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Is Knowing Half the Battle? An Examination of the Relationship between Folic Acid Knowledge and Awareness and Daily Supplementation with Folic Acid among 18 to 24 year old Women Who are Not Contemplating Pregnancy

Katie P. Kilker

ABSTRACT

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Is Knowing Half the Battle? An Examination of the Relationship between Folic Acid Knowledge and Awareness and Daily Supplementation with Folic Acid among 18 to 24 year old Women Who are Not Contemplating Pregnancy
(Under the direction of Russ Toal, Associate Professor)

Neural tube defects (NTDs) are serious birth defects that affect 3,000 pregnancies in the United States annually. All women of childbearing age are recommended to consume 400 micrograms of folic acid daily for the prevention of NTDs. Women aged 18 to 24 years have multiple risk factors for having an NTD-affected pregnancy and should be targeted by efforts to promote folic acid consumption.

Survey data capturing folic acid awareness, knowledge, and supplementation behavior of women aged 18 to 24 years who are not contemplating pregnancy were examined to identify the relationship of folic acid awareness and knowledge to daily supplementation with folic acid in an effort to predict the effectiveness of education-only interventions. Results of the study suggested that awareness and knowledge was not consistently related to daily supplementation. An evaluation of qualitative data using the Health Belief Model offers explanations for the findings and recommendations for targeting these at-risk women.

INDEX WORDS: folic acid, birth defects prevention, neural tube defects, pregnancy, nutrition, health education, knowledge, awareness, young adult women, daily supplementation

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A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of the Requirements for the Degree

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Chapter I

INTRODUCTION

In the United States, approximately 3,000 pregnancies are affected by neural tube birth defects each year. Neural tube defects (NTDs) are birth defects of the brain and spine that can result in varying degrees of paralysis, loss of bowel and bladder control, and even death. The toll of neural tube defects on affected families and infants is not only physical and emotional, but financial as well. The average lifetime cost of caring for a child born with spina bifida, the most common of these birth defects, is estimated at approximately $636,000 per child and can often surpass $1 million (Waitzman, Romano, and Gross 2005). Research shows that up to 70% of all cases of NTDs can be prevented by the periconceptional maternal consumption of folic acid (Laurence et al 1981; MRC Vitamin Study Research Group 1991; Smithells et al. 1983; Vergel et al. 1990; Mulinare et al. 1988; Bower and Stanley 1989; Mills et al. 1989; Milunsky et al. 1989). In 1992, the United States Public Health Service recommended that all women who can become pregnant consume 400 micrograms of folic acid daily for the prevention of NTDs (Centers for Disease Control 1992).

Although there have been increases in folic acid awareness and knowledge since this official recommendation, most women of childbearing age still do not consume the recommended amount of folic acid daily for the prevention of NTDs. Awareness of folic acid among women 18-45 years of age has increased from 52% in 1995 to about 84% in

2005 and knowledge of folic acid has increased from 4% to 19% in the same time (Green-Raleigh et al. 2006). Yet, the percentage of reported daily consumption of a folic acid-containing supplement has hovered around 30% since 1995 (Green-Raleigh et al. 2006). In an effort to better understand the stagnancy of reported use of folic acid supplements in the face of increasing awareness and knowledge about folic acid, this research study will identify and describe the relationship of reported awareness and knowledge of folic acid to regular consumption of a vitamin containing folic acid.

All women who can become pregnant are at risk for having a pregnancy affected by an NTD (Centers for Disease Control and Prevention 2004). Since 1999, the prevalence of NTDs has been estimated to be 7 per 10,000 live births in the United States (Spina Bifida Association of America 2007). The Centers for Disease Control and Prevention (CDC) estimate that 50% to 70% of all NTDs can be prevented with the maternal periconceptional consumption of the B vitamin, folic acid (Centers for Disease Control 1992). The Institutes of Medicine and CDC recommend the maternal consumption of 400 micrograms of synthetic folic acid daily at least 1 month before conception and during the first few months of pregnancy (Institute of Medicine 1998; Centers for Disease Control 1992). Because half of all pregnancies in the United States are unplanned (Finer and Henshaw 2006), and because NTDs occur often before a woman knows she is pregnant, CDC recommends that all women who can become pregnant consume the recommended amount of folic acid daily, regardless of their pregnancy intentions (Centers for Disease Control and Prevention 2004). Adult multivitamins and folic acid-only supplements sold in the United States are a widely available and complete source of the recommended amount of folic acid.

Factors that affect young women's vitamin supplementation behavior can be identified and explained using the Health Belief Model. The Health Belief Model (HBM) was developed in the 1950s by a group of social psychologists in the United States Public Health Service (Rosenstock 1974). The model attempts to explain and predict an individual's given health-related behavior from their beliefs about the behavior and the health problems that the behavior was intended to prevent or control using a value expectancy approach (Glanz et al. 1997). It assumes that behavior depends upon the expected outcomes of an action and the value an individual places on those outcomes. As described in Chapter II, the HBM suggests that the following factors both explain and predict a health-related behavior: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self efficacy and cues to action (National Cancer Institute 1995).

The purpose of this research is twofold

- to identify the relationship of reported folic acid knowledge and awareness to daily supplementation with a vitamin containing folic acid among women 18 to 24 years of age who have never been pregnant and are not planning to become pregnant within the next year (non-contemplators), and
- to describe perceptions related to vitamin-taking behavior among women aged 18 to 24 years using the framework provided by the Health Belief Model.

Identifying the relationship of reported folic acid knowledge and awareness to regular folic acid supplementation among this population of women was selected as the focus of this research study in an effort to characterize this relationship quantitatively and evaluate the potential predictability of success of behavioral interventions and campaigns with this

population that take a traditional health education approach.

According to national data, rates of regular folic acid supplementation have not changed in spite of rising knowledge and awareness indicators (March of Dimes Birth Defects Foundation 2005). This research study aims to identify and describe the relationship of awareness and knowledge to behavior and offer recommendations for how public health practitioners might be able to promote folic acid supplementation behavior more successfully among a group of women at risk for having a pregnancy affected by an NTD.

The test hypothesis is: Reported knowledge and awareness of folic acid are significantly associated with daily supplementation with a vitamin containing folic acid among 18 to 24 year old female non-contemplators. The null hypothesis tested in this study is: Even under favorable sociodemographic conditions (i.e. education level, ethnicity, socioeconomic status), reported knowledge and awareness of folic acid are not significantly associated with daily supplementation with a vitamin containing folic acid among non-contemplating women age 18-24.

This study presents a three-step hypothesis test. Step 1: The statistical relationship between folic acid knowledge and awareness (independent variables) and daily supplementation of a vitamin containing folic acid (dependent variable) among non-contemplating women aged 18 to 24 years, from a national, population-based dataset, is identified and described using the chi square test for independence and by calculating the Pearson correlation coefficient. Step 2: The hypothesis is tested further by repeating the chi square test for independence and Pearson correlation with data from a similar cross-sectional survey of non-contemplating women, 18 to 24 years of age, currently attending

a state university. Step 3: Qualitative data gathered through focus groups with female students, aged 18 to 24 years, currently attending the same state university, are examined and presented using the framework offered by the Health Belief Model to elucidate the findings generated from the quantitative survey data and provide recommendations for health practitioners aiming to increase folic acid supplementation behavior among young non-contemplating women.

This research study focuses on non-contemplating women age 18 to 24 years of age and provides recommendations largely based upon qualitative data collected from a small sample of women 18-24 years of age currently attending the University of Georgia. This population was chosen, in part, due to the availability of multiple data sources, but also because, according to national data, women in this age group were found to have the lowest knowledge, awareness, and consumption of folic acid (Green-Raleigh et al. 2006), give birth to almost one third of all babies born in the United States (Chandra et al. 2005), and therefore have the potential to be affected by nearly 30 percent of all predicted annual NTD cases, making it an important age group of women for whom to target interventions to increase folic acid supplementation.

Chapter II

LITERATURE REVIEW

Neural Tube Defects

Neural tube defects (NTDs) are serious birth defects of the brain and spine. There are two common forms of NTDs, anencephaly and spina bifida, which account for 90 percent of all cases (Centers for Disease Control 1989). NTDs occur very early in pregnancy, between 18 and 28 days postovulation, often before a woman knows that she is pregnant (Geisel 2003). The defect occurs when the neural tube, which later becomes the brain and spine, does not form or close completely. Anencephaly, the condition that results when the upper end of the neural tube does not close completely and the brain and skull are missing or underdeveloped, is a fatal birth defect (Geisel 2003). Pregnancies affected by anencephaly often end in miscarriage or stillbirth. Babies who survive to term and are born with anencephaly die shortly after birth. Most babies born with spina bifida, the condition that results when an area along the lower end of the neural tube fails to close and the spine and spinal nerves do not form normally (Geisel 2003), do survive into adulthood. Though it has not been validated, the Spina Bifida Association of America estimates that there are 70,000 people currently living with spina bifida in the United States (Spina Bifida Association of America 2007).

Since 1999, the prevalence of neural tube defects in the United States has been estimated at 7 per 10,000 pregnancies (Spina Bifida Association of America 2007). Approximately 3,000 pregnancies are affected by NTDs in the United States each year

(~1600 spina bifida cases, ~1400 anencephaly cases), and every woman who can become pregnant is at risk for an NTD-affected pregnancy (Centers for Disease Control and Prevention 2004). In the United States, NTDs are the most common birth defect second only to congenital heart defects (Yoon et al. 2001).

