The relationship between awareness and supplementation: Which Canadian women know about folic acid and how does that translate into use?

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ABSTRACT

OBJECTIVE: Although the benefit of folic acid (FA) to prevent neural tube defects (NTD) is well established, not all women take supplements in the periconceptional period. This study used data from the Public Health Agency of Canada's Maternity Experiences Survey to evaluate determinants of awareness of FA among recently pregnant women in Canada, and the extent to which that translated into actual supplement usage.

METHODS: Telephone interviews took place between October 23, 2006 and January 31, 2007 with women who were 5 to 14 months postpartum to survey their experiences during pregnancy, birth and the postpartum period. These analyses were conducted on women who responded to questions relating to FA supplementation. The 6,421 respondents were weighted to represent 76,508 women using weights which corresponded to the sampling strata, the mother's first language and Aboriginal status.

RESULTS: Overall, 77.6% of surveyed women knew that taking FA periconceptionally could help protect against NTD. Women who were younger, single or separated reported less awareness and use of FA, while higher maternal age, level of education and income were positively associated with both knowledge and use. Despite longstanding national guidelines for supplementation, there were regional variations in knowledge and use of FA.

CONCLUSION: The data indicate clear socio-demographic differences among Canadian women with respect to their knowledge and use of FA. Although most women understood the benefits of FA supplementation, a little over a third of them did not take FA supplements prior to becoming pregnant, and less than half supplemented according to national guidelines. Identification of those subpopulations whose use of supplements is suboptimal may allow for targeted educational or other interventions to further encourage FA use.

KEY WORDS: Folic acid; pregnancy; Canada; knowledge; Maternity Experiences Survey

La traduction du résumé se trouve à la fin de l'article.

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The rate of neural tube defects (NTD) in Canada has declined significantly after the 1998 mandatory introduction of folic acid (FA) fortification of many food grain products, from a rate of 5.5 per 10,000 births in 1996 to 4.1 per 10,000 births in 2007.¹ Despite this fortification, a significant proportion of women of childbearing age still have levels of red blood cell folate below optimal for protection against NTD in their infants.² A diet including naturally folate-rich and FA-fortified foods may still provide less than adequate amounts of folate, therefore supplementary FA may be required to ensure a fetus is optimally protected. Use of such supplements may be influenced by many maternal factors, including age, education, income, smoking, employment, and mother's birth outside Canada.³

Public health strategies for optimizing FA intake in women of childbearing potential involve two interrelated components: improving awareness and knowledge concerning the benefits of FA; and increasing the proportion of women who take supplements prior to conception. In order to facilitate such activities in Canada, this report uses data from the Canadian Maternity Experiences Survey (MES) to identify factors associated with prior awareness of FA benefits, and those related to use among those who were considered knowledgeable.

METHODS

The MES was developed and implemented by the Public Health Agency of Canada (PHAC). The primary objective of the survey was

to provide representative, pan-Canadian data on women's experiences during pregnancy, birth and the postpartum period.

The following description of the MES is taken from Dzakpasu et al. (2008) and further details on the survey's methods are available there.⁴ Interviews were conducted primarily by telephone between October 23, 2006 and January 31, 2007. Most (96.9%) women were interviewed at 5 to 9 months postpartum, with the timing ranging from 5 to 14 months. Interviews were conducted in the participant's first language; languages included English, French and 13 non-official languages.

Birth mothers 15 years of age and older who had a singleton live birth in Canada between November 1, 2005 and May 15, 2006 and who lived with their infant at the time of data collection were eligible to participate in the survey. Mothers under 15 years of age at the time of giving birth and mothers living on First Nations reserves or living in institutions were excluded for operational reasons. Any mother who had a multiple birth (e.g., twins), stillbirth, suffered an infant death or was no longer living with her baby was also excluded. A stratified, random sample of 8,542 women was selected without replace-

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Table 1. Percent of women reporting folic acid awareness in relation to selected factors

