Assessing Awareness, Knowledge and Use of Folic Acid in Kansas Women Between the Ages of 18 and 44 Years

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Assessing Awareness, Knowledge and Use of Folic Acid in Kansas Women Between the Ages of 18 and 44 Years

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Abstract Taking folic acid daily, before and during early pregnancy, has been proven to reduce neural tube birth defects (NTD). Unfortunately, many women fail to take it daily as recommended. *Objectives* To assess women's self-reported awareness, knowledge and use of folic acid. *Methods* Data were obtained by cross-sectional, random digit-dialing, computer-assisted telephone interviews with 250 women in Kansas. Associations were determined by chi-squared analysis. *Results* Eighty-eight percent of childbearing age women in Kansas have a general awareness of folic acid, 20% have knowledge that it reduces birth defects, but only 25% report taking it daily. Awareness was associated with high school or greater education ($P < .0001$), incomes over $25,000 ($P = 0.0003$), being married ($P = 0.0035$), being white ($P = 0.0135$), having health insurance ($P = 0.0152$) and being capable of pregnancy ($P = 0.0119$). Knowledge that folic acid reduces birth defects was associated with being aware of the USPHS recommendation ($P < .0001$), being capable of pregnancy ($P = 0.0043$), being pregnant ($P = 0.0061$), and being aware of folic acid ($P = 0.0379$). Taking folic acid daily was associated with currently being pregnant ($P = 0.0126$). *Conclusions* Women less likely to take folic acid on a daily basis were young, non-Caucasians who reported less education, less income and no health insurance. Based upon these data, multi-level education campaigns that specifically target lower-SES women should be considered.

Keywords Folic acid · NTD · Birth defects · Awareness · Knowledge · Random

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Background

Birth defects continue to be a significant cause of infant morbidity and remain the leading cause of infant mortality in the U.S. [1]. Neural tube defects (NTDs), which include anencephaly and spina bifida, affect 1 out of 1,000 pregnancies. Infants born with an NTD are often miscarried, die shortly after birth, or suffer life-long disabilities [2] with individual costs ranging from $300,000 [3] to over $1 million [4]. Over 70% of NTDs can be prevented with periconceptual consumption of folic acid [3, 5–7]. However, periconceptual consumption presents a considerable challenge since 50% of all pregnancies are unplanned [8] and 68% of young women aged 15 to 24 years report unplanned pregnancies [8].

To achieve the 70% reduction in NTDs, the U.S. Public Health Service (USPHS) recommends that all childbearing age women capable of pregnancy consume 0.4 mgs of folic acid daily [9], and the U.S. Food and Drug Administration mandates folic acid fortification of enriched cereal grain products [10]. While the prevalence of NTDs has decreased nationally by 26% since 2000 [11] the expected 70% reduction has not been achieved [12]. In 2005, awareness of folic acid had risen nationally to 84%, yet knowledge

that folic acid prevents birth defects was only 19% [12]. Use of folic acid has increased only modestly: 33% of women reported taking folic acid daily in 1995 [12] while 40% reported taking it in 2007 [13].

The aim of this study is to examine awareness, knowledge and use of folic acid among child-bearing age women in Kansas between 18 and 44 years of age. Data analyses will be useful in developing intervention strategies to reduce NTDs in Kansas and other states with similar demographics.

Methods

Data were obtained by conducting a randomized cross-sectional survey using random-digit dialing (RDD) and computer assisted telephone interviewing (CATI) between November 2000 and January 2001. The Institutional Review Board (IRB) for the Kansas City University of Medicine and Biosciences (KCUMB) approved this study prior to data collection. Informed consent was obtained verbally from each participant prior to the telephone interview. The interview assessed respondent perceptions of forty-one questions which were derived from the Behavioral Risk Factor Surveillance Survey (BRFSS) [14], the March of Dimes/Gallup Organization national survey on folic acid [12], and the National Health Interview Survey [15].

There were 6,213 call attempts to get 252 completed calls (4% response rate) with ten attempts made until disposition for each number. There were 14% of calls with a non-eligible participant and 4% refused to participate. Response rate was calculated by the number of completed calls divided by the sum of completed calls plus refusals ($252/252 + 258 = 49.4\%$) with the refusal rate being 1 less the response rate [16].