Spina bifida is the most common, permanently disabling birth defect in the United States (Centers for Disease Control 1989; Spina Bifida Association of America 2007). It is a life-threatening and life-altering condition with varying health outcomes including hydrocephalus, full or partial paralysis, bladder and bowel control difficulties, learning disabilities, depression, latex allergy, and social and sexual issues (Centers for Disease Control 1989; Spina Bifida Association of America 2007). In most cases, babies born with spina bifida endure multiple surgeries starting almost immediately after birth. Although there is great variance in the manifestation of spina bifida from one affected person to the next, many require the use of some form of walking aid or wheelchair, special assistance to overcome learning disabilities, and reliance upon the use of a urinary catheter and regimented bathroom practices (Spina Bifida Association of America 2007). Individuals born with spina bifida and their families face many challenges. These challenges are not only physical and emotional, but financial as well. The average lifetime cost of caring for one child born with spina bifida is estimated at approximately $636,000 and can often surpass $1 million (Waitzman, Romano, and Gross 2005). The Medicaid share of these medical costs is unknown, but Medicaid coverage is higher among children with spina bifida than among other children; it is estimated by one expert that Medicaid provides coverage for approximately one third of affected children (Gross, via email correspondence, June 8, 2007).

Folic Acid Recommendation

Based on a combination of randomized controlled trials (Laurence et al 1981; MRC Vitamin Study Research Group 1991), nonrandomized intervention trials (Smithells et al 1983; Vergel et al 1990), and observational studies (Mulinare et al 1988; Bower and Stanley 1989; Mills et al 1989; Milunsky et al 1989) conducted in the 1980s and early 1990s, scientists observed that up to 70 percent of all NTDs could be prevented with daily periconceptional maternal intake of the B vitamin, folic acid. In 1992, the United States Public Health Service announced the following recommendation:

> *All women of childbearing age in the United States who are capable of becoming pregnant should consume 0.4 mg of folic acid per day for the purpose of reducing their risk of having a pregnancy affected with spina bifida or other NTDs* (Centers for Disease Control and Prevention 1992).

This recommendation has been endorsed by multiple health agencies including the World Health Organization (World Health Organization 2002) and the Institutes of Medicine (Institutes of Medicine 1998), domestic professional associations including the American Academy of Pediatrics (American Academy of Pediatrics 1999) and the American College of Obstetrics and Gynecology (American College of Obstetrics and Gynecology 2001), and domestic outreach organizations including the March of Dimes (March of Dimes 2007) and the National Healthy Mothers, Healthy Babies Coalition (National Healthy Mothers Healthy Babies Coalition 2001).

At the time of the folic acid recommendation, the CDC proffered three potential approaches to increase levels of folic acid consumption among the general population: 1) fortification of the U.S. food supply, 2) improvement of dietary habits, and 3) use of

dietary supplements (Centers for Disease Control and Prevention 1992).

Fortification of the Food Supply with Folic Acid

In 1996, to increase folic acid consumption among women of childbearing age, the United States Food and Drug Administration (FDA) issued a mandate to fortify all enriched grain products with folic acid by January 1998 (Food and Drug Administration 1996). Following the institution of this mandate, reported prevalence of spina bifida decreased by 31 percent and the prevalence of anencephaly decreased by 16 percent (Centers for Disease Control and Prevention 2004). The estimated number of NTD-affected pregnancies in the United States declined from approximately 4,000 in 1995-1996 to approximately 3,000 in 1999-2000 (Centers for Disease Control and Prevention 2004). Based on statistical stratification of data from the National Health and Nutrition Examination Surveys (NHANES), this decline in NTDs and the simultaneous marked increase in mean serum and red blood cell folate levels for U.S. women are attributed to fortification rather than to vitamin supplementation (Olney and Mulinare 2002). In 2004, CDC declared fortification a "partial" success as a public health strategy because the observed 26 percent decline in prevalence was less than what was estimated from research trials and 23 percentage points shy of the proposed national health objective for 2010 (Centers for Disease Control and Prevention 2004; Department of Health and Human Services 2000) At that time, CDC reiterated the folic acid recommendation, noting that daily supplementation with a complete source of the recommended amount of folic acid, such as daily vitamin supplements or fully fortified breakfast cereals, by all women of childbearing age regardless of pregnancy intention, was an important

component to further reduce the number of NTD-affected pregnancies (Centers for Disease Control and Prevention 2004).

Changes in Dietary Intake of Folic Acid

A review by Kumanyika and colleagues of over 50 studies regarding dietary behavior change in relation to key nutrients, fruits, and vegetables offers testament to the challenge that is sustained dietary modification. At the time of the review in 2000, fewer than half of U.S. adults met recommended guidelines for the above, and many did not see a need to align their diets with the recommendations (Kumanyika et al. 2000). A review of the literature regarding dietary intake of folic acid produces similar findings.

Meeting dietary recommendations for grain intake is an important step to achieving the recommended daily intake for folic acid, most notably for women who do not take a daily folic acid supplement. A 2004 review of national dietary trends by Briefel and Johnson examined multiples studies of data from the National Health and Nutrition Examination Survey (NHANES). They found that, although there was a marked increase in grain product consumption between the 1970s and 1994-1996 (the years before fortification of enriched grain products with folic acid), in 1999-2000 the recommendation for daily servings of grains was met by only 24% of the population. In spite of this finding, however, data from NHANES III (1988-1994) and NHANES 1999-2000 showed an increase in mean folate/folic acid intake among women of childbearing age of approximately 30 to 45 percent, from before to after the fortification mandate. Average daily folate/folic acid intake in 1999-2000 was between 300 and 350 micrograms in 1999-2000, just under the recommended daily intake (Briefel and Johnson

2004).

However, a recent study suggests that mean folic acid intake from fortified grain products may be less than what was estimated in 1999-2000. Yang and colleagues examined 2001-2002 NHANES data from a 24 hour food recall questionnaire and calculated dietary intake of food folate and folic acid from fortified foods. Nonpregnant women of childbearing age reported an average daily consumption of 128 mcg of folic acid, only 32 percent of the daily recommended amount (Yang et al. 2007). The researchers determined that, at the present level of folic acid fortification, most women still need to consume a folic acid-containing dietary supplement daily to achieve the 400 microgram per day recommendation for folic acid (Yang et al. 2007), thus supporting the need for continued promotion of folic acid supplementation, the behavior of primary interest in this research study.

Promotion of Dietary Supplementation with Folic Acid

In the years following the 1992 folic acid recommendation, a variety of folic acid education and promotion efforts were undertaken in the United States. Quinn and colleagues (2005) reported the activities of public health agencies, such as CDC, and non-profit organizations, including the March of Dimes Birth Defects Foundation and its local chapters, the Spina Bifida Association of America and its local chapters, and other members of the National Council on Folic Acid who have developed and implemented folic acid education and promotion interventions on a variety of scales and with different levels of process or outcome evaluation. Most of these interventions remain unpublished and thus a literature search turns up very few. However, Quinn collected unpublished

reports on a collection of state-based folic acid promotion activities in areas including southwestern Virginia, Alaska, Ohio, middle Tennessee, Wisconsin, North Carolina, Montana, Puerto Rico, South Carolina, Delaware, California, Georgia, and Washington that target not only the generalized group of women of childbearing age but also more targeted groups including health care professionals, African-American women, Hispanic women, family-planning clinic staff, policy makers, and women who have had a past pregnancy affected by an NTD (Quinn, Thompson, and Ott 2005). Outreach activities mentioned in these reports included the distribution of educational brochures and guidelines, the development and airing of public service announcements, vitamin distribution, professional and community presentations, political advocacy, and partnerships with retailers and media to promote information and sources of folic acid (Quinn, Thompson, and Ott 2005). However, the majority of these efforts did not have a plan for evaluation, and those that did, (with a few exceptions) included evaluation measures to capture change in knowledge and awareness only. The primary objective of these local level efforts was to achieve a measurable change in knowledge and awareness of folic acid. During the years in which states were active, reported awareness and knowledge of folic acid among women of childbearing age increased nationally, a change which may be attributable to a combination of national and local efforts. However, reported daily supplementation with folic acid has not changed (Green-Raleigh et al. 2006). The decline in neural tube defects that was observed during this time is not attributed to active folic acid supplementation but rather to passive folic acid intake resulting from the fortification of the food supply with folic acid (Olney and Mulinare 2002).

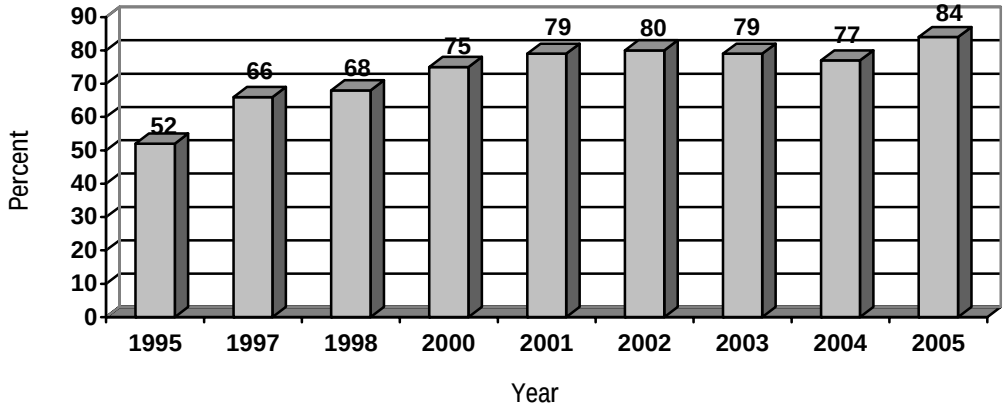
Folic Acid Awareness, Knowledge, and Consumption

In 1995, the March of Dimes Birth Defects Foundation began collecting data from an annual population-based survey of women of childbearing age (18-45 years of age) in the United States. This telephone survey, conducted by the Gallup Organization, measures awareness, knowledge, and consumption of a folic acid-containing supplement from an annual sample of at least 2,000 women (March of Dimes Birth Defects Foundation 2005). Each year, awareness is measured based on the "yes" response to the question, "Have you ever heard, read or seen anything about folic acid?" A "yes" response indicates awareness of folic acid. To measure knowledge of folic acid, the survey participant is then asked "What have you heard, read or seen about folic acid?" This is an open-ended question, and knowledge of folic acid is indicated if the respondent mentions the prevention of birth defects in her response. A higher degree of knowledge is attributed to those respondents who mention that folic acid is needed before pregnancy to prevent birth defects. Daily consumption of a vitamin containing folic acid is calculated from responses to two questions. The first question is, "Do you take any vitamin or mineral supplements on a daily basis?", and if the respondent answers "yes," it is followed by, "What type of vitamin or mineral supplements do you take?" Supplements that contain folic acid (multivitamins, prenatal vitamins, and folic acid-only vitamins) are coded as a folic acid supplement, and the percentage of respondents who report taking a folic acid supplement daily is then generated (March of Dimes Birth Defects Foundation 2005).

