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Impact of Brochures Conveying Folic Acid Prevention Messages on Women's Multivitamin Intake, Knowledge, and Intentions

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ABSTRACT

Folic acid campaigns primarily focus on the well-documented reproductive benefit of NTD risk reduction. However, recent studies showed that folic acid confers additional reproductive and adult health benefits. The study aim was to determine and compare the effect of two brochures conveying folic acid prevention messages on women's multivitamin intake, knowledge, and intentions. 212 college women were systematically assigned to either a reproductive health benefit (RHB) group or a multiple health benefit (MHB) group. Baseline measurements were assessed followed by a brochure intervention. Post-intervention measurements were assessed one month following the intervention. Post-intervention multivitamin intake increased significantly within each group; however, no difference in post-intervention intake was found between the groups. Following the intervention, RHB subjects averaged a 12% increase in knowledge whereas MHB subjects averaged a 28% increase. Our study showed that a MHB message is equally effective in promoting increased multivitamin intake as the traditionally used RHB message.

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INTRODUCTION

In 1992, the U.S. Public Health Service recommended that all women of childbearing age take a daily multivitamin containing 400 μg of folic acid.[1] Numerous studies have demonstrated that periconceptional maternal ingestion of folic acid decreases the risk of neural tube defects (NTDs) by 50-70%.[2-6] Neural tube defects are serious birth defects that affect approximately 4,000 pregnancies each year in the U.S.[7] These conditions are associated with significant morbidity and mortality, and the economic impact of these conditions is high.[8] Unfortunately, in 2002, only 31% of women age 18-45 reported consuming a daily multivitamin containing folic acid.[9] Of those women who had heard of folic acid, only 10% knew that folic acid should be taken before pregnancy, and only 20% of women understood that folic acid prevents birth defects.[9] Therefore, factors that are effective in increasing women's knowledge of the importance of folic acid and in promoting consistent use of folic acid among women of childbearing age must be identified. The specific content of folic acid health messages is one potential variable that, to our knowledge, has not been previously evaluated.

Most folic acid education campaigns focus on the well documented reproductive health benefit of neural tube defect risk reduction when folic acid is taken periconceptionally. However, recent studies showed that folic acid confers additional reproductive health benefits to women as well as several adult health benefits to both women and men. Adequate daily folic acid intake during early pregnancy reduces the risk of orofacial clefts by as much as 65%[10] and congenital heart defects by as much as 43%.[11] Other studies demonstrated that folic acid lowers the amount of serum total homocysteine, a risk factor for cardiovascular disease. Recent studies indicated that the

incidence of heart disease in adults is reduced by as much as 70% when adequate folic acid is taken daily.[12-14] Several studies showed that folic acid consumption decreases the risk of colon cancer by 40-75%.[15-17] An inverse relationship between the occurrence of Alzheimer's disease and folic acid levels was identified, and research showed significant correlations between low blood levels of folate, elevated serum homocysteine concentrations and cognitive decline in patients with Alzheimer's disease.[18-20]

Kloeblen and Batish suggested in 1999 that the health belief model (HBM) may be an effective foundation for the development of folic acid educational interventions. Their research showed that perceived benefits are the most predictive factor influencing folic acid intention.[21] Furthermore, an individual's intention was indicative of the behavior practiced.[22] To our knowledge, the only campaign that focuses on benefits other than the well established risk reduction for NTDs is Kellogg's®™ Healthy Hearts campaign.[23]

Multiple health benefit messages were effective in other prevention campaigns including, anti-smoking initiatives,[24-25] skin cancer prevention campaigns,[26] and HIV prevention campaigns.[27] A review of health behavior compliance literature indicated that multiple levels of intervention are needed to affect individual compliance.[28] These researchers found that individuals who are supported by medical professionals, family, work, and community are more likely to achieve compliance. A multiple health benefit folic acid message applies to *all* individuals, not just to women of childbearing age. Such a message would assist in providing multiple levels of support and reinforcement to women in the targeted group. Further, a multiple health benefit message will apply to those women who are not contemplating a pregnancy.