Factor n=76,508	(%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Province			
NL	83.2	1.4 (0.99-1.9)	1.1 (0.77-1.6)
PEI	77.6	1.0 (0.71-1.5)	0.82 (0.55-1.2)
NS	83.7	1.5 (1.1-2.0)	1.2 (0.84-1.7)
NB	77.3	0.95 (0.71-1.3)	0.80 (0.57-1.1)
QC	77.0	1.0 (0.8-1.1)	0.74 (0.61-0.90)
ON	78.3	1	1
MB	72.4	0.73 (0.6-0.9)	0.74 (0.55-0.99)
SK	77.9	1.0 (0.8-1.3)	0.95 (0.70-1.3)
AB	76.7	0.90 (0.7-1.2)	0.84 (0.67-1.1)
BC	80.5	1.2 (0.9-1.5)	1.0 (0.81-1.3)
YK	83.9	1.5 (0.7-2.9)	1.3 (0.60-2.7)
NT	54.3	0.38 (0.2-0.6)	0.42 (0.25-0.71)
NU	35.1	0.15 (0.09-0.2)	0.49 (0.27-0.90)
Age group (years)			
15-19	32.3	0.07 (0.05-0.099)	0.12 (0.08-0.17)
20-24	50.5	0.15 (0.13-0.18)	0.19 (0.16-0.23)
25-29	77.4	0.51 (0.44-0.61)	0.54 (0.45-0.64)
30-34	87.0	1	1
35-39	84.8	0.84 (0.68-1.02)	0.88 (0.71-1.1)
40-44	81.0	0.64 (0.45-0.92)	0.68 (0.47-0.99)
45-49	92.9	1.95 (0.25-14.9)	1.3 (0.16-10.0)
Employment			
Employed	77.6	1	1
Unemployed	58.8	0.52 (0.46-0.60)	0.78 (0.67-0.91)
Maternal education			
<high school	43.2	0.10 (0.08-0.12)	0.19 (0.15-0.25)
High school and some post-secondary	65.5	0.25 (0.21-0.29)	0.31 (0.25-0.38)
Post-secondary	81.6	0.58 (0.49-0.68)	0.55 (0.46-0.66)
University degree	89.8	1	1
Low income cut-off			
At or below LICO	59.2	0.33 (0.29-0.37)	0.58 (0.49-0.69)
Above LICO	84.5	1	1
Smoking 3 months prior to pregnancy			
Smoked daily or occasionally	63.5	0.33 (0.29-0.37)	0.55 (0.45-0.66)
Non-smoker	81.9	1	1
Country of birth			
Canada	80.3	1	1
Other	67.1	0.44 (0.38-0.50)	0.26 (0.22-0.31)
First prenatal care visit			
1 st trimester	78.9	1	1
After 1 st trimester	60.8	0.33 (0.27-0.40)	0.51 (0.40-0.64)
Aboriginal status			
Aboriginal	51.5	0.33 (0.27-0.41)	0.52 (0.41-0.67)
Non-Aboriginal	79.6	1	1
Pre-existing health issue			
Existing condition	75.9	0.89 (0.78-0.99)	0.97 (0.85-1.1)
No medical condition	72.8	1	1
Parity			
Primiparous	72.2	0.59 (0.56-0.66)	0.59 (0.51-0.69)
Multiparous	81.6	1	1
Planned pregnancy			
Planned	83.0	1	1
Unplanned	63.1	0.4 (0.3-0.4)	0.6 (0.50-0.71)
Marital status			
Single, never married	49.8	0.20 (0.16-0.24)	
Married	83.5	1	1
Common-law	71.5	0.50 (0.43-0.57)	
Separated	63.8	0.35 (0.23-0.54)	
Divorced	64.0	0.35 (0.16-0.80)	

Adjusted for all factors listed in this table.

ment, using recent births drawn from a Census-based sampling frame; of these women, 6,421 completed enough of the questionnaire to be considered respondents for the MES study cohort. Each responding woman was assigned a sampling weight calculated within weighting classes, which generally corresponded to the strata used to draw the sample. Additional post-strata information based on the mother's first language and Aboriginal status was also used. The 6,421 respondents were thus weighted to represent 76,508 women, which is considered a nationally representative sample.

Women were considered to be knowledgeable if they reported "yes" to the question "before your pregnancy, did you know that taking folic acid before pregnancy can help prevent some birth defects?"

Women were categorized into two groups according to their FA supplementation: "met recommended guidelines", meaning they reported "yes" to all of the following questions: "In the 3 months before you got pregnant, did you take a multivitamin containing folic acid or a folic acid supplement?", "Did you take it every day?", "During the first 3 months of your pregnancy, did you take a multivitamin containing folic acid or a folic acid supplement?", and "Did you take it every day?"; or, "did not meet the recommended guidelines".