According to the national survey, folic acid awareness among women of childbearing age (18-45) has increased by approximately 32 percentage points from 1995

to 2005 (52 to 84 percent, respectively) (March of Dimes Birth Defects Foundation 2005). Figure 1 presents the percentage of respondents to the national March of Dimes survey who indicated awareness of folic acid from 1995 to 2005. These percentages are slightly higher than those found by some state and local surveys conducted in some regions of the United States. It should be noted that questions related to awareness on the local surveys were phrased similarly, but not always identically, to those in the national March of Dimes survey. According to 2006 reports, 78 percent of women of childbearing age in Texas in 2001 were aware of folic acid (Canfield et al. 2006), while 64 percent of women in the lower Mississippi Delta in 2000 had heard of folic acid (Robbins 2006). Michigan and Southwestern Virginia both experienced increases in awareness between 1996 and 1999. In Michigan, a study of current mothers revealed that overall awareness had increased from 60.3 percent in 1996 to 71.4 percent in 1999 (Alozie Arole et al. 2003), while awareness among women of childbearing age in Southwestern Virginia climbed from 31 percent in 1997 to 54 percent in 1998 to 75 percent in 1999 (Centers for Disease Control and Prevention 1999). Changes in awareness of folic acid may be attributable to a combination of national, state, and local efforts to promote folic acid during this time.

Figure 1. Percentage of Respondents to the National March of Dimes Survey who were Aware of Folic Acid by Year



Folic acid knowledge, as indicated by the respondent reporting that folic acid can help to prevent birth defects, also has increased, though it remains low. In 1995, only 4 percent of respondents to the national March of Dimes Birth Defects Foundation survey knew that folic acid could prevent or help reduce the risk of birth defects. In 2004, this statistic was its highest at 24 percent, before decreasing to 19 percent in 2005 (March of Dimes Birth Defects Foundation 2005) (See Figure 2). In 1995, only 2 percent of women were attributed a higher degree of knowledge by reporting that folic acid should be taken before pregnancy to prevent birth defects. Again, this statistic peaked in 2004 at 12 percent before dropping to 7 percent in 2005 (March of Dimes Birth Defect Foundation 2005) (See Figure 3). While state and local surveys have measured folic acid knowledge, the only survey identified to measure folic acid knowledge similarly to how it was measured by the national survey was conducted in Texas in 2001. With this survey, folic acid knowledge was higher than the national sample, with 28 percent of women of childbearing age reporting knowledge that folic acid prevents birth defects and 25 percent knowing that it needed to be taken before pregnancy (Canfield et al. 2006).

Figure 2. Percentage of Respondents to the National March of Dimes Survey who Knew that Folic Acid Prevents Birth Defects by Year

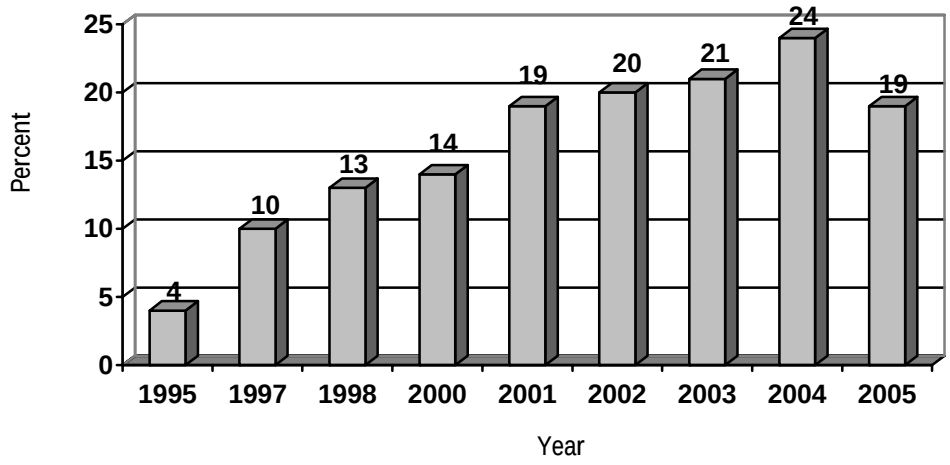
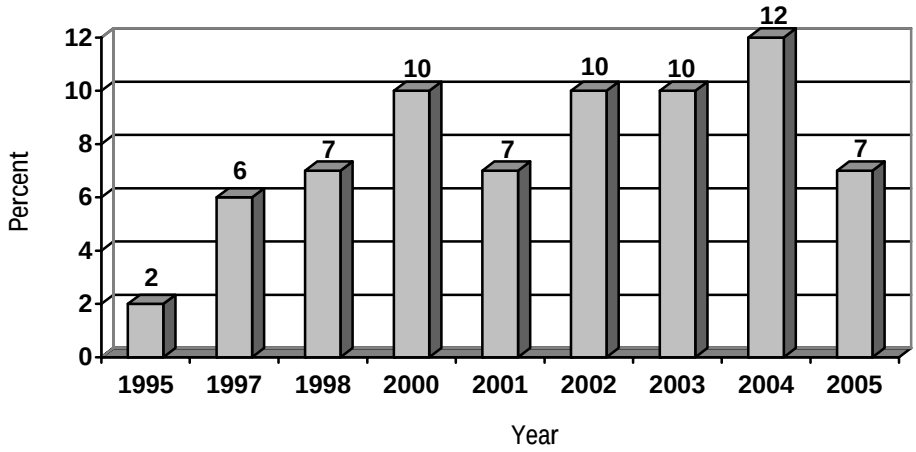


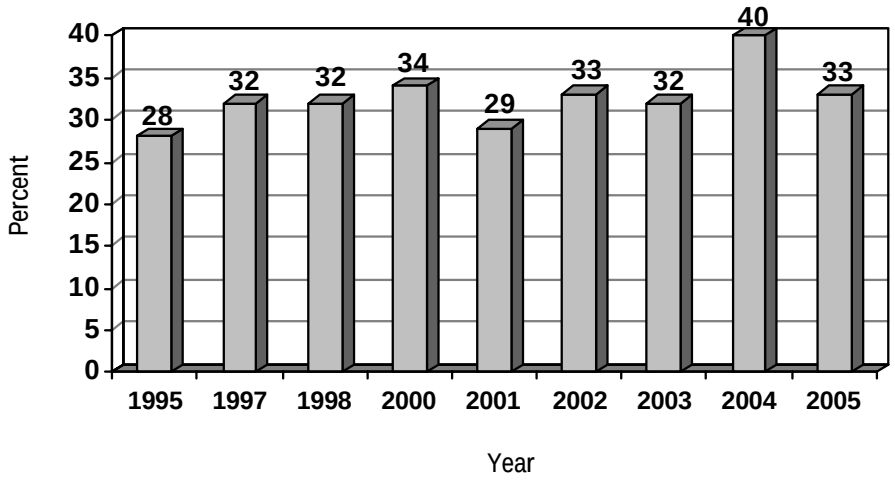
Figure 3. Percentage of Respondents to the National March of Dimes Survey who Knew that Folic Acid is Needed Before Pregnancy by Year



Daily consumption of a vitamin containing folic acid supplement has remained the most constant of the three mentioned variables. The percentage of women of childbearing age who take a daily vitamin supplement containing folic acid in the United States has increased, only slightly, from 28 percent in 1995 to 33 percent in 2005 (March of Dimes Birth Defects Foundation 2005) (See Figure 4). State and local surveys of women of childbearing age report similar or more dismal findings. In Georgia in the late

1990's, 20 percent of women reported consuming a vitamin with folic acid (Centers for Disease Control and Prevention 1996), and in the lower Mississippi Delta in 2000, 22 percent of survey respondents reported taking folic acid supplements 5 or more days per week (Robbins et al. 2006). In Texas, reported daily folic acid supplement consumption in 2001 mirrored the national percentage most closely with 33 percent of respondents reporting daily supplementation (Canfield et al. 2006).

Figure 4. Percentage of Respondents to the National March of Dimes Survey who Indicated Daily Consumption of a Vitamin Containing Folic Acid by Year



Factors Associated with Folic Acid Awareness, Knowledge and Consumption

Awareness

A review of literature about factors associated with folic acid awareness revealed that age, education, income and pregnancy planning are related to awareness of folic acid. These studies show that older women, women with more years of education, women with higher household incomes and women planning pregnancy are more likely to be aware of folic acid (Alozie Arole et al. 2003; Canfield et al. 2006; Centers for Disease Control and

Prevention 1996; Robbins 2006).

Similar associations were also detected by the national survey that found that being more than 24 years of age and having higher education and income is associated with greater likelihood of awareness of folic acid (March of Dimes Birth Defects Foundation 2005).

Knowledge

As in the case of awareness, higher age, education, and income are associated with a greater likelihood of knowledge of the link between folic acid insufficiency and birth defects in local studies (Cleves et al. 2004) and the national survey (March of Dimes Birth Defects Foundation 2005). Additionally, women who are currently pregnant or who have had a pregnancy within the last two years are more knowledgeable about folic acid than other women (March of Dimes Birth Defects Foundation 2005). In one study, women with education beyond high school were three times more likely to know of the relationship between folic acid and birth defects than women with high school education or less. Similarly, women with an annual household income over $30,000 were three times more likely to be knowledgeable about folic acid than women of lower household incomes (Cleves et al. 2004).

