that both those who wanted to be pregnant then and those who wanted to be pregnant sooner were more likely to take periconceptional folic acid (44.2% and 48.4%, respectively) than those with either mistimed or unwanted pregnancies (14.3% and 16.2%, respectively; Table 2).

Adolescent mothers were more likely than older women (age 20+ years) to have unintended pregnancies (64.0% vs 36.2%, respectively) and less likely to have taken periconceptional folic acid (9.2% vs 36.5%, respectively). After stratifying by maternal age and income level, adolescent unintenders (6.0%), low-income unintenders (11.0%), and adolescent intenders (14.9%) were least likely to have taken periconceptional folic acid (Table 3).

TABLE 2. Periconceptional Folic Acid Intake by Pregnancy Intendedness

	n*	%†	Taking Folic Acid
Intended	948	60.4%	45.3%
Sooner‡	270	15.9%	48.4%
Then§	678	44.5%	44.2%
Unintended	681	39.9%	14.8%
Mistimed	523	28.6%	14.3%
Unwanted¶¶	158	11.0%	16.2%

*Unweighted number of respondents (excluding those who did not know or did not respond).

† Weighted percentage of sample in each category (excluding those who did not know or did not respond).

‡ Wanted to be pregnant sooner.

§ Wanted to be pregnant then.

|| Wanted to be pregnant later.

¶¶ Did not want to be pregnant then or at any time in the future.

TABLE 3. Periconceptional Folic Acid Use by Pregnancy Intention, Income, and Maternal Age

	% Taking Folic Acid (Weighted)	95% CI
Adolescent intenders*†	14.9%	2.3%–27.5%
Adolescent unintenders*‡	6.0%	0.3%–11.7%
Older intenders†§	47.6%	42.3%–52.9%
Older unintenders‡§	17.0%	11.8%–22.2%
Low-income intenders†	26.9%	20.1%–33.6%
Low-income unintenders‡	11.0%	6.0%–15.9%
High-income intenders†¶¶	58.1%	51.3%–65.0%
High-income unintenders‡¶¶	22.8%	13.5%–32.1%

CI indicates confidence interval.

* Maternal age at time of birth was <20 years.

† Women who wanted to be pregnant sooner or then.

‡ Women who wanted to be pregnant later or at no time in the future.

§ Maternal age at time of birth was ≥20 years.

|| Annual family income before pregnancy was <\$30 000.

¶¶ Annual family income before pregnancy was ≥\$30 000.

DISCUSSION

Our findings demonstrate that women, especially adolescents, who do not contemplate pregnancy are much less likely to have taken periconceptional folic acid than contemplators. This shows the importance of changing the behavior of noncontemplators. In addition to media campaigns, public health professionals can work with school health education curriculum developers to ensure that girls are encouraged to take vitamins and eat superfortified cold cereals.

A previously published study, using a 1993–1995 high-income clinic-based sample, found that women with intended pregnancies were ~1.5 times more likely to have taken vitamins immediately before pregnancy than those with mistimed or unwanted pregnancies (30.3% vs 19.8% and 20.3%, respectively).¹² In our study, we asked specifically about taking folic acid, so the numbers may not be comparable. We found that women with intended pregnancies were nearly 4 times more likely to have taken folic acid than women with unintended pregnancies. These results suggest the importance of encouraging noncontemplators to take folic acid regularly.

In the early 1990s, public health education efforts focused on the prevention of birth defects. This approach limited the success of the campaign because it

provided no motivation for women who did not intend to become pregnant. Recent public health education has begun to appeal to noncontemplators, largely by associating folic acid with good health.^{14,15}

This work has 4 major limitations: 1) We rely on data that were self-reported and retrospective and therefore subject to recall bias. However, because all of the women had live births and we are not comparing malformations with normal births, the expected bias would be minimal. 2) We interviewed only women who have had a live birth. Women who had miscarriages or abortions may have different characteristics, especially with respect to pregnancy intendedness. 3) Some respondents' folic acid intake may have been underascertained because they did not realize that their multivitamins contained folic acid or because they consumed 400 µg of folic acid per day in foods. However, unless this underascertainment was more likely among those with unintended pregnancies, bias would be toward the null. 4) We may have introduced a misclassification of pregnancy intent by asking women about pregnancy intendedness after birth; asking very early in the pregnancy might have produced different categorization. However, unless this misclassification was differential with respect to folic acid use, the results would again be biased toward the null.

CONCLUSIONS

The importance of fertile women's taking daily multivitamins that contain 400 µg of folic acid should be stressed in public health education and physician counseling, both for women who are contemplating and those who are not contemplating pregnancy. This is particularly true for adolescent and low-income women. Schools should encourage girls to take daily multivitamins that contain folic acid, and women should continue to take them as long as they are capable of becoming pregnant.

ACKNOWLEDGMENTS

We thank Tina Kent for work on PRAMS, Lowell Sever for critique of an early draft, and Elizabeth T. Luman for editing.

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