For this survey, awareness was assessed by respondents having "heard, read, or seen anything" about folic acid, while knowledge indicated respondents knew specifically that folic acid reduces birth defects. A series of three questions were used to determine if a woman consumed folic acid on a daily basis. The first question asked if a woman took any 'vitamin or mineral supplement'. If the response was 'yes', they were asked if 'any of the vitamin or mineral supplements taken included folic acid.' 'Yes' responses were then asked 'how often do you take this vitamin or mineral supplement that contains folic acid' with one of the five choices being 'daily.' Because the recommendation is that women take folic acid daily, the authors considered any response other than 'daily' to be 'not daily' in the analysis.

Data analysis was completed using SAS 9.1. Univariate analyses were conducted using chi-square statistics. Multivariate logistic and stepwise multiple-logistic regressions were conducted to identify factors that predict awareness, knowledge, and use of folic acid. Factors were considered to be significant at $\alpha < .05$. Women who did not respond or provided 'don't know' responses were considered non-responders and eliminated from the analyses because they were few in number and the characteristics of non-responders were not significantly different from responders (Fisher's Exact >0.05) [17].

Results

A total of 250 completed surveys were used in this analysis. Demographic characteristics of study respondents are provided in Table 1. There were seven participants that described themselves as being of Spanish or Hispanic origin. However, because 90.8% of participants were white, all other races were placed into a 'not white' category to simplify analysis. Almost half of survey respondents were 35 years of age or older, with 37% between 25 and 34 years, and 13.6% < 25 years of age. Most study respondents were white (90.8%), had health insurance (86.4%), an annual household income ≥$25,000 (78.8%), were married (76%), and had some college or were college graduates (65.6%). There were 6% of study respondents that were pregnant at the time of the survey, while 79.6% had been pregnant before with 95% of those giving birth to a live child. The characteristics of women in this study reflect the overall demographics of Kansas in 2000 [18].

Table 2 summarizes responses to questions about general awareness of folic acid and being aware of the USPHS recommendation to take folic acid daily. Table 3 shows responses to questions about having the specific knowledge that folic acid prevents birth defects, and Table 4 displays responses of those reporting use of vitamins and folic acid.

Education beyond high school was the factor most strongly associated with having a general awareness of folic acid and being aware of the USPHS recommendation. Having an income ≥$25,000, being married, and having health insurance were also significant for both general awareness and awareness of the USPHS recommendation. Being white was strongly associated with being aware of folic acid, but race was not significantly associated with being aware of the USPHS recommendation.

Significant factors associated with the general knowledge there is 'something' a woman can do to prevent birth defects were: education beyond high school, an income ≥$25,000, having health insurance, and being aware of folic acid. Being aware of the USPHS recommendation to take folic acid daily was a factor that was significant for having general knowledge, for knowing that taking

Table 1 Sample characteristics for all women ($n = 250$)[a]

	n	%
Age (years)		
<25	34	13.6
25–34	93	37.2
35+	123	49.2
Race		
White	226	90.8
Black	14	5.6
Asian, Pacific Islander	3	1.2
American Indian, Alaska native	5	2.0
Other	1	0.4
Education		
<High school	15	6.0
High school graduate	71	28.4
Any college or college graduate	164	65.6
Marital status		
Married	190	76.0
Not married	60	24.0
Annual household income		
<$15,000	20	8.7
$15,000–$24,999	29	12.6
$25,000–$49,999	85	37.0
$50,000–$69,999	56	24.4
≥$70,000	40	17.4
Health insurance		
Yes	216	86.4
No	34	13.6
Is capable of pregnancy		
Yes	189	75.9
No	60	24.1
Currently pregnant		
Yes	15	6.0
No	234	94.0

[a] Each category may not equal 250 due to non-response

vitamins reduced birth defects, and knowing that specifically taking folic acid reduces birth defects. Other factors significantly associated with specifically knowing that taking folic acid reduces birth defects were: being capable of pregnancy and being pregnant at the time of the survey.

Over half the women who responded to the survey said they take a vitamin or mineral supplement. Of those women that reported taking a vitamin or mineral, 95 (66%) said the vitamin contained folic acid. For those who knew they were taking folic acid, 63 (66%) stated they took it daily. Thus, of the 250 women surveyed, only 25% took folic acid daily.

Factors associated with women taking a vitamin or mineral supplement were education, having health insurance, and having the specific knowledge that folic acid prevents birth defects. However, the factors associated with a woman reporting she specifically took a vitamin containing folic acid were having a general awareness of folic acid and being aware of the USPHS recommendation. The only factor significantly associated with taking folic acid daily was being pregnant. In this survey, 15 women reported being pregnant, and all of them reported taking folic acid daily.