The purpose of this study is to examine the impact of brochures conveying folic acid prevention messages on women's multivitamin intake, knowledge, and intention to take multivitamins. Our study tests the hypothesis that an educational intervention emphasizing the multiple health benefits of folic acid would be more effective in promoting increased, self-reported, weekly folic acid intake among women aged 18-45 than an intervention emphasizing only the reproductive health benefits of consuming folic acid. This study has two specific aims:

1) To obtain a baseline measurement of folic acid knowledge, intake intention, and behavior in a sample of women aged 18-45.

2) To *determine and compare* the effectiveness of brochure educational interventions in increasing multivitamin intake behavior, promoting folic acid knowledge, and increasing multivitamin intake intention one month following the educational intervention.

METHODS

Subjects

Prior to initiation of the study, institutional review board (IRB) approval was granted from participating institutions. Subjects included 244 undergraduate/graduate students enrolled at one of the following institutions: University of Cincinnati, College of Mount St. Joseph, Good Samaritan Hospital, and Great Oaks Institution of Technology and Career Development. Instructors for courses in nursing, biology, and counseling were contacted by the principal investigator and asked for class time to conduct the study. The principal investigator recruited study subjects from sixteen classes including: three counseling, one biology, and twelve nursing. All males and females in each class were asked to participate in the study. However, to minimize bias, the data generated by men

(n=12) were not included in the results of the study. Men were asked to participate so that the female participants would not assume that the benefits of folic acid only relate to women's health. Data generated by females greater than age 45 (n=20) were also excluded from the results of this study as previous folic acid education campaigns have targeted women between the ages of 18-45 years.[9] Data analysis was performed on the remaining 212 female subjects. Participation in this study was voluntary, and non-participation did not result in any penalty to the student.

Instrument Development and Testing

Nine widely distributed folic acid promotion brochures were reviewed to assess their benefit content. Three were from the March of Dimes, two were from Kellogg's®™ Company, one was from Children's Hospital Medical Center of Akron, Ohio, and three were from the CDC. Seven of the nine brochures promoted only the benefit of NTD risk reduction. One March of Dimes brochure focused on NTD risk reduction, but it also included decreases in heart disease and colon cancer as additional benefits of folic acid consumption. A Kellogg's®™ brochure focused only on the heart benefits of folic acid. None of the brochures that we reviewed emphasized both reproductive and additional adult health benefits.

The two education brochures used in this study, reproductive health benefits (RHB) and multiple health benefits (MHB), were developed using text excerpts from existing folic acid promotion brochures. A panel of folic acid community education experts assisted in the development of the brochures, pre-intervention questionnaire, and the follow-up post-intervention questionnaire. The panel evaluated all materials for their

content validity. Pre and post-survey questions consisted of closed-ended questions including multiple choice, true and false, Likert-scale, and yes/no items.

Brochures

The brochures developed for this study contained both text and color photographs to emphasize the benefits of daily folic acid intake, food and supplemental sources of folic acid, and the U.S. Public Health Service's recommendations for folic acid consumption. The RHB brochure emphasized decreased risks for NTDs, orofacial clefts, and congenital heart defects when adequate folic acid is consumed daily. The MHB brochure equally emphasized both the reproductive benefits and the adult health benefits when folic acid is taken daily including, risk reduction for cardiovascular disease, stroke, colon cancer, and Alzheimer's disease. A comparison of the brochure text is summarized in Table 1.

Procedures

Initial Session

Prior to the initial session, each class was systematically assigned to one of two groups. Group one received the RHB educational intervention (i.e., the RHB brochure); group two received the MHB educational intervention (the MHB brochure). Entire classes, rather than individuals, were assigned to groups in order to reduce brochure contamination among the students. Students were assigned to the groups in the following manner: the first class scheduled for the initial session received the RHB brochure; the next class received the MHB brochure; the next class received the RHB brochure and so on. The dates of the initial sessions were determined by the instructors for each class.