Socio-demographic characteristics included self-reported age (in years), marital status, education, ethnicity, province/territory of residence, employment status, and country of birth (of mothers). A variable labelled low income cut-off (LICO) was derived using a set of

Table 2. Folic acid use in preconception and first three months of pregnancy in relation to selected factors

Factor n=76,508	3 months before pregnancy (%)	First 3 months of pregnancy (%)
Province		
NL	60.2	92.2
PEI	47.9	87.4
NS	59.8	91.3
NB	58.3	92.2
QC	56.0	87.0
ON	58.6	90.5
MB	49.7	90.5
SK	56.7	90.0
AB	59.3	87.8
BC	61.3	93.9
YK	67.5	98.7
NT	45.9	80.7
NU	16.1	51.5
Age group (years)		
15-19	16.1	70.5
20-24	32.2	81.9
25-29	55.0	89.9
30-34	66.5	91.8
35-39	67.5	93.3
40-44	58.8	86.5
45-49	89.0	89.0
Employment during pregnancy		
Employed	61.6	90.9
Unemployed	44.8	85.3
Maternal education		
<high school	29.6	73.0
High school and some post-secondary	40.6	86.0
Post-secondary	60.2	91.0
University degree	71.8	94.3
Low income cut-off		
At or below LICO	34.9	80.9
Above LICO	65.4	92.5
Smoking 3 months prior to pregnancy		
Smoked daily or occasionally	43.8	82.4
Non-smoker	58.7	90.1
Country of birth		
Canada	61.0	90.4
Other	48.4	87.7
First prenatal care visit		
Before end of 1 st trimester	59.3	91.1
After 1 st trimester	32.7	61.1
Aboriginal status		
Aboriginal	35.3	79.8
Non-Aboriginal	58.9	90.1
Pre-existing health issue		
Existing condition	56.2	88.7
No medical condition	59.2	90.4
Parity		
Primiparous	59.4	91.6
Multiparous	56.9	88.2
Planned pregnancy		
Planned	68.4	92.0
Unplanned	30.5	83.7
Marital status		
Single, never married	22.5	79.8
Married	65.4	91.8
Common-law	48.1	87.5
Separated	36.9	78.1
Divorced	45.8	83.2

criteria used by Statistics Canada that help identify an income threshold below which a family will likely devote a larger share of its income on the necessities of food, shelter and clothing than the average family in Canada. This was dichotomized as “at/below LICO” and “above LICO”. Marital status categories included: single/never married, married, living common-law, divorced, separated, widowed, and refused. Education was based on the highest level of formal education completed and was grouped as: less than high school, completed high school and some post-secondary, post-secondary and university degree.

Pregnancy-related characteristics included parity (primiparous/multiparous), pre-pregnancy smoking status (no smoking/occasionally/daily), time to first prenatal care visit (in first

trimester/after first trimester), any pre-existing health issues and planned or unplanned pregnancy. Planned and unplanned pregnancy was determined by a proxy question: “Thinking back to just before you became pregnant, would you say that you wanted to be pregnant..?” If women answered “later” or “not at all”, they were considered to have had an unplanned pregnancy, and if women responded “sooner” or “then”, they were considered to have had a planned pregnancy.

Data were analyzed using SPSS software for Windows, version 16.0.⁵ The statistical significance of crude comparisons of proportions was assessed using chi-squared tests ($p < 0.05$). Logistic regression was used to calculate univariate and multivariate odds ratios; variance and 95% CI for various risk factors in relation to both awareness and use of FA were calculated using 1,000 replicate bootstrap weights. The models were adjusted for all socio-demographic and pregnancy-related factors.

RESULTS

Demographics

The weighted sample consisted of 76,508 women (based on 6,421 survey respondents). The majority of women were aged 25-29 years of age (33.1%), followed by 30-34 (32.9%). Most of the women had post-secondary diplomas (37.0%) or were university graduates (31.0%) and were above LICO (72.6%). Over half the sample had already experienced a pregnancy (54.9%), while the other women were first-time mothers (44.7%).

Folic acid awareness

Overall, 77.6% of women surveyed were aware of the benefits of taking FA before pregnancy. Awareness increased with age, as knowledgeable women represented 32.3% of those aged 15-19 and 77.4% of those aged 25-29, compared to the highest frequencies of awareness, which were seen in the 30-34 (87.0%) and the 45-49 (92.9%) age groups (Table 1).