Folic Acid Supplementation

Daily folic acid supplementation is shown to be associated with race/ethnicity, marriage status, income, attitude toward taking a physician's advice, pregnancy intent, knowledge of the relationship between folic acid and birth defects (Ahluwalia, Lawrence, and Balluz 2007; Cleves et al. 2004), whether or not a pregnancy was planned (Rosenberg, Gelow, and Sandoval 2003), and whether or not a woman had ever had a

discussion with her health provider about vitamins (Ahluwalia, Lawrence, and Balluz 2007) or had ever been pregnant before (Carmichael et al. 2006; Nilsen et al. 2006). National data indicates that women age 18-24 years, women who have not attended college, women with household incomes less than 40,000 per year, and non-white women are least likely of all women of childbearing age to consume a folic acid supplement (March of Dimes Birth Defects Foundation 2005).

In one study, African-American women were particularly unlikely to take a daily folic acid supplement compared to Caucasian women, and this gap was largest among women 18-24 years of age (7.7 percent versus 26.7 percent, respectively) (Cleves et al 2004). Two other studies showed that consumption of a supplement containing folic acid of Hispanic women was only about half that of non-Hispanic white women (Ahluwalia, Lawrence, and Balluz 2007; Carmichael et al. 2006). Interestingly, married women were almost two times more likely than single or divorced women to take a daily supplement (Cleves et al. 2004). Whether or not a pregnancy had been planned also is an important variable in folic acid supplementation. In one study, women whose pregnancies were intended were 3 times more likely to have taken folic acid than those who had not intended to become pregnant (Rosenberg, Gelow, and Sandoval 2003). The impact of this measure of intent increases with proximity of the planned conception. According to one study, women who indicate a desire to become pregnant at some time in the future, but with no specific plan, were no more likely to take a daily folic acid supplement than women never wanting to become pregnant (Cleves et al. 2004). Additionally, knowledge of the relationship between birth defects and folic acid was related to daily folic acid supplementation (Cleves et al. 2004).

Women 18 to 24 years of age

As mentioned, women 18 to 24 years of age are the least likely age group (of women 18-45 years of age) to be aware of folic acid, to know that folic acid can prevent birth defects, and to take a supplement containing folic acid daily. Women in this age group also are less likely to be married and to intend to become pregnant (Rosenberg, Gelow, and Sandoval 2003) and have the highest risk for unintended pregnancies in the United States. In 2001, the rate of unintended pregnancy among 18 to 24 year old women nationally was approximately 50 per 1,000 women; approximately 80 percent of pregnancies to women in this age group were unintended (Finer and Henshaw 2006). Among 18 to 24 year old women in college, the 1995 National College Health Risk Behavior Survey found that 18.5% of those who were sexually active reported having been pregnant (Centers for Disease Control and Prevention 1997).

Although many women in this age group may currently attend college, in 2006 only 14.2 percent of women 18 to 24 years of age had already completed college (U.S. Census Bureau 2006). In the same year, this age group had the lowest median annual household income (<$30,000) among heads of households 18 to 64 years of age (DeNavas-Walt, Proctor and Lee 2006). In 2002, approximately 71 percent of women 18 to 19 years of age were sexually active; sexual activity jumped to 92 percent among women aged 20 to 24 years, and about one in five women do not use birth control every time they have sex (Chandra et al. 2005). Furthermore, women in this age group, including those currently attending college, are likely not getting enough folic acid or food folate from their diets. They engage in unhealthy dietary behaviors and often fail to meet dietary intake recommendations (Centers for Disease Control and Prevention, 1997;

Dinger 1999; Hilton 2002). One study of the dietary behavior of college women found that 95 percent of the participants did not comply with the dietary guideline regarding the consumption of grain products, vegetables, and fruits (Anding, Suminski, and Boss 2001), and others found that college women had dietary folic acid/folate intakes of 156 to 248 micrograms per day, about half of the recommended amount (Hendricks, Herbold, & Fung 2004; Wild et al. 1996).

Simply put, women 18 to 24 years of age, whether or not they attend college, have multiple risk factors (behavioral, dietary, economic, and educational) for inadequate folic acid consumption and unintended pregnancy and, therefore, are at increased risk for having a pregnancy affected by a neural tube defect. These compounded risk factors might help to explain one study's finding that women aged 14 to 19 years were nearly twice as likely to have a pregnancy affected by anencephaly than women 25 to 29 years of age (Reefhuis and Honein 2004).

Interventions Targeting Women 18 to 24 Years of Age

In spite of the risk factors for NTDs among women aged 18 to 24 years and the abundance of resources and outlets for reaching these women in a concentrated setting such as on a college campus, a search for literature about interventions targeting this group of women of childbearing age produced only five publications, of which three are scientific articles, one a professional magazine-style article, and one a conference abstract for work that has not yet been published. Because it did not collect or report any evaluation data, the magazine-style article was omitted from this review.

The first article, by DiPietro and Kier (2001), reported the success of a one-time

45 minute presentation about periconceptional nutrition and NTDs in increasing knowledge about folic acid and NTDs, raising scores on pretest to posttest from 48 percent correct to 86 percent correct. One month following the intervention, follow-up posttest scores were still higher than at pretest but had decreased slightly to 73 percent. Reported daily vitamin consumption increased from 43 percent at the time of the intervention to about 52 percent one month following the intervention, but this change was not statistically significant (DiPietro and Kier 2001).

As part of a larger effort by Quillen et al (2000) to evaluate attitudes and knowledge about folic acid and NTDs among female college students, researchers designed an intervention that included a one-time, five minute educational slide presentation about folic acid and neural tube defects. This presentation included information that was designed to address the constructs provided by the Health Belief Model (*susceptibility, severity, benefits, barriers, self-efficacy*, and *cues to action*). Results based on a pretest and posttest showed that the percentage of women who believed that they were either unlikely or very unlikely to become pregnant in the next year (*susceptibility*) did not change following the intervention. Although measures of respondents' current folic acid consumption were only collected at baseline and the researchers did not measure intent to consume folic acid post-intervention, they did find significant increases in folic acid and NTD knowledge and awareness at posttest (Quillin et al. 2000).

The third article, by Chacko et al (2003), reports the findings of a folic acid promotion program targeting low-income adolescent and young adult women between the ages of 13 years and 22 years seeking free services at one of three reproductive health

clinics in a large city in Texas. The intervention consisted of an initial questionnaire and then immediate individual and personalized education about NTDs and the role of folic acid in preventing NTDs. A three month supply of multivitamins was provided to the women if they indicated interest in taking them. At baseline, of the 387 minority women enrolled in the program, 52 percent reported having heard of folic acid, 45 percent had heard of spina bifida or neural tube defects, 50 percent had heard that taking multivitamins before and after conception could prevent birth defects, and approximately 9 percent reported taking a daily multivitamin. Three months later at follow-up, of the 30 women who were interviewed, about 90 percent could answer correctly to "What is spina bifida?" and "What is folic acid?", and about 40 percent of women responded "everyone", "all women of childbearing age", or "only women planning to have a baby" when asked who should take folic acid. About 67 percent of respondents reported taking a multivitamin on a daily basis at follow-up, however, when asked how many days in the previous month they had taken a multivitamin, only 9% reported taking it 30 days in the previous month (Chacko et al. 2003). This finding suggests that the respondents' report of current behavior in this study may be unreliable.

The largest folic acid campaign identified in the literature is the *Point 4 the Future* campaign that targeted college students on 60 college campuses in North Carolina using an education model that involved peer education, in other words, students were highly involved in teaching their fellow students about folic acid. Because the report of this campaign is limited to a conference abstract, details about the intervention and significance measurement are severely restricted. According to this abstract, the intervention consisted of educational sessions and multivitamin distribution to all those

who attended. At baseline, approximately 50 percent of the students knew that folic acid could help prevent neural tube defects and 30 percent of the women reported taking a daily folic acid supplement. The abstract reports that, at a one to three month follow-up, participants' knowledge about folic acid increased significantly and 82 percent of female participants reported daily folic acid supplementation (Krowchuk and Verbiest 2003).

Not only are there very few published reports of interventions targeting this at-risk age group of women, but, according to the information available, of those that have been published only one was based on any theory of behavior change, health education, or health promotion. The only apparent assumption driving the rest of these interventions is that a one-time educational presentation can increase folic acid awareness, knowledge, and consumption among young women of childbearing age and that these changes will lead to sustained behavior change and, ultimately, a reduction in the number of pregnancies affected by neural tube defects. This is surprising given that the complexity of health behavior is undisputed in the field of public health and medicine (Institute of Medicine 2001). One definition of health behavior that expresses this complexity particularly well was offered by Gochman (1982);

> *"…those personal attributes such as beliefs, expectations motives, values, perceptions and other cognitive elements; personality characteristics, including affected and emotional states and traits; and overt behavioral patterns, actions, and habits that relate to health maintenance, to health restoration, and to health improvement"* (Gochman 1982).

Thus, this lack of theory-based intervention is concerning because, as the opening sentence of Glanz, Lewis, and Rimer's Health Behavior and Education (1996) states, "A

health promotion and education program or intervention is most likely to benefit participants and the community when it is guided by a theory of health behavior."

The Health Belief Model

Factors that affect young women's folic acid supplementation behavior can be identified and explained using the Health Belief Model. The Health Belief Model (HBM) was developed in the 1950s by a group of social psychologists in the United States Public Health Service (Rosenstock 1974). The model attempts to explain and predict an individual's given health-related behavior from their beliefs about the behavior and the health problems that the behavior was intended to prevent or control using a value expectancy approach (Glanz et al. 1997). It assumes that behavior depends upon the expected outcomes of an action and the value an individual places on those outcomes. Six constructs shape the HBM: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues to action (National Cancer Institute 1995).

Perceived susceptibility measures an individual's perception of his or her risk for a health condition or disease while perceived severity measures feelings surrounding the seriousness of the condition and the effects of leaving it untreated (Glanz et al. 1997). The combination of perceived susceptibility and perceived severity is considered a threat or, more broadly, fear of a disease or health condition.