The principal investigator conducted all initial sessions following the written protocol. The study was introduced to subjects as an "Adult Health Survey."

Subjects were asked to read an informed consent form attached to the initial questionnaire. Subjects provided informed consent by completing and returning the initial questionnaire to the principal investigator. The pre-intervention questionnaire measured baseline multivitamin intake, folic acid knowledge, and intention to take a multivitamin containing folic acid. In addition, subjects were asked if they had heard of folic acid before today's session, when they believed was the best time to take folic acid, and about specific incentives and barriers to taking a multivitamin every day. The last section of the questionnaire contained demographic questions such as age, education, race, time of last pregnancy and marital status. After completing the initial questionnaire, subjects were then asked to read the assigned brochure. Students returned the brochures to the principal investigator after reading them.

Follow-up Session

Approximately one month following the educational intervention, the principal investigator attended a second class and asked study subjects to complete a post-intervention questionnaire measuring the same parameters as those measured at the initial session, excluding the demographic information. The scores on this questionnaire were used to assess the latent effect of brochure message content on multivitamin intake behavior, folic acid knowledge, and the intention to take multivitamins containing folic acid.

Statistical Methods

SPSS and SAS statistical software packages were used to perform all statistical analyses. Descriptive statistics and frequencies were used to analyze all demographic questions. For all continuous variables (i.e., multivitamin intake behavior, total knowledge scores, and multivitamin intake intentions), differences between intervention groups were analyzed using t-tests. Tests of differences between responders and non-responders also involved t-tests for continuous variables. Differences between pre and post-intervention continuous variables were calculated for each group using paired t-tests.

Friedman tests were used to determine whether there were significant changes in the subjects' perceived future health risks. McNemar tests were used to evaluate the change in multivitamin intake motivators and barriers. To determine whether correlations existed between selected variables, Spearman's correlation coefficients were calculated. Chi-square analyses were used to determine whether the intervention groups differed in individual knowledge questions and to determine whether responders and non-responders differed in race, marital status, date of last pregnancy, and highest education achieved. All statistical tests performed were two sided with significance levels set at alpha = .05.

RESULTS

Of the 212 pre-questionnaire respondents, 91% (n=192) also completed the post-questionnaire. The 20 non-responders did not attend class during the scheduled one month follow-up session. No additional attempts were made to contact these students. The distribution of subject response rate is summarized in Table 2. All subjects who did not complete the follow-up questionnaire were excluded from the following data analysis.

Pre-Intervention Measures

Demographics

The mean age of students was 28 years (*SD* 7.5). The ethnic distribution of subjects was 79.7% (n=153) white/non-Hispanic, 16.1% (n=31) African American, .5% (n=1) Hispanic, 1.6% (n=3) Asian, and 1% (n=2) other. Regarding marital status, 36.5% (n= 70) were married, 9.9% (n=19) were divorced, and 53.6% (n= 103) were single. Educationally, 21.9% (n= 42) reported that their highest achieved education was high school/technical school, 56.3% (n= 108) had some college, 17.2% (n= 33) had college degrees, and 4.7% (n= 9) had a graduate or professional degree. 66.7% of subjects had never been pregnant or were pregnant five years ago or more. The remaining 33.3% of subjects were either currently pregnant or had been pregnant four years ago or less. Prior to the brochure intervention, 94.3% of subjects reported that they had heard of folic acid.

Behavior

The subjects' baseline multivitamin intake behavior is summarized in Table 3. The mean pre-intervention multivitamin intake for the RHB group was 2.17 days and the mean intake for the MHB was 2.44 days. There was no significant difference in baseline multivitamin intake found between the groups (p= .519).

