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Characteristics Associated with Lack of Preconception Multivitamin Supplementation in Ohio Women

Background

Maternal folic acid consumption in the periconception period confers protection against development of neural tube defects (NTD)[1]. Studies have estimated that 50-75% of first-occurence NTDs may be prevented with daily periconception consumption of 0.4 mg of folic acid[2,3,4]. As a result, the U.S. Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC) issued 1992 recommendations for supplementation with 0.4 mg/day folic acid by all women capable of becoming pregnant[1,5]. Subsequently, in 1996, the FDA recommended folic acid fortification of enriched grains, and in 1998 the U.S. became the first country in the world to mandate folic acid fortification of enriched grain products[1].

While fortification initially resulted in an overall doubling of serum folate levels when compared to population levels in the pre-fortification era, a significant percentage of non-pregnant women have failed to achieve 0.4mg/day folic acid intake[1,6,7]. The goal set by the Healthy People 2010 objective, that 80% of U.S. women of childbearing age would achieve the recommended daily amount (RDA) of folic acid, was not met [1,8]. Furthermore, disparities in folic acid intake continue to exist in the U.S., with Hispanic, non-Hispanic black, low income, young women and those with low education levels most likely to consume below the RDA[7,9]. Of additional concern, in 2003-2004, data from the National Health and Nutrition Examination Survey found a drop in serum folate levels when compared to those from 1999-2000[6]. Among women who did achieve the recommended 0.4 mg/day, 76% consumed a daily supplement[10]. As a result, U.S. Public health groups continue to recommend that all women capable of becoming pregnant supplement their diets with daily folic acid or folic acid-containing multivitamins, regardless of pregnancy intention or fortified grain consumption[1].

While national surveys and other studies have illustrated disparities in folic acid consumption at the national level, little is known about patterns of folic acid and/or multivitamin supplementation among fertile Ohio women, making it difficult to appropriately target and prioritize interventions in the state. Therefore, it was of interest to characterize the prevalence of preconception multivitamin consumption in Ohio mothers of recent live-born infants and to identify factors associated with failure to consume multivitamins in the month prior to pregnancy.

Methods

Data from the Ohio Pregnancy Risk Assessment Monitoring System (PRAMS) covering Ohio resident women giving birth from 2006 through 2008 were used for the assessment. Ohio PRAMS is designed as a representative survey of Ohio resident mothers of live born infants and is part of a cooperative state/federal effort to carry out ongoing surveillance with the goal

of better understanding and ultimately preventing poor birth outcomes. PRAMS data include results from survey questions about behaviors before, during, and after pregnancy, as well as information from the Ohio vital record of birth. All answers to survey questions are self-reported.

For this report, we constructed the outcome of interest from answers to the following question, using the first answer choice to indicate "no vitamin use" and any of the subsequent three answer choices to indicate "any vitamin use."

> **During the *month before* you got pregnant with your new baby, how many times a week did you take a multivitamin or a prenatal vitamin?** These are pills that contain many different vitamins and minerals.
>
> ☐ I didn't take a multivitamin or a prenatal vitamin at all
> ☐ 1 to 3 times a week
> ☐ 4 to 6 times a week
> ☐ Every day of the week

Using weighted survey methods, we estimated the prevalence of any multivitamin use and non-use for the state overall. We categorized non-use by a variety of maternal demographic and other factors identified *a priori* as potential risk factors for vitamin non-use, based on the national literature and knowledge of Ohio regional differences in socioeconomic status. These covariates included maternal age, race/ethnicity, pre-pregnancy body mass index (BMI), education level, pregnancy intention, Appalachian county of residence, family income, pre-pregnancy insurance status, and whether a preconception health care visit took place. Women who answered "yes" to whether they had had a discussion prior to conception with a health care provider about how to have a healthy pregnancy were considered to have had a preconception health care visit.