Perceived barriers include the perceived negative consequences of adopting a behavior while perceived benefits are the perceived positive consequences of adopting a behavior (Janz and Becker 1984). Though these barriers and benefits can be health

related, often they are not. Instead, they might be associated to a greater degree to one's environment, lifestyle, or social surroundings.

Self-efficacy is characterized as the overall confidence in one's own ability to adopt and successfully perform a behavior (Bandura 1986). Having a strong sense of self-efficacy is of great importance. People with high confidence in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided. Conversely, people who doubt their capabilities shy away from difficult tasks which they view as personal threats (Bandura 1994). Thus, lack of self-efficacy can be viewed as a barrier to behavior. Finally, cues to action refer to "cues such as bodily events and environmental events that instigate action" (Glanz et al. 1997). They are the reminders in our everyday lives that signal us to act in one way or another.

The HBM has been applied to explain a variety of preventive health behaviors, sick-role behaviors, and health service utilization behaviors. A search of literature found that the HBM has been of particular value in the study and promotion of behaviors related to such health topics as breast and cervical cancer screening (Austin et al. 2002), adherence to diabetes regimen (Kurtz 1990), prenatal care (Stout 1997), adolescent condom use (Hiltabiddle 1996), AIDS prevention (Carmel 1990), and adherence to asthma medication (Trueman 2000).

A search for literature on HBM and folic acid produces three publications; two of which were produced from the same study of low-income pregnant women participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in 1997 in Atlanta, GA (Kloeblen 1999; Kloeblen and Batish 1999). The purpose of the WIC study was to examine knowledge and behaviors relevant to folic acid intake

(Kloeblen 1999) and to test the utility of the HBM in understanding and predicting the intention to permanently follow a high folic acid diet among low-income women (Kloeblen and Batish 1999). Fifteen-minute interviews were conducted with 251 participants. The interviews consisted of 58 items designed to measure participants' supplement use, health behaviors, knowledge and beliefs about folic acid, intake of grain products, and demographic characteristics (Kloeblen 1999) as well as women's intentions to permanently follow a diet with adequate folic acid as assessed by the HBM (Kloeblen and Batish 1999). After performing correlation examinations, the study found that no relationships existed between the HBM constructs and participants' reported folic acid intake from fortified grains or their ability to correctly list high-folic acid foods (Kloeblen 1999). However, in studying participants' intention to permanently follow a high-folic acid diet (*folic acid intention*), perceived susceptibility, perceived severity, perceived benefits, and self-efficacy were found to be positively correlated. The perceived barrier construct was negatively correlated with folic acid intention. Standard multiple linear regression analysis showed that the strongest predictor of folic acid intention was the perceived benefits construct, followed by perceived barriers, and self-efficacy. Perceived susceptibility, perceived severity, preconceptional use of supplements, and having heard of folic acid did not contribute significantly to the model for folic acid intention (Kloeblen 1999). The cues to action construct had been omitted since most cues did not significantly contribute to the regression models and several represented preferred learning methods rather than pertinent factors influencing folic acid intention (Kloeblen and Batish 1999). Both publications concluded that the studies provide evidence to support the use of the HBM to understand knowledge, attitudes, and beliefs about folic

acid (Kloeblen, 1999) and intention to permanently follow a diet high in folic acid (Kloeblen and Batish 1999). The only limitation noted by the authors was the inability of the HBM constructs to explain all of the variance in folic acid intention. Despite this one limitation, the authors still recommend the HBM as a foundation for tailoring folic acid educational interventions to specific populations and credit the model with providing educators a valuable opportunity to more effectively promote the adoption of a high folic acid diets among low-income women to improve pregnancy outcomes (Kloeblen and Batish 1999).

The third publication identified by a search of literature examines awareness and consumption of folic acid among 71 female college students in relation to four constructs of the HBM (*perceived susceptibility, perceived severity, perceived benefit,* and *perceived barriers*) (Quillin et al. 2000). Folic acid and NTD awareness, multivitamin consumption, and beliefs about folic acid related to HBM constructs were assessed. A pretest was given, followed by a brief intervention consisting of a five-minute slide presentation designed to address the constructs of the HBM. Then, a posttest was completed by participants immediately following the intervention. Three categories of questions were found to account for the most variance, namely, perceived benefits of taking folic acid supplements, perceived barriers to taking folic acid supplements, and perceived threat (combination of susceptibility and severity) of becoming pregnant and having that pregnancy be affected by a neural tube defect. Following the intervention, there was a significant increase in knowledge of folic acid and NTDs as well as in scores related to perceived benefits, barriers, and threat. However, HBM variables related to folic acid were not associated with multivitamin consumption. This indicates that the

consumption behavior of the participants does not appear to relate to their beliefs about folic acid, nor to their awareness of folic acid or of NTDs (Quillin et al. 2000). The authors express concern regarding the design of campaigns that primarily focus on education about the preventive effects of daily maternal folic acid use for a college population. They suggest that interventions targeting college women that focus on other health benefits related to general vitamin intake might be more successful at raising levels of multivitamin consumption and, subsequently, folic acid intake. This suggestion is underscored by the finding that 94 percent of the women in the study felt they were unlikely or very unlikely to become pregnant in the next year (Quillin et al. 2000).

Overall, findings from the few HBM studies that examined folic acid awareness, knowledge, and consumption of folic acid indicate that the HBM is a valuable guide to the exploration of folic acid supplementation behavior and an effective tool for the development of interventions to promote folic acid supplementation. Upon review, the qualitative data presented in Chapter IV, seemed a natural fit for presentation within the constructs of the HBM as information related to each of the constructs presented itself organically in the focus groups. The HMB meets each of the four "goodness of fit" criteria as outlined by the National Cancer Institute (1995); the model's application to folic acid supplementation behavior is logical, consistent with everyday observances (including the qualitative data to be described in Chapter IV), is similar to those used in other folic acid programs, and is supported by research (as presented above). The HBM provides the most useful constructs by which to examine and promote this behavior among 18 to 24 year old women, largely because a lack of perceived susceptibility to having an unplanned pregnancy, let alone a pregnancy affected by a neural tube defect, is

common among this age group, as noted by Quillen and colleagues (2000). The presentation of the qualitative data within construct provided by the HBM in Chapter IV offers insight to how this model is useful in the design and implementation of education and communication interventions to effectively promote folic acid consumption among women 18 to 24 years of age.

Chapter III

METHODS AND PROCEDURES

The purpose of this research is twofold; to identify the relationship of reported folic acid knowledge and awareness to daily supplementation with a vitamin containing folic acid among women 18 to 24 years of age who have never been pregnant and who do not plan to become pregnant within the next year (non-contemplators), and to qualitatively describe perceptions related to vitamin-taking behavior among women aged 18 to 24 years using the framework provided by the Health Belief Model.

Identifying the relationship of reported folic acid knowledge and awareness to daily folic acid supplementation was selected as the focus of this research study in an effort to characterize this relationship quantitatively and evaluate the potential predictability of success of behavioral interventions and campaigns targeting non-contemplating women aged 18 to 24 years with a traditional health education approach. The review of literature in Chapter II revealed that the success of many folic acid promotion interventions is often measured by changes in knowledge and awareness about folic acid among women of childbearing age, when the truly necessary outcome for the prevention of NTDs is behavior change, that is, folic acid supplementation. This study is intended to test the assumption that was at the heart of the folic acid education only interventions and to determine whether Green and Kreuter's (2000) statement that "changes in knowledge and awareness alone cannot be assumed to translate into changes

in behavior" is supported or challenged by these data.

To test whether reported knowledge and awareness of folic acid are significantly associated with daily supplementation with a vitamin containing folic acid, among non-contemplating women aged 18 to 24 years, two sources of data were evaluated. Quantitative data generated from two surveys were analyzed to examine and describe the relationship between these independent and dependent variables.

To qualitatively describe perceptions related to vitamin-taking behavior among 18 to 24 year old women, qualitative data from four focus groups was presented. The presentation of these data within the context of the Health Belief Model aimed to elucidate findings from the quantitative analysis and produces recommendations for interventions to promote folic acid consumption.

Described in this chapter is a three step procedure. First, the statistical relationship between folic acid knowledge and awareness (independent variables) and daily supplementation with a vitamin containing folic acid, (dependent variable) among non-contemplating women age 18-24, from a national, population-based dataset was identified and described using the chi-square test for independence and by calculating the Pearson correlation coefficient. Second, the hypothesis was tested further by repeating the test for independence and description of the correlation with data from a similar cross-sectional survey of non-contemplating women, 18 to 24 years of age, currently attending a state university. And finally, qualitative data gathered through focus groups with female college students from the same university were examined and presented within the framework provided by the Health Belief Model.

Quantitative Data Sources

The first of two sources of quantitative data is the dataset from the March of Dimes Birth Defects Foundation national random-digit dial telephone survey of pre-pregnancy awareness and behavior among women of childbearing age, conducted by The Gallup Organization. This data source was selected for this research study because it is the only national survey to measure indicators of folic acid awareness, knowledge, and consumption.

The March of Dimes survey has been conducted annually since 1995 (every year except 1999) among a national sample of approximately 2000 women (per survey year) aged 18 to 45 years. Survey response rates in the ten years it has been conducted have ranged from 24% to 52%. In 2005, the survey year from which data are analyzed for purposes of this research study, the response rate was 32%. The final sample size was 2,647 women. In 2005, women aged 18 to 25 years were oversampled; a total of 751 women aged 18 to 24 years completed the survey that year and were included in the analysis for step one. Data from survey year 2005 were selected from among the survey years because in that year the age group of interest (18 to 24) had been oversampled and it was the most recent data available.