Subjects were asked yes/no questions to assess their perceived incentives and barriers for multivitamin intake. The five most commonly reported incentives for taking multivitamins one or more days per week are summarized in Table 4. The five most common barriers of multivitamin intake reported by subjects who take multivitamins less than seven days per week are summarized in Table 5. Subjects were also given the opportunity to respond "other" for both the incentives and barriers and were asked to

specify a specific incentive and/or barrier when choosing this category. The incentives reported were: "helps with cramps," "I am breastfeeding," "helps with stress," "I feel better," and "for my future health." The barriers reported were: two reported: "I just don't think about taking them," two reported: "I never remember to buy them," one reported: "foods are enriched," one reported: "I've never had any interest in taking vitamins," and one reported: "they cause heartburn."

Knowledge

To measure folic acid knowledge, subjects were asked to answer seven true or false questions, one multiple choice question, and six yes/no questions. The true or false questions were based on factual benefits (i.e., folic acid prevents birth defects, Alzheimer's disease, colon cancer, and heart disease), fictitious benefits, (i.e., folic acid strengthens your bones and prevents diabetes) and a fictitious risk (i.e., folic acid can cause liver damage). The multiple choice question assessed the best time to take folic acid and the yes/no questions evaluated knowledge regarding food and supplemental sources of folic acid.

The total number of correct answers, ranging from 0-14, was calculated for each subject to determine each subject's total knowledge score. The results are summarized in Table 6. The mean total knowledge score for the RHB and MHB groups were 8.68 and 8.86, respectively. There was no significant difference between groups for baseline total knowledge scores (p=.538).

Intentions

Subjects were asked how many days during the next week they were planning to take a multivitamin containing folic acid to determine their multivitamin intake intention.

Mean intake intentions for each group are summarized in Table 7. There was no significant difference between groups for pre-intervention intake intentions (p= .808).

Perceived Risks

Subjects' perceptions regarding their risks of having a baby born with a birth defect, developing heart disease, Alzheimer's disease, and colon cancer were measured using a three point Likert-style scale that ranged from "lower risk than others" to "higher risk than others." Subjects' responses were scored from 1-3, with 3 being the maximum risk perception score. Subjects were also asked two control risk perception questions: one regarding the risk of having osteoporosis and another regarding the risk of developing diabetes. The risk perceptions are summarized in Table 8.

Subjects' perceptions regarding their chance of becoming pregnant in the next three months and the next five years were also measured using a multiple choice format. The results are summarized in Table 9.

Follow-up Measures

Behavior

Subjects' daily and mean multivitamin intake behavior one month following the initial session is summarized in Tables 3 and 10. There was no difference between the RHB and MHB groups in follow-up multivitamin intake behavior (p= .149). There was also no difference between groups in the number of subjects who increased their multivitamin intake (p= .404). However, when follow-up intake behavior was compared to baseline intake behavior, there was a statistically significant increase in multivitamin intake behavior for both groups (RHB-p=.0001, MHB- p=.0001).

The five most common motivators of follow-up multivitamin intake are summarized in Table 4. The list of motivators did not change from pre to post-intervention for the MHB group. Nonetheless, the order of the five motivators differed. For the RHB group, the top three motivators were consistent from pre to post-intervention. Although "to prevent birth defects in a future pregnancy" was not reported as one of the top five motivators for either group in the pre or post-intervention questionnaire, there was a significant increase in the percentage of subjects in both groups who reported birth defects as a motivator following the intervention (RHB-p=.035, MHB-p=.007).

The five most common barriers of follow-up multivitamin intake behavior are summarized in Table 5. The RHB group's post-intervention barriers were consistent with the barriers of pre-intervention intake behavior. The five most common post-intervention barriers for the MHB group were the same as the reported pre-intervention barriers; however, the order of the barriers changed.

Subjects were again given the opportunity to respond "other" for post-intervention incentives and barriers and were asked to specify a specific incentive and/or barrier when choosing this category. For incentives, two reported: "I am pregnant," two reported: "I read your pamphlet," one reported: "I am breastfeeding," and one reported: "to correct anemia." The barriers reported were: five reported: "I just don't think about taking them," two reported: "I forget to buy them," two reported: "I don't have any interest in taking multivitamins," one reported: "vitamins make me feel sick," one reported: "they cause constipation," one reported: "I haven't found a good multivitamin," one reported:

"I can't remember to take them," one reported: "I take folic acid," one reported: "I'm lazy," and one reported: "I don't have a reason."