The single factor logistic regression showed that women capable of pregnancy and those with insurance were almost three times more likely to be aware of folic acid (O.R. 2.76, 95% CI 1.22–6.24; and, 2.99, 95% CI 1.19–7.46 respectively). Women with incomes ≥$25,000 were more than five times as likely to be aware of folic acid (O.R. 5.44, 95% CI 1.19–7.46), while women with an education beyond high school were approximately nine times more likely to be aware of folic acid (O.R. 8.83, 95% CI 2.91–26.78). Women that were capable of pregnancy were almost four times more likely to know that folic acid reduced birth defects (O.R. 3.85, 95% CI 1.44–10.24).

With all factors included in a multiple logistic regression analysis, age was a significant factor ($P = 0.0254$) that affected 'lack of awareness.' Women aged 35 + were four times less likely to be aware of folic acid (OR 4.15; CI 1.19–14.48) compared to women 25 to 34 years of age. This was true even though the results shown in Table 2 for the individual factors of awareness shows that age was not a significant factor by itself. Results of the multiple regression analysis also showed that women with less than a high school education were five times less likely to be aware of folic acid (OR 5.23; CI 1.05–26.20).

Discussion

In this 2001 cross sectional study of Kansas women, 88% reported being aware of folic acid compared to 79% nationally in 2003 [19] while 55% reported being aware of the USPHS recommendation compared to 22% nationally in 1997 [20]. With only 25% of women in this study taking any amount of folic acid daily, there appears to be a significant gap between awareness, knowledge and actual use of folic acid in Kansas. It is interesting to note that there is very little difference in daily folic acid use between the overall sample of women (25%) and only those capable of pregnancy (27%). The Healthy People 2010 recommendation is for 80% of all childbearing age women to take the recommended amount of folic acid on a daily basis.

These results confirm previous studies [13, 20–33] that women most likely to be aware of folic acid were married, white, with higher incomes and health insurance. The only factors that actually predict taking folic acid were being aware of folic acid and being aware of the USPHS

Table 2 Awareness by demographic characteristics

Characteristic	Aware of folic acid[a] ($n = 250$)			Aware of USPHS recommendation for folic acid[b] ($n = 250$)		
	Aware %	Not aware %	χ^2 *P*-value	Aware %	Not Aware %	χ^2 *P*-value
Age						
18–24 years	88.2	11.8	0.1545	52.9	47.1	0.5008
25–34 years	93.6	6.5		60.2	39.8	
35+ years	85.1	14.9		52.5	47.5	
Race						
White	90.2	9.8	0.0135	57.3	42.7	0.0942
Not White	72.7	27.3		39.1	60.9	
Education						
<High school	53.3	46.7	<.0001	26.7	73.3	0.0208
High school or college	91.0	9.0		57.3	42.7	
Marital status						
Married	92.0	8.0	0.0035	61.4	38.6	0.0008
Not married	78.3	21.7		36.7	63.3	
Income						
<$25,000	75.5	24.5	0.0003	36.7	63.3	0.0029
≥$25,000	93.3	6.7		60.6	39.4	
Health insurance						
Yes	90.7	9.4	0.0152	58.1	41.9	0.0300
No	76.5	23.5		38.2	61.8	
Capable of pregnancy						
Is capable	91.5	8.5	0.0119	60.6	39.4	0.0036
Is not capable	79.7	20.3		39.3	60.7	
Pregnancy status						
Pregnant	93.3	6.7	0.5850	80.0	20.0	0.0501
Not pregnant	88.8	11.2		54.1	45.9	
Aware of folic acid						
Yes aware				62.1	37.9	<.0001
Not aware				7.1	92.9	

[a] Have you ever heard, read or seen anything about folic acid? (220 yes)

[b] Have you heard the USPHS recommendation of 400 micrograms of folic acid a day? (138 yes)

Reference Groups: 1. Age 25–34; 2. Race (White); 3. Education (>HS); 4. Married; 5. Income (>$25 K); 6. Insurance; 7. Capable of pregnancy; 8. Pregnant; 9. Aware of Folic Acid

recommendation to take folic acid daily. This highlights the critical importance of large scale, continuous education efforts to increase awareness. For women in this study, once they become pregnant, or intend to become pregnant, they have the knowledge that folic acid prevents birth defects. Unfortunately, for some women, this knowledge comes too late in the pregnancy to prevent an NTD.