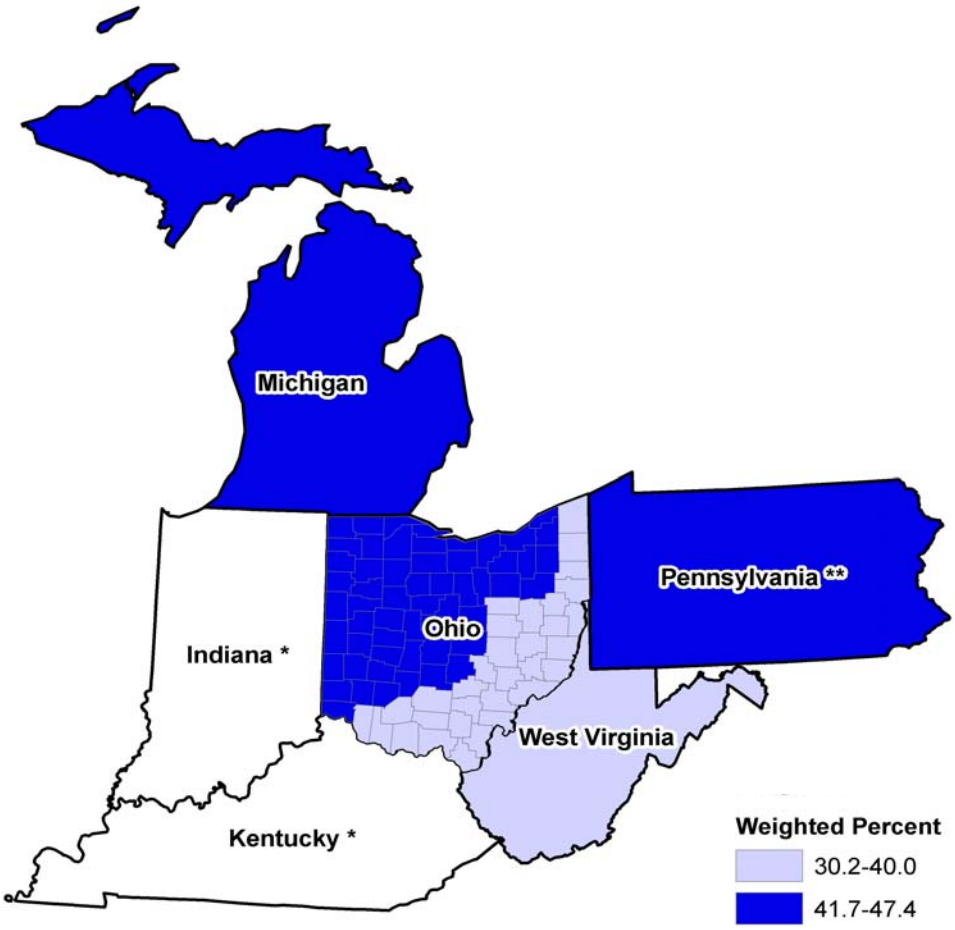
We then conducted weighted multivariable logistic regression analysis. We first determined bivariate crude associations (odds ratios) between vitamin non-use and covariates. Stratified assessments were then used to investigate possible interactions between covariates. A final model included variables having statistically significant joint associations with the outcome. Probabilities of vitamin non-use for selected covariate combinations were calculated from the final multivariable model results. All analyses were carried out using SUDAAN, version 10.

Results

Overall during 2006-2008, only an estimated 43.0% of women reported any multivitamin consumption in the month before pregnancy. As seen in Figure 1 (see page 3), multivitamin use varied by Ohio region, with vitamin consumption lower in the Ohio Appalachian county area. Ohio's Appalachian region more closely resembled West Virginia in the prevalence of any vitamin supplementation in the month prior to pregnancy.

Results of bivariate logistic regression analyses for multivitamin non-use are found in Table 1 (see page 4). Without controlling for other factors, increased odds of vitamin non-use were found for younger maternal ages, non-Hispanic black women, those with lower educational levels, women with unintended pregnancies, women not having had a preconception care visit, those with family income at or below poverty, women on Medicaid or with no insurance prior to pregnancy, those with low or high maternal BMI, and women residing in Appalachian counties. No statistically significant interactions between covariates in their relationship with vitamin non-use were observed (results not reported).

Figure 1: Percentage of Women Reporting any Multivitamin Use in the Month Before Pregnancy, Ohio, Michigan, Pennsylvania, and West Virginia PRAMS, 2006-2008.



* States without PRAMS
** Pennsylvania includes July – December 2007 and 2008 births

Table 1: Factors examined for an association with preconception multivitamin nonuse, unweighted frequencies, weighted percentages, and crude weighted odds ratios, Ohio PRAMS, 2006-2008.