Knowledge

Mean post-intervention total knowledge scores for each group are summarized in Table 6. Post-intervention total knowledge was significantly higher in the MHB group than in the RHB group (p=.0001). The change in knowledge from pre to post-intervention was significant for both groups (RHB- p=.002, MHB- p=.0001).

Prior to the intervention, 21% of subjects in the RHB group and 27% of subjects in the MHB group knew that the best time to take folic acid was everyday. Following the intervention, 32% of subjects in the RHB group and 67% of subjects in the MHB group knew that folic acid should be taken everyday. This difference is statistically significant (p=.001). Graph 1 serves as a summary of these results.

Intentions

Subjects' follow-up multivitamin intake intentions are summarized in Table 7. There was no significant difference between groups for post-intervention intake intentions (p= .416). However, the change in multivitamin intake intentions from pre to post-intervention among subjects in the MHB group was statistically significant (p= .046). In contrast, the change in multivitamin intake intentions was not statistically significant in the RHB group (p= .403).

Perceived Risks

Subjects' risk perceptions one month following the intervention are summarized in Table 8. No significant difference was found in either group between pre and post-intervention for perceived health risks including, risk of having a baby born with a birth

defect, risks for heart disease, Alzheimer disease, colon cancer, diabetes, and osteoporosis ($p>.05$).

Subjects' post-intervention perceptions regarding their chance of becoming pregnant in the next three months and the next five years are summarized in Table 9. There was only slight variation in subjects' reported chance of becoming pregnant in the next three months and the next five years between pre and post-intervention.

Correlation Analysis

Correlation analyses were performed to determine if a correlation exists between multivitamin intake intention, multivitamin intake behavior, chance of becoming pregnant in the next three months, and knowledge.

Multivitamin Intake Intention and Behavior

Pre and post-intervention multivitamin intake intention were positively correlated with post-intervention multivitamin intake behavior in both groups. For the RHB group, pre-intervention intention was moderately correlated with post-intervention intake behavior ($r=.626, p<.0001$), while post-intervention intention was highly correlated with post-intervention intake behavior ($r=.852, p<.0001$). For the MHB group, pre-intervention intake intention was moderately correlated with post-intervention intake behavior ($r=.723, p<.0001$), and post-intervention intake intention was highly correlated with post-intervention intake behavior ($r=.875, p=.0001$). These results indicate that multivitamin intake intention is indicative of the multivitamin intake behavior practiced.

Multivitamin Intake Behavior and Chance of Becoming Pregnant

Post-intervention multivitamin intake behavior was weakly correlated with pre-intervention perceived chance of becoming pregnant during the next three months in the

RHB group (r=.233, p=.015). No correlation was found between these variables in the MHB group (r= -.074, p=.459). These results indicate that multivitamin intake behavior in the RHB group was at least partially influenced by a woman's perceived chance of becoming pregnant in the next three months.

Multivitamin Intake Behavior and Knowledge

Post-intervention multivitamin intake behavior was not correlated with post-intervention total knowledge scores in either group. For the RHB group, r=-.048 (p=.637) and for the MHB group, r=.152 (p=.149).

Non-Responder Analysis

To determine whether non-responders differed from responders, pre-intervention measures were compared between responders and non-responders.

Demographics

There were no differences between responders and non-responders for age (p=.670), race (p=.487), marital status (p=.737), or date of last pregnancy (p=.563). Responders and non-responders differed in their highest education achieved (p=.014). These results are summarized in Table 11.

Behavior and Knowledge

The mean multivitamin intake behavior was 2.30 ± 2.902 for the responders and 2.70± 3.326 for the non-responders. This difference was not statistically significant (p=.560). There was no difference between responders and non-responders for pre-intervention total knowledge (p=.888). The mean total knowledge score for the responders was 8.77 ± 1.95; for non-responders, the mean total knowledge score was

8.70 ± 2.30. Responders and non-responders also did not differ in their responses to "When is/are the BEST time(s) to take folic acid?" (p=.929).