The other quantitative dataset analyzed in step two was the Student Intercept Survey conducted in 2006 by the Georgia Folic Acid Coalition. The purpose of this intercept survey, conducted among a convenient sample of women aged 18 to 24 years currently enrolled in an undergraduate program at the University of Georgia in Athens, was to establish baseline levels of folic acid knowledge, awareness, and consumption in preparation for the design of a future folic acid promotion campaign on campus. This

survey was modeled after the national March of Dimes survey, and although there are far fewer questions in this brief in-person survey, many questions are identical to those in the national survey. This source of data was selected for this research study not only because of its similarity to the national survey, but also because it was the most recent folic acid awareness, knowledge, and consumption survey of women 18 to 24 years of age and was readily accessible within the time constraints of this research study. This dataset was also identified to be of particular use in testing the null hypothesis, which stated that even under presumably favorable sociodemographic conditions (i.e. education level, ethnicity, socioeconomic status), reported knowledge and awareness of folic acid are not significantly associated with daily supplementation with a vitamin containing folic acid, among non-contemplating women aged 18 to 24 years. The UGA sample likely meets such conditions. According to the UGA Fact Book for 2006, 80 percent of undergraduate students enrolled in 2006-07 were white, 91 percent were full time students, and the estimated cost of attendance for academic year 2006-07 was $13,804 for residents (Allen 2006). These statistics suggest that a sample produced from UGA is not representative of the general U.S. population, but rather is more likely to have a higher prevalence of some of the characteristics that have been associated with awareness, knowledge and consumption of folic acid, making it an appropriate sample for testing the null hypothesis.

Sampling methods for the Student Intercept Survey were driven by convenience; female students were intercepted as they walked through campus. Though the exact response rate is unknown, personal accounts from the intercept team indicated that greater than 90 percent of potential participants stopped to complete the survey; a total of

162 female undergraduate students aged 18 to 24 years completed the survey.

Although the March of Dimes national survey and the Student Intercept Survey and their sampling and administration processes are not identical, both surveys measure folic acid knowledge, awareness, and daily supplementation with a vitamin containing folic acid, using very similar questions that are described later in this chapter.

Qualitative Data Source

Perceptions related to vitamin-taking behavior were extracted from a qualitative data source and presented within the framework provided by the Health Belief Model. The source of the qualitative data was four focus groups also conducted by the Georgia Folic Acid Coalition with female undergraduates (age 18 to 24) at UGA-Athens, as part of the formative research conducted by the Coalition in preparation for the development of a folic acid promotion campaign on campus. The purpose of the focus groups was to gain a better understanding of female UGA-Athens undergraduate students' perceptions related to vitamin-taking behavior, and existing folic acid promotion materials. This qualitative data source was selected because the sample was derived from the same population as the Student Intercept survey, therefore increasing the applicability of the conclusions and recommendations generated from the two sources to female undergraduates at UGA-Athens or like populations. Also, this was the only qualitative dataset identified that had transcripts that were readily accessible and could be reviewed in depth within the time constraints of the study.

The sample for the focus groups was also one of convenience from the populations of undergraduate females at UGA-Athens. Participants were recruited

through the use of posters, handouts, and word of mouth. Approximately 60 female students expressed interest in participating in the focus groups, but only 36 were able to be scheduled and attend. Potential participants were screened before being placed into one of two segmented groups, vitamin "users" and vitamin "non-users". Three "non-user" groups and one "user" group were completed. On average, nine undergraduate students, aged 18 to 24 years, participated in each of the four 2 ½ hour-long focus groups.

Variables

Awareness

In the national survey, awareness of folic acid was measured with one question, "Have you ever heard, read, or seen anything about folic acid?" Awareness was indicated if the participant responded "yes".

In the student survey, awareness was measured based on the participants' response to the question "What, if anything have you heard, read, or seen about folic acid?" Awareness was indicated if the open-ended response included anything other than "nothing at all" or "I don't know/I don't remember".

Knowledge

Two levels of knowledge about folic acid are measured. For purposes of this study, the knowledge that folic acid prevents birth defects is referred to as *general knowledge* while the knowledge that folic acid is needed before pregnancy is referred to as *advanced knowledge*. Delineation of these two levels of knowledge is important because to know that folic acid is needed before pregnancy is an especially important piece of knowledge especially for this age group of women because they have the highest

rates of unintended pregnancy and because these defects occur before most women realize that they are pregnant.

In the national survey, knowledge is measured based on the question "What have you heard, read, or seen about folic acid?" General knowledge of folic acid is indicated if the open-ended response includes "helps prevents birth defects", "helps reduce risk for spina bifida" or "prevents neural tube defects". Advanced knowledge is indicated if the response includes "it should be taken before pregnancy".

The student survey measures both general and advanced knowledge with the question "What, if anything, have you heard, read, or seen about folic acid?" General knowledge is indicated if the open-ended response includes "prevents birth defects", "reduces the risk of spina bifida", "reduces the risk of birth defects of the spine and brain", or "reduces the risk of neural tube defects." While advanced knowledge is indicated if the response includes "it should be taken before pregnancy."

Daily Supplementation

Daily supplementation with a vitamin containing folic acid was generated based on one question from the national survey that, by design of the survey, was only answered by those respondents who had indicated that they took a vitamin or mineral supplement on a daily basis. Those respondents were asked "What type of vitamin or mineral supplements do you take?" Daily supplementation with folic acid was indicated if the open-ended response included any supplement that contains folic acid (folic acid, multivitamin, prenatal vitamin or B complex).

The student survey measured daily supplementation based on a combination of two questions, "How often, if ever, do you take any vitamin or mineral supplement?" and

"What if any type of vitamin or mineral supplement do you currently take?" The daily supplementation variable was calculated from these questions; reports of taking any vitamin on a daily basis and taking a supplement that contained folic acid (folic acid, multivitamins, prenatal vitamins or B complex) were recoded as daily supplementation with folic acid.

Pregnancy Contemplation

Pregnancy contemplation was generated from questions in both the national and student survey that asked respondents to describe their pregnancy experience and plans. For purposes of this study, non-contemplation was indicated if the participant indicated that she had never been pregnant in the past and that she was "not planning to become pregnant within the next year or so, but at some point in the future" or did "not plan to become pregnant at any time in the future".

Statistical Analysis

As mentioned earlier in the chapter, steps one and two of the three step hypothesis test procedure consists of the statistical analysis of the relationship of the independent variables, folic acid awareness and folic acid knowledge, to the dependent variable, daily supplementation with a vitamin containing folic acid, from two data sources.

Quantitative data was analyzed using SPSS Version 14.0. The national dataset was prepared by extracting data for respondents aged 18 to 24 years who had not been pregnant previously and who were not planning to become pregnant within the next year (non-contemplators) and creating a new dataset that included only these women. The same preparations were made for the student dataset. Then, *awareness*, *knowledge*

(general and advanced), and *daily supplementation* variables were recoded and renamed according to the descriptions in the above section for both the national and student datasets. Frequency analyses were run so to describe the age, race, education level, and the three variables of interest, folic acid awareness, knowledge, and daily supplementation.

To identify a relationship between the variables, the chi-square test for independence was performed for four variable pairs, (1) awareness and knowledge (general or advanced), (2) awareness and daily supplementation, (3) general knowledge and daily supplementation, and (4) advanced knowledge and daily supplementation. Dependence detected by the chi-square test was significant at $p \leq 0.05$. Additionally, Pearson's correlation coefficient, *r*, was calculated to confirm the presence or absence of a relationship between the variables and, if a relationship was present, to describe its strength and direction. Correlations were significant at $p \leq 0.05$. These analyses were conducted for both the national March of Dimes dataset and the Student Intercept Survey dataset, separately. The results of these analyses are presented in Chapter IV.

The qualitative data from the series of student focus groups was abstracted from the professional verbatim transcripts produced at each focus group. Transcripts were reviewed by hand and general findings related to each construct of the Health Belief Model were synthesized. Participant quotes deemed representative of the general findings for each construct also were abstracted. The findings were organized by and presented within the following table.

	Vitamin Users		Vitamin Non-User	
HBM Construct	**Synthesized Findings**	**Quotes**	**Synthesized Findings**	**Quotes**
Perceived susceptibility				
Perceived Severity				
Perceived Benefits				
Perceived Barriers				
Self-efficacy				
Cues to Action				

Chapter IV

RESULTS

Quantitative Results

Sample Description

Table 1 provides the descriptive characteristics of both the national and student samples including respondents' age, race, last grade completed in school, current year in college (student sample only), folic acid awareness, knowledge (general and advanced), and daily supplementation behavior.

National Sample

From a total of 751 respondents aged 18 to 24 years, 564 (75 percent) were identified as pregnancy non-contemplators and were kept in the dataset to be used in the analyses. With regard to the age of the respondents, the sample was fairly well distributed. The mean age of respondents was 20.5 years.

Of the 564 respondents kept in the sample, most were white with 80 percent (n=450) reporting their race as such; 8 percent (n=46) were African-American, 5 percent (n=27) were Hispanic, 3 percent (n=14) were Asian, 1 percent (n=7) were American Indian, and 4 percent (n=20) reported some other race.

With regard to education, most of the respondents had completed high school or had started but had not completed college (25 percent and 49 percent, respectively). Approximately 4 percent (n=21) started but had not completed high school, 1 percent

(n=8) had trade or vocational training, while 19 percent (n=106) completed college and 2 percent (n=13) completed a post-graduate degree.

In terms of the variables of interest, approximately 70 percent (n=400) indicated awareness of folic acid, only 6 percent (n=32) knew that folic acid could prevent birth defects (*general* knowledge), almost the same amount, 5 percent (n=27), knew that folic acid was needed before pregnancy (*advanced* knowledge), while approximately 33 percent (n=187) reported taking a supplement containing folic acid on a daily basis.

Student Sample

Only 3 of the 162 total respondents to the student survey did not fit the criteria for pregnancy non-contemplators and were removed from the sample; the final sample size was 159. Most of the respondents in the Student Intercept Survey were aged 19 to 20 years (26 percent and 30 percent, respectively) with a mean age of 19.9 years. While respondents' ages were not as evenly distributed, their current class year was; 20 percent (n=33) were freshman, 30 percent (n=49) were sophomores, 25 percent (n=40) were juniors, and 23 percent (n=37) were seniors.