Variable	Preconception Vitamin Nonuse* # (%)	Crude Odds Ratio (95% CI)
Maternal Age (years)		
<18	138 (71.0)	4.0 (2.4 , 6.8)
18-35	2,189 (57.5)	2.2 (1.7 , 2.9
>35	172 (37.8)	Ref
Maternal Race/Ethnicity		
White, non-Hispanic	1,383 (54.3)	Ref
Black, non-Hispanic	1,105 (68.8)	1.9 (1.6 , 2.2)
Hispanic	57 (52.8)	0.9 (0.6 , 1.5)
Other, non-Hispanic	87 (63.3)	1.4 (0.9 , 2.2)
Maternal Education		
< High School	594 (69.6)	2.7 (2.1 , 3.5)
High School Graduate	838 (71.3)	3.0 (2.4 , 3.6)
>High School	1,200 (45.6)	Ref
Unintended Pregnancy		
Yes	1,572 (71.9)	3.2 (2.7 , 3.8)
No	998 (44.1)	Ref
Preconception Care		
Yes	345 (24.2)	Ref
No	2,280 (69.3)	7.1 (5.8 , 8.6)
Family Income		
Near or below 100% of poverty	1,202 (72.4)	2.8 (2.3 , 3.3)
Above 100% of poverty	1,205 (48.7)	Ref
Appalachian County Residence		
Yes	383 (65.0)	1.5 (1.2 , 1.9)
No	2,249 (55.4)	Ref
Pre-pregnancy Body Mass Index		
<18.5	220 (62.5)	1.5 (1.1 , 2.0)
18.5-24.9	1,121 (52.9)	Ref
25.0-29.9	629 (58.7)	1.3 (1.0 , 1.6)
>30.0	631 (62.5)	1.5 (1.2 , 1.8)
Pre-pregnancy Insurance Status		
Any Medicaid	613 (70.0)	2.6 (2.0 , 3.2)
Other Insurance but not Medicaid	1,234 (47.7)	Ref
None	772 (71.5)	2.8 (2.2 , 3.4)

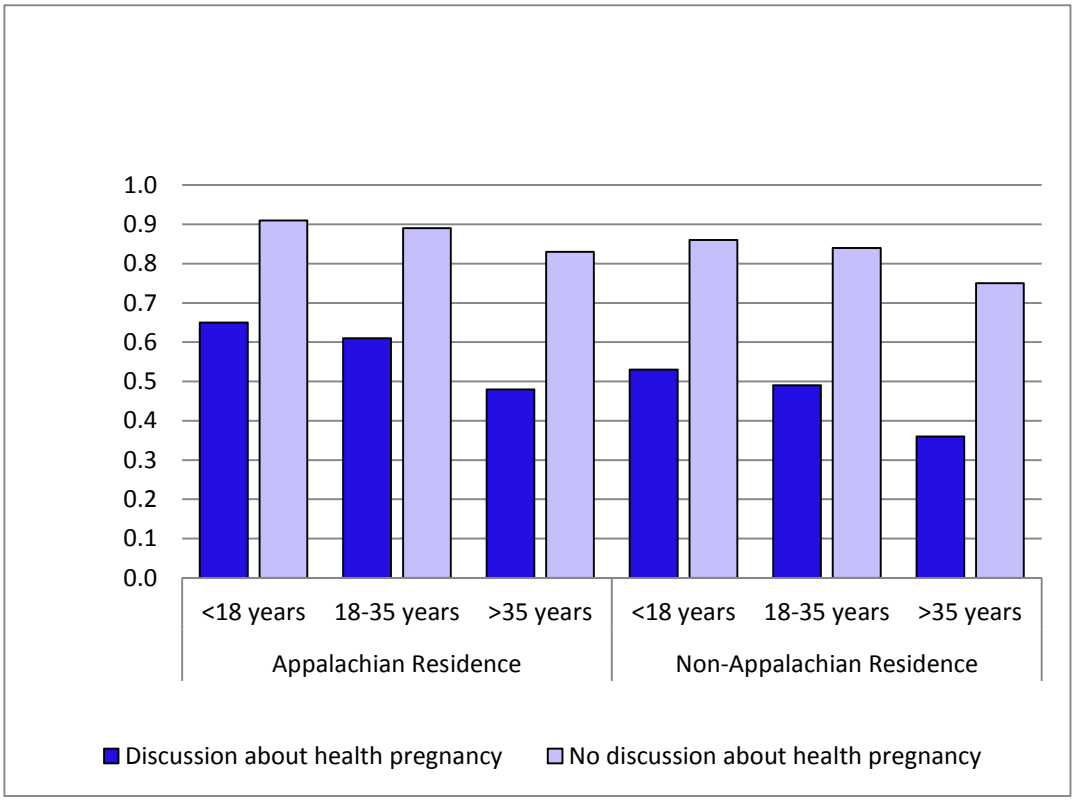
Results of the multivariable logistic regression model are found in Table 2. Of particular note, women without preconception care had more than five times the odds of not taking vitamins as those who had such care, after controlling for other factors including unintended pregnancy, age, education, Appalachian region of residence, obesity, and income. Appalachian residence remained associated with vitamin non-use even after controlling for other factors (aOR=1.7, 95%CI: 1.2,2.2). Health insurance status and race/ethnicity were not important explanatory factors when joint associations were examined, and were therefore not included in the final multivariable model.