With respect to geographical variation, levels of awareness ranged from 83.9% to 35.1% nationally ($p < 0.001$), with women in the Yukon, Nova Scotia, and Newfoundland reporting the highest levels, whereas women living in Nunavut and the Northwest Territories were the least knowledgeable.

There were statistically significant socio-economic differences ($p < 0.001$) in knowledge among women with less than high school education, single women and women living at or below the LICO compared to women with a university degree, married and living above the LICO.

Aboriginal women were less likely to report awareness of FA compared to non-Aboriginal women (51.5% versus 79.6%, $p < 0.001$). Women who reported having an unplanned pregnancy were less likely to report awareness of the benefits of FA than women who had a planned pregnancy (63.1% versus 83.0%, $p < 0.001$), even after controlling for age, income, education and other variables (AOR 0.6; CI 0.50-0.71).

Folic acid use

Overall, 57.7% of women reported taking a multivitamin containing FA and FA supplementation prior to becoming pregnant. Of these, 90% of women who reported taking a multivitamin or supplement took it every day.

Table 3. Folic acid use in preconception in relation to selected factors among women who were knowledgeable of folic acid benefits

Factor n=59,285	(%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Province			
NL	68.5	0.98 (0.73-1.3)	1.0 (0.73-1.4)
PEI	61.3	0.71 (0.50-1.0)	0.74 (0.51-1.0)
NS	69.0	1.0 (0.77-1.3)	1.0 (0.75-1.4)
NB	68.4	0.97 (0.72-1.3)	1.0 (0.73-1.4)
QC	67.8	0.95 (0.80-1.1)	0.93 (0.77-1.1)
ON	68.8	1	1
MB	66.7	0.90 (0.68-1.2)	1.0 (0.76-1.4)
SK	69.3	1.0 (0.78-1.4)	1.2 (0.91-1.7)
AB	69.7	1.1 (0.84-1.3)	1.1 (0.88-1.4)
BC	72.4	1.2 (0.93-1.5)	1.2 (0.94-1.5)
YK	71.2	1.2 (0.64-2.2)	1.2 (0.61-2.3)
NT	59.1	0.76 (0.43-1.4)	1.1 (0.56-2.0)
NU	33.3	0.23 (0.10-0.51)	0.56 (0.22-1.4)
Age group (years)			
15-19	26.6	0.13 (0.08-0.24)	0.22 (0.12-0.41)
20-24	44.0	0.29 (0.23-0.36)	0.41 (0.32-0.52)
25-29	66.3	0.73 (0.63-0.84)	0.77 (0.66-0.91)
30-34	73.0	1	1
35-39	75.9	1.2 (0.97-1.4)	1.2 (1.0-1.5)
40-44	70.9	0.90 (0.64-1.3)	1.1 (0.76-1.6)
45-49	92.3	4.4 (0.58-3.42)	5.1 (0.64-4.1)
Employment during pregnancy			
Employed	71.2	1	1
Unemployed	56.2	0.52 (0.45-0.60)	0.80 (0.67-0.93)
Maternal education			
<high school	42.0	0.20 (0.15-0.26)	0.45 (0.33-0.62)
High school and some post-secondary	52.7	0.31 (0.26-0.36)	0.46 (0.38-0.55)
Post-secondary	69.3	0.62 (0.54-0.72)	0.75 (0.64-0.87)
University degree	78.4	1	1
Low income cut-off			
At or below LICO	45.1	0.30 (0.25-0.35)	0.49 (0.41-0.58)
Above LICO	73.5	1	1
Smoking 3 months prior to pregnancy			
Smoked daily or occasionally	41.0	0.31 (0.26-0.37)	0.41 (0.34-0.49)
Non-smoker	71.5	1	1
Country of birth			
Canada	69.6	1	1
Other	62.7	0.74 (0.63-0.86)	0.59 (0.49-0.70)
First prenatal care visit			
Before end of 1 st trimester	69.7	1	1
After 1 st trimester	44.3	0.33 (0.25-0.44)	0.41 (0.30-0.55)
Aboriginal status			
Aboriginal	47.8	0.41 (0.31-0.53)	0.51 (0.38-0.68)
Non-Aboriginal	69.5	1	1
Pre-existing health issue			
Existing condition	67.2	0.90 (0.80-1.0)	0.88 (0.77-1.0)
No medical condition	69.4	1	1
Parity			
Primiparous	74.2	2.4 (1.8-3.2)	2.1 (1.5-3.0)
Multiparous	64.4	1	1
Planned pregnancy			
Planned	83.3	1	1
Unplanned	63.5	0.16 (0.12-0.23)	0.19 (0.13-0.27)
Marital status			
Single, never married	28.6	0.13 (0.10-0.18)	0.18 (0.14-0.25)
Married	75.1	1	1
Common-law	58.4	0.47 (0.40-0.54)	0.55 (0.47-0.63)
Separated	50.0	0.33 (0.20-0.55)	0.40 (0.24-0.68)
Divorced	56.2	0.43 (0.16-1.1)	0.45 (0.16-1.5)