DISCUSSION

Prior to the intervention, 94% of women in the study had heard of folic acid but only 21% of women in the study reported taking a daily multivitamin containing folic acid. This statistic is similar to reported multivitamin intake in other studies,[9] and it clearly indicates the need for education and behavior modification interventions. This study showed that brochures conveying folic acid prevention messages are effective strategies to increase multivitamin intake behavior. Following the intervention, 32% of women in the study reported taking a daily multivitamin containing folic acid. Our hypothesis, that a MHB message is more effective in promoting increased weekly multivitamin intake than a RHB message, was rejected. However, we found that a multiple health benefit message was equally effective in promoting increased multivitamin intake as the traditionally used reproductive health benefit message. Consistent with the results of studies focused on other prevention messages,[24-27] our results suggest that a MHB folic acid message is an effective strategy that can be successfully utilized in prevention campaigns.

This study also found that brochures conveying folic acid prevention messages are effective in increasing folic acid knowledge. Both brochures had a latent effect on total folic acid knowledge. We found that a MHB message was more effective in increasing post-intervention total knowledge scores among women in the study than a RHB message. This is not surprising given that 4 of the 14 knowledge questions pertained to the adult health benefits of folic acid consumption and that women in the

RHB group did not receive the message that folic acid has adult health benefits. Although all women in the study, regardless of group assignment, received the same message that folic acid should be taken *everyday*, we found that a multiple health prevention message was more effective than a reproductive prevention message in conveying the recommendation that folic acid should be taken daily. Given that daily multivitamin ingestion is the easiest way to achieve optimal folic acid levels in the target population, we believe that a MHB message should be promoted in future folic acid campaigns.

In this study, we found that multivitamin intake intentions are positively correlated with multivitamin intake behavior in both groups. Numerous authors have provided unequivocal evidence that an individual's intention predicts the actual behavior practiced.[22,29,30] We found that a MHB message positively influenced the women's intention to take multivitamins. This same result was not found among women in the RHB group. In contrast, neither brochure intervention had any effect on women's perceived risk of having a baby born with a birth defect or perceived risks for developing adult onset health conditions.

This study had sufficient power to detect differences between groups in multivitamin intake behavior, folic acid knowledge, and the intention to take multivitamins due to the large sample size (n=192) and the high follow-up response rate (91%). A strength of this study is that we included women from a wide variety of ages, 18-45 years. Many folic acid educational campaigns have targeted women from specific age groups rather than women from a broad age range.[31-33] A limitation of this study is that all women were enrolled in college courses. It is important to note however, that

there was great variability in the highest education achieved as well as in the women's future career goals. According to the 2002 March of Dimes Gallup Survey, women who attend college are more likely to take daily multivitamins than women who have not attended college. Therefore, it is possible that the multivitamin intake behavior reported in this study may be higher than that reported in the general population. Another limitation of this study is that we were not able to use a randomized study design; we felt that the risk for brochure contamination among subjects and the potential for bias would be substantially lower if a systematic assignment was used.

This study evaluated the effects of a one-time brochure intervention. Rimer et al. however, suggested that serial interventions which provide multiple levels of reinforcement are needed to achieve individual compliance.[28] Future studies should evaluate the effect of serial MHB interventions on behavior modification. Also, because the results of this study are not generalizable to all women of childbearing age, future studies should evaluate the effects of a multiple health benefit folic acid message among different populations of women, including women who are not college educated and women from different ethnicities.