Table 2: Final multivariable logistic regression model of factors associated with preconception multivitamin nonuse, Ohio PRAMS, 2006-2008

Variable	β	β Standard Error	B p-value	Adjusted Odds Ratio	95% Confidence Intervals for Odds Ratio
Intercept	-2.22	0.18	0.000	--	--
<18 years old	0.68	0.35	0.054	2.0	1.0, 3.9
19-35 years old	0.51	0.17	0.002	1.7	1.2, 2.3
High school or less	0.66	0.11	0.000	1.9	1.5, 2.4
Appalachian residence	0.50	0.15	0.001	1.7	1.2, 2.2
Obese	0.30	0.12	0.013	1.4	1.1, 1.7
Unintended pregnancy	0.65	0.10	0.000	1.9	1.6, 2.3
No preconception care	1.68	0.11	0.000	5.4	4.3, 6.7
Family income at or below 100% poverty	0.35	0.12	0.003	1.4	1.1, 1.8

Figure 2 presents the estimated probabilities of multivitamin non-use for women who were not obese, but who had low income, high school or less education, and an unintended pregnancy. Those who were less than 18 years old and living in Appalachian Ohio with no preconception care visit had a probability of 0.9 of not taking multivitamins in the month before conception. For each age group/residence combination, the probability of vitamin non-use was substantially less when a preconception care visit had taken place. Women with non-Appalachian county of residence were less likely to abstain from vitamin use when compared to their age - and preconception care - matched counterparts. Furthermore, probability of vitamin non-use decreased with increasing age within county type and preconception care status. Non-Appalachian women over age 35 years who had preconception care experienced the lowest probability of vitamin non-use (0.4).

Figure 2: Probability of Preconception Multivitamin Non-use among Non-Obese Low Income Women with High School or Less Education and an Unintended Pregnancy, Ohio PRAMS, 2006-2008



Conclusion

Results of this analysis indicate that a large percentage of Ohio reproductive aged women with recent live births are not following the recommendation for consumption of folic acid-containing multivitamins prior to conception. This finding is limited by the fact that the Ohio PRAMS survey did not specifically inquire about folic acid consumption independent of a multivitamin. Thus it is possible that these results underestimate the true prevalence of folic acid use, if significant numbers of women took folic acid supplements without also taking multivitamin supplements. However, our results are largely consistent with those from studies in other states and nationally. Furthermore, we used a conservative measure of vitamin non-use by assessing "any" use versus "non-use." Given that the recommendation is for daily consumption, whereas we combined answers of daily use with one to three times per week and four to six times per week, we consider it safe to assume that daily folic acid/multivitamin supplementation prior to pregnancy among Ohio women is well below the Healthy People Goals for the population. Since multivitamin supplementation alone prior to conception has been found to protect against other birth defects in addition to folic acid-susceptible NTDs, we consider this an important and potentially modifiable public health issue in Ohio[11].

The finding that the race/ethnicity disparity was explained by other factors in the multivariable model suggests that vitamin non-use in the examined Ohio minority groups is due less to an unmeasured cultural issue and more to socioeconomic factors and other differences captured by the model, such as maternal age and pregnancy intention. This does not mean, however, that minority groups should not be specifically targeted for appropriate interventions.

Lower vitamin use in Appalachian Ohio counties, even after controlling for income, education, and other factors was somewhat unexpected. Reasons for this disparity should be explored so that effective interventions may be developed for this geographic region. Regional differences in knowledge about and attitudes toward vitamin supplementation may exist, although a search of the published literature found little to support or detract from this conclusion. Nevertheless, Ohio Appalachian adults are known to have higher prevalence of other risky health behaviors, including tobacco use and energy imbalance (poor diet, obesity and physical inactivity), and lower self-reported health status[12]. Furthermore, cultural diversity in Appalachian eating patterns is recognized[13].

In this assessment, the factor having the largest measure of association with vitamin non-use was not having had a preconception health care visit. Due to the cross-sectional nature of this investigation, it is not possible to definitively conclude that a temporal relationship existed between a preconception visit and subsequent vitamin use. It is possible that one factor did not explain the other, but rather that positive health behaviors tended to go hand in hand. Yet, with increasing recognition of the importance of preventive care visits prior to conception for improving the health of mothers and their infants, this finding nevertheless supports the preconception health visit as important for counseling women about the benefits of folic acid. Since studies have shown that this venue of educating about folic acid is underutilized, providers of health care to reproductive aged women should be educated about and encouraged to recommend folic acid to non-pregnant women seeking preventive care[14].

Lastly, given that pregnancy intention was independently related to vitamin non-use in this analysis, and in light of the other benefits to mothers, their children and society in preventing unintended pregnancy, efforts to reduce the prevalence of unintended pregnancy in Ohio should be paramount. Success in this area, particularly among young women, is expected to also reduce the number of observed women with recent live births reporting that they failed to take the recommended preconception vitamin supplements.

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