Adjusted for all factors listed in this table.

The majority of women, 89.4%, reported taking FA (multivitamin or supplement) during the first three months of pregnancy, 92.2% of whom took it every day. Women aged 15-19 were the least likely to take FA during their first three months of pregnancy (69.8%) compared to women aged 35-39 (93.5%, $p<0.001$).

A pattern is noted among preconception FA use, similar to the trend found in FA awareness (Table 2). Women who had less than high school education, were high school graduates or had post-secondary education below university level were less likely to report use than those with a university degree ($p<0.001$). Women who reported living at or below the LICO also reported less use than those reporting being above the LICO ($p<0.001$). Women who were employed during their pregnancy reported higher use than those who were unemployed ($p<0.001$).

Provincial variations were noted in FA use prior to pregnancy and during the first trimester of pregnancy. Pre-pregnancy use ranged from 16.1% in Nunavut to 67.5% in Yukon ($p<0.001$). Similarly, women in Nunavut reported the least use in the first three months of pregnancy (51.5%), while women in the Yukon reported the highest rate (98.7%, $p<0.001$).

Non-Aboriginal women reported more FA use in pre-pregnancy and during their first trimester than Aboriginal women (58.9% versus 35.3%, and 90.1% versus 79.8%, respectively; $p<0.001$).

Folic acid awareness versus use

Despite their awareness of the benefits of FA, only 68.8% of knowledgeable women actually took an FA-containing supplement before

Table 4. Knowledgeable women who supplemented with folic acid according to recommended guidelines in relation to selected factors

Factor n=59,285	(%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Province			
NL	62.8	1.1 (0.86-1.42)	1.1 (0.75-1.29)
PEI	52.1	0.65 (0.48-0.89)	0.54 (0.18-1.61)
NS	60.4	1.0 (0.82-1.30)	0.82 (0.65-2.19)
NB	58.8	0.88 (0.69-1.13)	0.94 (0.47-1.92)
QC	56.8	0.82 (0.71-0.94)	0.62 (0.39-0.99)
ON	60.8	1	1
MB	55.9	0.68 (0.54-0.86)	0.67 (0.38-1.19)
SK	61.3	0.93 (0.74-1.18)	1.4 (0.83-2.45)
AB	59.8	0.91 (0.76-1.08)	0.75 (0.50-1.14)
BC	61.1	1.0 (0.85-1.22)	0.61 (0.41-0.92)
YK	64.7	1.2 (0.72-2.0)	0.60 (0.19-1.89)
NT	52.9	0.56 (0.36-0.87)	0.94 (0.28-3.15)
NU	28.6	0.12 (0.06-0.23)	0.85 (0.21-3.62)
Age group (years)			
15-19	20.3	0.08 (0.05-0.13)	0.12 (0.03-0.47)
20-24	34.5	0.21 (0.18-0.26)	0.24 (0.16-0.37)
25-29	57.6	0.67 (0.59-0.75)	0.52 (0.38-0.71)
30-34	64.0	1	1
35-39	65.6	1.1 (0.91-1.22)	1.1 (0.77-1.59)
40-44	61.1	0.80 (0.34-2.85)	0.86 (0.46-1.64)
45-49	61.5	0.99 (0.34-2.86)	1.02 (0.61-1.71)
Employment during pregnancy			
Employed	62.0	1	1
Unemployed	47.1	0.53 (0.47-0.60)	0.98 (0.73-1.32)
Maternal education			
<high school	32.1	0.14 (0.11-0.17)	0.25 (0.13-0.45)
High school and some post-secondary	44.2	0.27 (0.23-0.31)	0.40 (0.28-0.58)
Post-secondary	60.0	0.60 (0.53-0.68)	0.68 (0.50-0.93)
University degree	69.0	1	1
Low income cut-off			
At or below LICO	35.9	0.26 (0.23-0.30)	0.60 (0.42-0.86)
Above LICO	64.2	1	1
Smoking 3 months prior to pregnancy			
Smoked daily or occasionally	44.0	0.46 (0.37-0.58)	0.38 (0.22-0.65)
Non-smoker	60.0	1	1
Country of birth			
Canada	60.3	1	1
Other	53.7	0.67 (0.59-0.76)	0.39 (0.29-0.54)
First prenatal care visit			
Before end of 1 st trimester	67.6	1	1
After 1 st trimester	67.8	1.0 (0.79-1.29)	0.93 (0.70-1.23)
Aboriginal status			
Aboriginal	39.4	0.33 (0.27-0.42)	0.39 (0.22-0.69)
Non-Aboriginal	60.2	1	1
Pre-existing health issue			
Existing condition	58.3	0.92 (0.83-1.01)	0.97 (0.75-1.24)
No medical condition	59.9	1	1
Parity			
Primiparous	67.1	1.24 (1.12-1.37)	2.0 (1.53-2.60)
Multiparous	53.6	1	1
Planned pregnancy			
Planned	68.3	1	1
Unplanned	30.4	0.21 (0.18-0.23)	0.23 (0.17-0.31)
Marital status			
Single, never married	22.9	0.15 (0.12-0.19)	0.27 (0.14-0.51)
Married	65.6	1	1
Common-law	49.5	0.45 (0.40-0.51)	0.44 (0.31-0.63)
Separated	36.7	0.26 (0.16-0.41)	0.38 (0.11-1.40)
Divorced	37.5	0.29 (0.12-0.69)	0.36 (0.18-1.12)