Future folic acid campaigns need to heighten feelings of personal susceptibility. Joffe (2002) reported that individuals need to feel personally vulnerable to a health problem before behavior change can occur. We believe that this can be accomplished by using educational interventions which promote the multiple health benefits of taking daily folic acid. Our study results indicate that women who are not contemplating a pregnancy, but who are at risk of becoming pregnant, may be more motivated by campaigns emphasizing the adult health benefits of taking folic acid daily than campaigns

which only emphasize the reproductive health benefits. In addition, multiple health benefit educational campaigns will potentially contribute to reduced morbidity of serious adult onset disorders such as heart disease, colon cancer, and Alzheimer's disease.

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APPENDIX A

TABLE 1
Comparison of Brochure Text

Focus	Reproductive Health Benefit Brochure	Multiple Health Benefit Brochure
Why is Folic Acid So Important?	Taking folic acid every day is good for your **FUTURE BABY'S** health.	Taking folic acid every day is good for **YOUR** health. Taking folic acid every day is good for your **FUTURE BABY'S** health.
Risk Reduction	**Getting enough folic acid every day, before you know you are pregnant, can:** Reduce the risk of serious birth defects of the brain and spine (spina bifida and anencephaly) by as much as 70%. Reduce your risk of having a baby with a cleft in the lip or palate by as much as 65%. Reduce your risk of having a baby with a heart defect by up to 43%.	**Getting enough folic acid every day, before you know you are pregnant, can:** Reduce the risk of serious birth defects of the brain and spine (spina bifida and anencephaly) by as much as 70%. Reduce your risk of having a baby with a cleft in the lip or palate by as much as 65%. Reduce your risk of having a baby with a heart defect by up to 43%. **Taking the recommended amount of folic acid can:** Reduce your risk of developing heart disease by as much as 70%. Reduce your risk of colon cancer by up to 75% New studies show that taking folic acid significantly reduces your risk of developing Alzheimer disease.
When should I take folic acid?	The best way to ensure that you get enough folic acid is to **take a multivitamin pill every day.**	The best way to ensure that you get enough folic acid is **to take a multivitamin pill every day.**

TABLE 2
Subject Response Rate by Brochure Type

	Completed Initial Session	Completed Follow-up Session	Response Rate
Brochure Type			
RHB Group	109	101	93%
MHB Group	103	91	88%
Total n	212	192	91%

TABLE 3
Daily Multivitamin Intake Behavior

	Days intake	Pre-Intervention	Post-Intervention
		Frequency (%)	Frequency (%)
Brochure Type			
RHB Group	0	57 (56.4%)	44 (43.6%)
	1	2 (2.0%)	4 (4.0%)
	2	3 (3.0%)	4 (4.0%)
	3	9 (8.9%)	3 (3.0%)
	4	4 (4.0%)	6 (5.9%)
	5	6 (5.9%)	11 (10.9%)
	6	2 (2.0%)	0 (0%)
	7	18 (17.8%)	29 (28.7%)
MHB Group	0	47 (51.6%)	39 (42.9%)
	1	7 (7.7%)	3 (3.3%)
	2	2 (2.2%)	1 (1.1%)
	3	3 (3.3%)	3 (3.3%)
	4	4 (4.4%)	5 (5.5%)
	5	5 (5.5%)	3 (3.3%)
	6	0 (0%)	5 (5.5%)
	7	23 (25.3%)	32 (35.2%)

TABLE 4
Pre and Post-Intervention Reasons to Take Multivitamins

	RBH Group		MHB Group	
	Pre	**Post**	**Pre**	**Post**
Reasons to Take Multivitamins				
To improve current health	41/47 (87.2%)	53/57 (93.0%)	39/47 (83.0%)	47/52 (90.4%)
To supplement my diet	36/47 (76.6%)	43/57 (75.4%)	34/46 (74.9%)	37/51 (72.5%)
It is part of my routine	34/47 (72.3%)	39/58 (67.2%)	33/47 (70.2%)	36/51 (70.6%)
To provide energy	33/46 (71.7%)	34/57 (59.6%)	37/46 (80.4%)	41/52 (78.8%)
To prevent illness	31/47 (66.0%)	37/57 (64.9%)	37/47 (78.7%)	40/50 (80.0%)
To strengthen my bones	28/47 (59.6%)	36/57 (63.2%)	28/46 (60.9%)	35/51 (68.6%)