The major strength of this study is that it was a randomized cross-sectional survey. A second strength is that it looks at women in a central mid-west state (Kansas). The demographics in Kansas are different than most other states where folic acid studies have been conducted [13, 20–33]. The lack of racial diversity in Kansas should simplify the development of educational campaigns to promote the importance of folic acid throughout Kansas.

The survey instrument has strong validity. All questions used in this analysis were from the BRFSS survey developed by the Centers for Disease Control and Prevention (CDC) with rigorous validation techniques. Even though the survey instrument was not re-validated, because BRFSS responses are used at the national and state level for prevalence rates, the authors feel the analysis has strong validity.

There are a few notable limitations of this study. One limitation is that there was no information on the amount of folic acid contained in the vitamin or mineral

Table 3 Knowledge that a woman can reduce birth defects by demographic characteristics

Characteristic	Do something[a] ($n = 250$)			Take vitamins[b] ($n = 65$)			Take folic acid[c] ($n = 51$)		
	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value
Age									
18–24 years	90.6	9.4	0.5381	37.9	62.1	0.2052	34.5	65.5	0.2265
25–34 years	89.1	10.9		32.9	67.1		23.2	76.8	
35+ years	93.4	6.6		23.9	76.1		19.5	80.5	
Race									
White	91.9	8.1	0.3778	28.4	71.6	0.4404	24.5	75.5	0.0561
Not White	86.4	13.6		36.8	63.2		5.3	94.7	
Education									
<High school	60.0	40.0	<.0001	33.3	66.7	0.7709	22.2	77.8	0.9682
High school or college	93.5	6.5		28.8	71.2		22.8	77.2	
Marital status									
Married	92.0	8.0	0.5808	27.9	72.1	0.5052	22.1	77.9	0.6614
Not married	89.7	10.3		32.7	67.3		25.0	75.0	
Income									
<$25,000	79.2	20.8	0.0010	31.6	68.4	0.7686	18.4	81.6	0.4747
≥$25,000	94.4	5.6		29.2	70.8		23.8	76.2	
Health insurance									
Yes	93.4	6.6	0.0070	28.4	71.6	0.5983	23.9	76.1	0.2933
No	79.4	20.6		33.3	66.7		14.8	85.2	
Capable of pregnancy									
Is capable	90.8	9.2	0.5442	29.8	70.2	0.6708	27.4	72.6	0.0043
Is not capable	93.3	6.7		26.8	73.2		8.9	91.1	
Pregnancy status									
Pregnant	86.7	13.3	0.5005	30.8	69.2	0.8945	53.9	46.2	0.0061
Not pregnant	91.7	8.3		29.1	71.0		21.0	79.1	
Aware of folic acid									
Yes aware	93.5	6.5	0.0010	30.2	69.8	0.2846	24.8	75.3	0.0379
Not aware	75.0	25.0		19.1	81.0		4.8	95.2	
Aware of USPHS recommendation									
Yes aware	97.8	2.2	<.0001	34.8	65.2	0.0211	33.3	66.7	<.0001
Not aware	83.0	17.0		20.5	79.6		6.8	93.2	

[a] From what you know, is there anything a woman can do to reduce her risk of having a baby with birth defects? (224 yes)

[b] Specifically mentioned taking vitamins when asked "What can a woman do to reduce the risk of birth defects?" ($n = 65$)

[c] Specifically mentioned taking folic acid when asked "What can a woman do to reduce the risk of birth defects?" ($n = 51$)

Reference groups: 1. Age 25–34; 2. Race (White); 3. Education (>HS); 4. Married; 5. Income (>$25 K); 6. Insurance; 7. Capable of pregnancy; 8. Pregnant; 9. Aware of folic acid; 10. Aware of USPHS recommendation

supplement taken. Thus, even though a woman reports using folic acid daily, it is impossible to determine if the vitamin or supplement contained the recommended 400 micrograms. Another limitation is that only one delivery method of folic acid was assessed—vitamins and supplements taken orally. To get a complete picture, respondents could have been asked about dietary intake of foods containing folic acid. An added limitation is that women 18–24 years of age ($n = 34$) were under-represented, while women 35–44 years may have been over-represented ($n = 123$). By not including women younger than 18 years, an important group may have been left out that could greatly benefit from taking folic acid to prevent adverse birth outcomes.

There may also be a generation difference in responses. The USPHS recommendation was not issued until 1992 and widespread national support was not given until 1998. Thus, younger women may have known about folic acid from the time they were of reproductive age, while older women may not have known of the recommendation.