Adjusted for all factors listed in this table.

becoming pregnant. After controlling for age, parity, LICO, education and other factors, there were still clear socio-economic differences among those knowledgeable women who did not use FA in the preconception period compared to those who did (Table 3).

A trend was observed between education and FA use. Women who reported having less than high school education were less likely to use FA (AOR 0.45; CI 0.33-0.62) compared to women with a university degree. This relationship was also noted between employment and reported LICO. Women who were unemployed and those who lived at or below the LICO were less likely to report FA use in comparison to women who were employed and lived above the LICO (AOR 0.49; CI 0.41-0.58). Being a first-time mother increased the likelihood of use (2.1 times (CI 1.5-3.0) more like-

ly to use FA), even after controlling for a myriad of potential confounding variables, including unplanned pregnancy (Table 3). In general, among knowledgeable women, those whose pregnancies were unplanned were significantly less likely to use FA (AOR 0.19; CI 0.13-0.27).

There were statistically significant age differences among knowledgeable women who did not take FA. Women aged 15-19 (AOR 0.22; CI 0.12-0.41) and 20-24 (AOR 0.41; CI 0.32-0.52) reported less FA use prior to becoming pregnant, compared to those aged 30-34 (reference group). No significant differences were noted among women older than the reference group.

Regional differences were noted in the distribution of knowledgeable women; however, once adjusted for the potential con-

founding variables, these differences were no longer significant. Nunavut reported the least FA use (AOR 0.56; CI 0.22-1.4) while women in Yukon reported the most (AOR 1.1; CI 0.56-2.0). Aboriginal women were less likely to report FA use (AOR 0.51; CI 0.38-0.68) compared to non-Aboriginal women.

Awareness versus use according to the national recommended guidelines

Although 68.8% of knowledgeable women took FA, only 49.2% of the total sample followed the national guidelines for optimal use, which include daily supplementation prior to conception and during the first three months of pregnancy.

Similar to the trends noted above, there were statistically significant differences in frequency of optimal use among women aware of the benefits of FA (Table 4). With regard to age, knowledgeable women 15-19 (AOR 0.12; CI 0.03-0.47), 20-24 (AOR 0.24; CI 0.16-0.37) and 25-29 years (AOR 0.52; CI 0.38-0.71) were less likely to use FA optimally compared to women aged 30-34 (reference group). With respect to any socio-demographic factor, women who made up the largest proportion of those who supplemented according to the recommended guidelines reported having a university degree (69.0%). Women with lower levels of education reported significantly less optimal use ($p < 0.001$). Similar to the above-noted trends, women who reported living above the LICO and employed women reported optimal supplementation more than their counterparts ($p < 0.001$).