TABLE 5
Pre and Post-Intervention Barriers to Taking Multivitamins

	RBH Group		MHB Group	
	Pre	**Post**	**Pre**	**Post**
Reasons to Take Multivitamins				
I sometimes forget to take them	44/79 (55.7%)	43/74 (58.1%)	50/65 (76.9%)	38/55 (69.1%)
They cost too much	27/74 (36.5%)	31/70 (44.3%)	20/64 (31.3%)	13/54 (24.1%)
I am too busy	26/72 (36.1%)	26/70 (37.1%)	33/60 (55%)	18/54 (33.3%)
I don't like taking pills	27/75 (36.0%)	24/72 (33.3%)	16/64 (25%)	16/55 (29.1%)
I am healthy	22/73 (30.1%)	18/71 (30.1%)	17/65 (26.2%)	9/54 (16.7%)

TABLE 6
Mean Total Knowledge Scores ±*SD*

	N	Pre-intervention	Post-intervention
Brochure Type			
RHB Group	101	8.68 ± 1.90	9.38 ± 1.50
MHB Group	91	8.86 ± 2.02	10.33 ± 1.54

Scores ranged from 0-14, with 14 being the maximum.

TABLE 7
Mean Multivitamin Intake Intentions ±*SD*

	N	Pre-intervention	Post-intervention
Brochure Type			
RHB Group	101	3.42 ± 3.33	3.62 ± 3.28
MHB Group	90	3.53 ± 3.32	4.01 ± 3.30

TABLE 8
Mean Risk Perceptions ± *SD*

	RHB Group		MHB Group	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Risk perception				
Birth Defect	1.61 ± 0.57	1.71 ± 0.59	1.53 ± 0.54	1.45 ± 0.56
Heart Disease	2.24 ± 0.70	2.32 ± 0.63	2.07 ± 0.70	1.98 ± 0.75
Alzheimer Disease	1.87 ± 0.54	1.99 ± 0.56	1.81 ± 0.56	1.64 ± 0.56
Colon Cancer	1.87 ± 0.63	1.93 ± 0.62	1.81 ± 0.62	1.80 ± 0.62
Diabetes	2.25 ± 0.69	2.13 ± 0.73	2.08 ± 0.78	2.12 ± 0.76
Osteoporosis	2.08 ± 0.60	2.03 ± 0.61	2.16 ± 0.72	1.95 ± 0.69

Scores ranged from 1-3, with 3 being the highest perceived risk.

TABLE 9
Pregnancy Risk Perceptions in Percentages

	Chance of pregnancy next 3 months		Chance of pregnancy next 5 years	
	No Chance or Unlikely	Likely or Highly Likely	No Chance or Unlikely	Likely or Highly Likely
RHB Group				
Pre-intervention	83.2%	16.8%	43.6%	56.4%
Post-Intervention	85.1%	9.9%	49.5%	45.5%
MHB Group				
Pre-intervention	90.1%	9.9%	42.9%	57.1%
Post-Intervention	86.8%	9.9%	50.6%	44.0%

TABLE 10
Mean Multivitamin Intake Behavior ± *SD*

	N	Pre-Intervention	Post-Intervention
Brochure Type			
RHB Group	101	2.17 ± 2.81	3.00 ± 3.05
MHB Group	91	2.44 ± 3.01	3.33 ± 3.21

TABLE 11
Highest Education Achieved in Responders and Non-responders

	Responders Frequency (%)	Non-responders Frequency (%)
Highest Education Achieved		
Less than high school	0/192 (0%)	1/20 (5%)
High school/technical school	42/192 (22%)	7/20 (35%)
Some college	108/192 (56%)	10/20 (50%)
College degree	33/192 (17%)	2/20 (10%)
Graduate or professional degree	9/192 (5%)	0/20 (0%)

APPENDIX B

GRAPH 1

The Best Time to Take Folic Acid; Post-Intervention