The majority of respondents were white; 66 percent (n=105) identified their race as such. About 18 percent (n=28) were Black, 3 percent (n=5) Hispanic, 5 percent (n=8) Asian, 4 percent (n=7) of mixed race, and 3 percent (n=5) reported some other race.

With regard to the variables of interest, 37 percent (n=59) of the student sample were aware of folic acid, 16 percent (n=26) knew that folic acid prevents birth defects (*general* knowledge), only 2 percent (n=3) knew that folic acid was needed before pregnancy (*advanced* knowledge), and 25 percent (n=39) reported taking a supplement containing folic acid on a daily basis.

Table 1. Characteristics of the Samples

Characteristic		National Sample (n=564)		Student Sample (n=159)	
		n	**%**	**n**	**%**
Age	18	107	19%	22	13.8%
	19	101	17.9%	42	26.4%
	20	95	16.8%	47	29.6%
	21	81	14.4%	30	18.9%
	22	64	11.3%	14	8.8%
	23	63	11.2%	1	.6%
	24	53	9.4%	3	1.9%
Race	White	450	79.8%	105	66%
	Black	46	8.2%	28	17.6%
	Hispanic	27	4.8%	5	3.1%
	Asian	14	2.5%	8	5%
	American Indian	7	1.2%	-	-
	Mixed Race/Other	20	3.6%	14	8.8%
Last grade completed	Grade 8	-	-	-	-
	High School, incomplete	21	3.7%	-	-
	High School, graduate	140	24.8%	-	-
	Trade/Vocational Training	8	1.4%	-	-
	College, incomplete	275	48.8	159	100%
	College, graduate	106	18.8%	-	-
	Postgraduate	13	2.3%	-	-
Current College Year	Freshman			33	20.8%
	Sophomore			49	30.8%
	Junior			40	25.2%
	Senior			37	23.3%
Folic Acid Awareness	Aware of folic acid	400	70.9%	59	37.1%
	Not aware of folic acid	164	29.1%	100	62.9%
Folic Acid Knowledge	General knowledge	32	5.7%	26	16.4%
	Advanced knowledge	27	4.8%	3	1.9%
	Neither general nor advanced knowledge	508	90.1%	132	83%
Daily Supplementation	Supplement daily	187	33.2%	39	24.5%
	Do not supplement daily or at all	377	66.8%	120	75.5%

Dependence and Correlation within Variable Pairs

Table 2 presents the Pearson chi-square test statistics (x^2) and significance value (p) used to determine dependence within each variable pair from both samples, while Table 3 presents the Pearson correlation coefficient (r) and significance values (p) used to confirm the presence or absence of a statistical relationship between the variables and to describe the direction and strength of the relationship if detected, for both samples.

Awareness ⟷ *Knowledge (general or advanced)*

Statistically significant dependence between awareness and knowledge of folic acid was detected by the chi-square test for independence and confirmed by the Pearson correlation coefficient in both the national and student samples. Dependence was significant at $p < .01$. For the national sample, the correlation coefficient, $r = .213$, indicated a positive correlation between the two variables. This correlation was significant at $p < .01$. For the student sample, $r = .589$, indicating a stronger, positive correlation between the variables that was also significant at $p < .01$.

Awareness ⟷ *Daily Supplementation*

Statistically significant dependence between awareness and daily supplementation was detected in only the student sample and was significant at $p < .05$. For this sample only, a significant positive correlation was detected; $r = .167$, significant at $p < .05$. For the national sample, however, the variables were found to be independent of one another based on a chi-square statistic that was insignificant ($x^2 = 3.41$; $p = .065$), and confirmed by the absence of a significant correlation between the two ($r = .076$; $p = .065$).

General Knowledge ⟷ *Daily Supplementation*

Again, statistically significant dependence was only found between general knowledge about folic acid and daily supplementation with a vitamin containing folic acid in the student sample and was significant at $p < .05$. This dependent relationship was found to have a significant positive correlation ($r = .183$; $p < .05$). For the national sample, however, the variables were found to be independent of one another based on a chi-square statistic that was insignificant ($x^2 = 1.71$; $p = .190$), and confirmed by the absence of a significant correlation between the two ($r = .055$; $p = .191$).

Advanced Knowledge ⟷ *Daily Supplementation*

In both samples, advanced knowledge about folic acid and daily supplementation with a vitamin containing folic acid were found to be independent of one another, indicated by insignificant chi-square statistic for both the national and student samples ($x^2 = 2.876$; $p = .090$ and $x^2 = .128$; $p = .720$, respectively) and confirmed by insignificant Pearson's correlation coefficients ($r = .071$; $p = .090$ and $r = .028$; $p = .723$, respectively).

Table 2. Chi-square Test for Independence within Variable Pairs

Variable Pairs	National Sample		Student Sample	
	X^2	p	X^2	p
Awareness and Knowledge	25.491	.000**	55.123	.000**
Awareness and Daily Suppl	3.410	.065	4.449	.035*
General Knowledge and Daily Suppl	1.718	.190	5.308	.021*
Advanced Knowledge and Daily Suppl	2.876	.090	.128	.720

** $p < .01$, * $p < .05$

Table 3. Pearson's Correlation within Variable Pairs

Variable Pairs	National Sample		Student Sample	
	r	p	R	p
Awareness and Knowledge	.213	.000**	.589	.000**
Awareness and Daily Suppl	.078	.065	.167	.035*
General Knowledge and Daily Suppl	.055	.191	.183	.021*
Advanced Knowledge and Daily Suppl	.071	.090	.028	.723

** p < .01, * p < .05

Qualitative Results

Participant Characteristics

A total of 36 volunteer subjects participated in the four focus groups. All participants were female undergraduate students currently enrolled at UGA-Athens and were 18 to 24 years of age. No additional demographic characteristics were collected from the participants. As mentioned in Chapter IV, all participants were screened for regular vitamin use. A total of 24 women were placed among the three vitamin "non-user" groups while 12 women were placed in one "user-group".

Table 4 presents synthesized findings and representative participant quotes for both the vitamin "user" and vitamin "non-user" groups with regard to each of the six constructs of the Health Belief Model. The non-user groups and user group had many similarities and a few important differences with regard to each construct of the model; these are mentioned below.

Perceived Susceptibility

Women in both groups were particularly adverse to the idea of becoming pregnant anytime soon and did not believe that they were at all susceptible to having an unplanned pregnancy or having a pregnancy affected by a birth defect. As one participant described, "…the topic of pregnancy or babies is no where near our radar screen." Both groups did believe, however, that they were susceptible to getting sick and to not always eating well. The vitamin user group expressed more perceptions of susceptibility than vitamin non-user groups, including feeling susceptible to not being able to control other things that impacted their health, and to having certain health problems.

Perceived Severity

Neither the vitamin user group nor the vitamin non-user groups spontaneously mentioned their perceived severity of having a pregnancy affected by a birth defect, though, when the issue of birth defects was raised by the moderator, reactions from both groups were similar, in that they perceived birth defects, in general, to be "scary" or "terrible" and something they would want to avoid "in the future". Regarding other issues, vitamin users were concerned about the severity of the long term consequences of not eating healthy, about how difficult it would be if they got sick during the school year, and about health conditions that they might be at risk for. Vitamin non-users, on the other hand, lacked concern for what would happen if they did not take vitamins or the consequences of not eating well.

Perceived Benefits

Both groups believed that there were benefits to taking vitamins regularly, but the vitamin-user group expressed much more resolve in this belief. Non-users thought that

taking a vitamin every day is "probably a good thing to do," but they articulated a great deal of skepticism about whether taking vitamins really made a difference in their overall health. Vitamin users cited a long list of the benefits of taking vitamins that included such things as their good taste, feeling healthier, having a sense of responsibility for their health, and making their parents happy, among other things. Vitamin non-users did not perceive nearly as many benefits of vitamin taking and those benefits they did cite they presented as potential and unrealized.

Perceived Barriers

Vitamin non-users perceived many barriers to vitamin-taking. Three categories of barriers were found. The first category, *logistical and lifestyle* barriers, included not having regular access to a store from which to buy vitamins, not wanting to spend money from their limited budgets, and a dislike for the size, taste and smell of vitamin pills, and a lack of daily routine. The second category, labeled *skepticism*, included the finding that they didn't really believe that taking vitamins was necessary or could have a major impact on their health; their doctors never told them to take vitamins and when they did, they didn't see any results. And finally, vitamin non-users shared *myths*, the third category of barriers. They believed that vitamins had to be taken in the morning; that the vitamins that weren't used up by their bodies would turn to fat; that they could easily get all the nutrients they needed from food alone if they simply ate "healthy" (without regard to highly fortified or full fortified food sources); and that food sources of vitamins were always better than synthetic sources (which is not the case for folic acid).

Vitamin users also encountered challenges to taking vitamins regularly. Like the non-user groups they did not have regular access to a store so that they could replenish

their supply of vitamins. Additionally, they reported having trouble remembering to take their vitamins when they were traveling or away from their home environment, and sometimes felt discouraged when health care professionals did not praise their efforts.

Self-Efficacy

Overall, the vitamin non-user groups lacked self-efficacy in taking a vitamin regularly as well as confidence in their ability to make this behavior a daily habit or even to perform it at all, especially if it involved swallowing a pill. Vitamin users, however, knew that they could be successful at this behavior largely because many of them had been doing it, to some degree, all of their lives and their parents and friends modeled the behavior for them.

Cues to Action

Regular cues to action were an underpinning of the success and self-efficacy expressed by the vitamin-users with regard to their sustained vitamin-taking habit. Users cited ample cues to action that they encountered regularly or established for themselves such as placing their vitamins where they would be seen daily; taking their vitamin along with other pills they take daily; their parent sending them vitamins; and seeing others take vitamins.