Provincial variation also existed, even after controlling for potential confounding variables. Optimal use among knowledgeable women ranged from a low of 28.6% in Nunavut to a high of 64.7% in Yukon, with significant differences noted in Quebec (AOR 0.62; CI 0.39-0.99) and British Columbia (AOR 0.61; CI 0.41-0.92). Knowledgeable non-Aboriginal women reported more FA use according to the recommended guidelines than knowledgeable Aboriginal women (60.2% versus 39.4%, AOR 0.39; CI 0.22-0.69).

Last, knowledgeable women experiencing a first pregnancy were two times more likely to report having supplemented optimally, which resulted in the strongest predictor of ideal FA use (AOR, 2.0; CI 1.53-2.60; $p < 0.001$), even after controlling for potential confounders, including planned pregnancy.

DISCUSSION

The data from the MES revealed that less than half of all Canadian women adhered to the national recommended guidelines for FA supplementation, including daily supplementation before conception and during the first three months of pregnancy. This study identified several maternal socio-economic factors that may influence whether women supplement optimally, if at all. Consistent with most public health literature, the data indicated that women who were under 25 years, had less than a university education and were at or below the low income cut-off score, were less likely to have knowledge of FA benefits, and were less likely to report supplement use prior to conception.

Although the majority of women in our sample understood that FA supplementation could help prevent NTDs, approximately one quarter were unaware of this information. The first Canadian guidelines for use of FA supplementation at levels of 0.4 mg/day for all low-risk women of childbearing potential were published in 1993.⁶ Previous research showed that a lack of awareness of the relation-

ship between FA and NTD and failure to use supplements subsequently remained a major problem. A survey of 123 women attending a medical genetics clinic in Montréal in 1994 documented that only 18% were aware of the association between FA and NTD, and few (18%) were taking supplements regularly.⁷ A further study of 342 women attending a similar clinic in Ottawa was carried out in 1996. A high proportion of these (81%) were aware of FA, but only 26.3% had taken FA early enough before pregnancy to be effective.⁷

Our results show that, although the majority of women reported knowledge of FA, the percentage who were supplementing according to national guidelines was less than 50%. Similar findings have been observed elsewhere in Canada. For example, a study done in the Chaudière-Appalaches region of Québec⁸ evaluated a health promotion intervention in two phases in 1999 and 2001. The proportion of women identifying that FA was important for NTD risk reduction did increase significantly between the two phases of the project, from 62.0% (CI 95% 57.3-66.7%) to 70.9% (65.9-75.9%). However, this increase in knowledge did not translate into a marked increase in women using FA. Adequate periconceptional FA use was reported by 26.1% of women in phase 1 and by 31.6% after the intervention ($p < 0.05$).⁸

While some Canadian studies prior to the MES explored factors relating demographic and pregnancy-related factors with appropriate use of FA supplementation, few documented their impact on knowledge and fewer still did so in the context of multivariate analysis. Women's age was an important factor, with younger women – especially those under 20 years⁹ – being significantly less aware. A large Slone Epidemiology Study found no relationship with age once adjustments were made for confounding factors such as education, ethnicity, income, parity and planned pregnancy.¹⁰ Our study, however, demonstrated that age was an independent predictor of FA awareness and use, even after controlling for education, income, parity, marital status and planned pregnancy, among others.

Women's education level was an important independent variable in many studies, and knowledge, not unexpectedly, was highest among those with post-secondary qualifications and lowest among those who had not completed high school.^{7-9,11} Our study supports these findings, as a linear relationship was noted among FA use and awareness and level of education. Those with university degrees made up the largest group of women supplementing pre-conceptionally and according to the national recommended guidelines.

With respect to geography, the MES was the first to document knowledge across the country. Previously, rates of awareness of FA had been noted to be lower in rural areas and small cities than in large population centres, but there was considerable variation.¹² The geographic variability in both use and knowledge has been highlighted, particularly for Northern Canada. Women in Nunavut reported the least knowledge and use of FA. Furthermore, Aboriginal women reported less knowledge and use of FA compared to non-Aboriginal women in Canada. The survey did not interview Aboriginal women on reserve; therefore the results are limited by way of knowing if similar patterns exist elsewhere in Canada.