Table 4 Use of vitamins and folic acid by demographic characteristics

Characteristic	Vitamin[a] ($n = 250$)			Folic acid[b] ($n = 143$)			Folic acid daily[c] ($n = 95$)		
	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value
Age									
18–24 years	55.9	44.1	0.9154	79.0	21.1	0.9886	86.7	13.3	0.0749
25–34 years	55.9	44.1		77.8	22.2		54.3	45.7	
35+ years	58.5	41.5		79.0	21.1		68.9	31.1	
Race									
White	58.0	42.0	0.3494	77.5	22.5	0.3558	66.3	33.7	0.9813
Not White	47.8	52.2		90.0	10.0		66.7	33.3	
Education									
<High school	13.3	86.7	0.0004	100.0	0.0	0.7851[d]	100.0	0.0	0.6632[d]
High school or college	60.0	40.0		78.3	21.7		66.0	34.0	
Marital status									
Married	59.0	41.1	0.3204	78.1	21.9	0.8389	62.7	37.3	0.1450
Not Married	51.7	48.3		80.0	20.0		80.0	20.0	
Income									
<$25,000	46.9	53.1	0.0819	88.9	11.1	0.1373[d]	62.5	37.5	0.6955
≥$25,000	60.8	39.2		76.3	23.7		67.6	32.4	
Health insurance									
Yes	60.2	39.8	0.0162	80.4	19.6	0.0767[d]	66.7	33.3	0.3399[d]
No	38.2	61.8		55.6	44.4		60.0	40.0	
Capable of pregnancy									
Is capable	56.6	43.4	0.7416	81.9	17.0	0.0891	64.9	35.1	0.5559
Is not capable	59.0	41.0		66.7	9.0		72.2	27.8	
Pregnancy status									
Pregnant	80.0	20.0	0.0682	100.0	0.0	0.0799[d]	100.0	0.0	0.0126[d]
Not pregnant	56.0	44.0		76.6	23.4		62.4	37.7	
Aware of folic acid									
Yes aware	58.6	41.4	0.1123	81.6	18.4	0.0065[d]	65.6	34.4	0.6596[d]
Not aware	42.9	57.1		20.0	80.0		100.0	0.0	
Aware of USPHS recommendation									
Yes aware	60.9	39.1	0.1722	86.3	13.8	0.0069	63.8	36.3	0.3921
Not aware	52.3	47.8		65.0	35.0		73.1	26.9	
Know any reduces birth defects									
Yes know	59.8	40.2	0.0538	79.1	20.9	0.4176[d]	65.9	34.1	0.3992[d]
No does not know	38.1	61.9		80.0	20.0		75.0	25.0	

Table 4 continued

Characteristic	Vitamin[a] ($n = 250$)			Folic acid[b] ($n = 143$)			Folic acid daily[c] ($n = 95$)		
	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value	Yes %	No %	χ^2 *P*-value
Know vitamins reduces birth defects									
Yes know	56.9	43.1	0.5716	81.8	18.2	0.6528	66.7	33.3	0.9237
No does not know	61.0	39.0		78.1	22.0		65.6	34.4	
Know folic acid reduces birth defects									
Yes know	72.6	27.5	0.0349	88.2	11.8	0.1196	66.7	33.3	0.9176
No does not know	56.1	43.9		75.3	24.7		65.6	34.4	

[a] Do you currently take any vitamins or mineral supplements? (143 yes)

[b] Do any of the vitamin pills or supplements you take contain folic acid? (95 yes)

[c] How often do you take a vitamin containing folic acid? (63 yes)

[d] Fisher's Exact Test used instead of chi-square due to expected cell counts less than 5

Reference Groups: 1. Age 25–34; 2. Race (White); 3. Education (>HS); 4. Married; 5. Income (>$25 K); 6. Insurance; 7. Capable; 8. Pregnant; 9. Aware of Folic Acid; 10. Aware of USPHS Recommendation; 11. Knows something reduces birth defects; 12. Knows vitamins reduces birth defects; 13. Knows folic acid reduces birth defects

Another limitation is that recall bias may have been introduced into the analysis because all responses were self-reported.

Conclusion

Many women are aware of folic acid, but fewer know about its role in preventing NTDs, and even less take it daily as recommended. In order to reduce NTDs, multi-level education strategies that target lower SES women must be developed and delivered continuously. It is critical that women recognize the importance of folic acid and take it daily as recommended to reduce the number of NTDs.

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