Last, although the majority of women were aware of the benefits of supplementing FA in their diets, only 57.7% of women were supplementing prior to becoming pregnant and less than half of all women were supplementing according to the Canadian recom-

mended guidelines. As all women were interviewed postpartum, there may be recall issues in terms of knowledge of folic acid (i.e., they may have learned this information after they found out they were pregnant) or social desirability bias, as all data were self-reported (the proportion of knowledgeable women may be lower than reported).

By evaluating the characteristics of women who understood the benefits of FA, we have been able to identify several socio-demographic factors influencing the translation of this knowledge into actual supplement use. This information can be used to tailor specific interventions to target populations (i.e., younger women, Aboriginal women). However, these data indicate that knowledge alone is not enough to increase supplementation in Canadian women. An opportunity to hear women's voices may provide important messages with respect to FA supplementation and the potential approaches that could enhance its use, particularly for women who have already experienced a pregnancy.

CONCLUSIONS

This study documents findings that are consistent with other literature on FA awareness, and presents new information that can be used for public health interventions. Although most women surveyed in the MES understood the benefits of FA supplementation, a little over a third of them did not take FA supplements prior to becoming pregnant, and less than half supplemented according to national guidelines. Socio-economic factors are highlighted as potential foci for public health interventions to increase awareness and use of FA. Having a first pregnancy seems to be a predictor of supplementation, but not for subsequent pregnancies. Knowledge is still imperfect and more needs to be done to increase awareness, especially among certain population groups such as younger women and those with lower socio-economic status. Unplanned pregnancy is still a major impediment and emphasizes the need for promotion of regular and consistent use: if you can conceive, you should be taking supplements. Issues of non-compliance, such as financial barriers or concerns about the safety of FA, need to be acknowledged and addressed and form the basis for subsequent qualitative research studies.

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RÉSUMÉ

OBJECTIF : Les avantages de l'acide folique (AF) pour prévenir les anomalies du tube neural (ATN) sont bien démontrés, mais toutes les femmes ne prennent pas de suppléments nutritifs durant la période périconceptionnelle. Nous avons utilisé les données de l'Enquête sur les expériences de la maternité de l'Agence de la santé publique du Canada pour évaluer les déterminants de la connaissance de l'AF chez les femmes ayant été enceintes récemment au Canada, et la mesure dans laquelle cette connaissance se traduit par l'usage réel de suppléments.

MÉTHODE : Nous avons mené des entrevues téléphoniques entre le 23 octobre 2006 et le 31 janvier 2007 avec des femmes entre le 5^e et le 14^e mois post-partum afin de connaître leur expérience durant la grossesse, l'accouchement et la période post-partum. Ces analyses ont été menées pour les femmes ayant répondu aux questions sur la supplémentation en AF. Les 6 421 répondantes ont été pondérées pour représenter 76 508 femmes à l'aide de pondérations correspondant aux strates de l'échantillon, à la langue maternelle de la mère et au statut autochtone.

RÉSULTATS : Globalement, 77,6 % des femmes sondées savaient que la prise d'AF durant la période périconceptionnelle pouvait protéger contre les ATN. Les femmes plus jeunes, célibataires ou séparées ont déclaré moins connaître et moins utiliser l'AF, tandis que l'âge maternel, le niveau de scolarité et le revenu plus élevés étaient liés positivement à la connaissance et à l'utilisation de l'AF. Malgré les lignes directrices nationales de longue date sur la supplémentation, il y avait des écarts régionaux dans la connaissance et l'utilisation de l'AF.

CONCLUSION : Nos données indiquent des différences sociodémographiques claires entre les Canadiennes en ce qui a trait à leur connaissance et à leur utilisation de l'AF. Bien que la plupart des femmes connaissent les avantages de la supplémentation en AF, un peu plus du tiers n'avaient pas pris de suppléments d'AF avant de tomber enceintes, et moins de la moitié en avaient pris en respectant les lignes directrices nationales. L'identification des sous-populations chez qui l'utilisation des suppléments est sous-optimale pourrait permettre de mener des interventions ciblées (éducatives ou autres) pour mieux encourager l'utilisation de l'AF.

MOTS CLÉS : acide folique; grossesse; Canada; connaissance; Enquête sur les expériences de la maternité