The vitamin non-user groups, however, did not report having established cues to action, but listed many potential cues that might make them more likely to take vitamins regularly in the future. Some of those ideas included, if someone or something reminded them to take the vitamin every day; if they were exposed to many different products and forms of media that told them about how vitamins could benefit them right now; if a doctor told them they needed to take vitamins; if they found out they were pregnant; if

someone gave them free vitamins; if they knew that their friends and other people took vitamins; if they saw it on "Oprah"; or if there was an established "movement" or a "cause" that they could be a part of by taking vitamins daily.

Table 4. Vitamin "Users" Perceptions about Vitamin-Taking Behavior within the Framework of the Health Belief Model

	Vitamin Users	
HBM Construct	**Synthesized Findings**	**Quotes**
Perceived Susceptibility	*They take vitamins regularly because they feel susceptible to…* - getting sick - feeling too tired to get work done - not eating well - not being able to control other things that affect their health - certain health problems such as osteoporosis or anemia - not getting enough from food because of a restrictive diet *Of note:* *none of the participants mentioned that they believed they were susceptible to becoming pregnant or to having a pregnancy affected by a birth defect	*"Living in the dorms it's almost impossible to stay healthy."* *"I had a bone test and my doctor told me I was at risk for osteoporosis—that really freaked me out."* *"…the topic of pregnancy or babies is no where near our radar screen."*
Perceived Severity	*They take vitamins regularly because they are concerned about the severity of…* - being sick and unable to get things done - not having a healthy diet and the long term consequences that might be related to that - health problems that run in their family *Of note:* *none of the participants mentioned their concern about the severity of birth defects, however, after the topic of birth defects was brought up by the moderator, they did respond with statements about how terrible it would be for a baby to be born with a birth defect and how they would never want to have a pregnancy affected by a birth defect	*"Being sick at school isn't like when you were young and at home. Things don't stop just because you're sick."* *"I see what my dad has gone through with his health and I don't want to have the same problems."*

Perceived Benefits	*They take vitamins regularly because it…* - Gives them what they don't get when they aren't able to eat well - Helps keep them from getting sick - Gives them a sense of control over their health - Makes them feel like they are doing something good for themselves, something that their parents would be proud of - Helps their skin, hair, and nails look better - Is the one healthy thing they can do easily every day even when they don't have time to exercise, eat healthily - tastes good! - makes them feel like they are taking responsibility for their health - makes their parents happy - makes them feel healthier	*"My first year in the dorms I was sick like all the time, I was like, I need to take vitamins. It became a regular thing when I noticed that it was actually, like, helping."* *"I think it might make my skin look better."* *"I take those gummy-bear ones… they're so good!"*
Perceived Barriers	*Taking vitamins regularly can be a challenge…* - on the days when they are completely out of routine or are in a new environment (on vacation, away for the weekend, etc) - when they have a lot of competing priorities - because they don't get to go to the grocery store often to buy more when they run out - when they tell their doctor that they take them and they don't get positive reinforcement for it	*"When I'm away for the weekend, I always take them with me in, like, a little bag, but I usually forget to take them."* *"Whenever I do tell my doctor, you know, when they ask what medications I take regularly, I say, 'oh, I take a multivitamin,' and I expect them to be very excited for me and, like, praise me for it, but they never do. They're just like, 'okay'."*
Self-efficacy	*They feel they are able to take a vitamin regularly because…* - many of them took a daily vitamin from a very young age - it's part of the routine they have every day - they found a vitamin form that they like (gummies, chewables, soft chews, liquids, etc) - their parents and friends take them	*"[Taking vitamins] is just a habit now because I've done it forever, like, my parents always told me to take vitamins when I lived with them, so now it's just a habit."* *"My parents take vitamins, all my friends take vitamins…"*

Cues to Action	*They remember to take a vitamin regularly because…* - their roommates or friends do - their parents ask them about it - they place their vitamins where they can see them every day or near to something else they use daily (other pills, toothbrush, contact lenses, makeup, kitchen counter, etc.) - they do it at the same time every day - their parents send them vitamins	*"My roommate takes a vitamin every day, too. We've been roommates for two years now. And so, like, in the morning… we see each other take them and go, oh, oh, I almost forgot to take my vitamin!"* *"…I put it by my toothbrush and my makeup and everything so when I'm getting ready, it's right there."*

Table 5. Vitamin "Non-Users" Perceptions about Vitamin-Taking Behavior within the Framework of the Health Belief Model

	Vitamin Non-Users	
HBM Construct	**Synthesized Findings**	**Quotes**
Perceived susceptibility	*They do not take vitamins regularly because they **lack** susceptibility to…* - becoming pregnant anytime soon or to having that pregnancy be affected by a birth defect - having an unplanned pregnancy - experiencing ill effects from not taking vitamins *Yet, they **might** consider taking vitamins **when** they feel susceptible to…* - getting sick - not eating well	*"I would say even the word "baby" is kind of scary… it's like whoa, what baby? I'm not having a baby in college!"* *"Even if there's a chance they could get pregnant, nobody believes it's going to happen to them."*

Perceived Severity	*They do **not** take vitamins regularly because they **lack** concern about the severity of…* - what could happen if they didn't take vitamins - not getting enough vitamins from their food *Of note:* * Most respondents did not know potential consequences of not getting enough vitamins *none of the participants mentioned their concern about the severity of birth defects, however, after the topic of birth defects was brought up by the moderator, they did respond with statements about how birth defects sounded "scary" and how they would never want to have a pregnancy affected by a birth defect	*"I'm young and pretty healthy; it's not like if I don't take a vitamin I could die tomorrow."* *"When I'm pregnant I know I'll do everything I can to be healthy. I would feel so guilty if something went wrong."*
Perceived Benefits	*Although they don't take them regularly, they believe that taking vitamins regularly…* - is a good idea - could make them feel like they were being healthy - might lead to doing other healthy things - might treat or prevent sickness - benefits some women more than others	*"Taking a vitamin every day is a good idea, it's like common sense… but that doesn't mean I actually do it."*

Perceived Barriers	*They don't take vitamin supplements regularly because…* <u>*Logistics and Lifestyle*</u> - vitamin pills are hard to swallow - vitamin pills are too big and smell and taste badly - they don't have regular access to places that sell supplements - there are too many choices and they don't know which is best for them - packaging is inconvenient for travel - vitamin supplements must be taken with food and they usually eat on the run or away from home - vitamins need to be taken in the morning with breakfast and they never have enough time in the morning or often skip breakfast - they are expensive - they don't have daily reminders - there are too many competing priorities for their time, their money, or what to remember to do every day - they have very little routine and just forget <u>*Skepticism*</u> - they are skeptical that vitamin supplements really help to improve health - they haven't seen enough evidence about the benefits of taking vitamin supplements - they never saw results from taking vitamin supplements in the past - their doctor has never told them to - they don't ever see anyone else taking them <u>*Myths*</u> - they believe that overdosing on vitamins is likely and dangerous - what vitamins the body doesn't use might turn to fat - their bodies could become dependent on vitamin supplements and stop producing vitamins - they can get easily get all the nutrients their body needs from food if they just "eat healthy" - it is always better to get nutrients from food than supplements	*"When I wake up, I think about everything I need to do that day… there's so much to do and taking a vitamin isn't on my list of priorities."* *"I know it's bad, but I don't even eat breakfast most days… unless coffee counts."* *"I don't have a ton of money; I'm not going to spend 12 bucks on a bottle of vitamins."* *"There is no routine… one Monday doesn't even look like the next."* *"I think if it was something that I really needed to be healthy, my doctor would tell me."*

Self-efficacy	*They feel they are **not** able to take a vitamin regularly because…* - they do not know which vitamin supplement is right for them - they are not able to swallow pills - they are not able to make it a sustained habit	*"There are so many on the shelf…I don't know which one is right for me."* *"I choked and almost died once trying to take a vitamin- I just can't swallow them."* *"I've tried taking vitamins before… I'm good for a few days, but I just can't stick to it."*
Cues to Action	*They might be **more likely** to take vitamins regularly **if**…* - their doctor told them they needed to - they were encouraged to by a trustworthy and credible source - people in their lives (friends, roommates, parents) reminded them on a regular basis - they wanted to become pregnant - they found out they were pregnant - they saw that vitamins were being marketed to women their age - they were provided evidence that it worked to improve health - they saw results in their own health after taking them - they were given a free supply - they heard about how they could benefit from vitamins through multiple message channels (i.e. bus ads, table tents in the cafeteria, "flyers" on FaceBook, posters on bulletin boards outside of class or in bathroom stalls, from strong women like the gymnastics team, campus ministries, residence assistants, at Freshman orientation, on TV and radio, and in the student newspaper). - they were asked to be part of a "movement" or a "cause" to eliminate birth defects that others were a part of - they heard about it on "Oprah"	*"They market [vitamins] to old people and young kids, but we're kind of in-between and left out."* *"We need to hear it over and over again, and from many different places. If I just hear it once, I won't pay attention."* *"Don't be afraid to be shocking or risqué, you've got to get our attention."* *"As lame as it sounds… like even Oprah doing something on it, I'd be like, alright, Oprah says so, so yeah… Whatever she says, goes."*

Chapter V

DISCUSSION

Variables of Interest (Awareness, Knowledge and Daily Supplementation)

Among non-contemplating women aged 18 to 24 years, levels of folic acid awareness and knowledge, and daily supplementation with a vitamin containing folic acid were different for the national and student samples for all measures but one. Advanced knowledge of folic acid was similar between the two samples; very few women in either the national sample or the student sample reported knowing that folic acid should be taken before pregnancy (5 percent and 2 percent, respectively).

However, there was more difference between the national and student samples for awareness, general knowledge, and daily supplementation. With regard to awareness of folic acid, far fewer women in the student sample had ever heard, read or seen anything about folic acid compared with the national sample (37 percent versus 70 percent). Yet, the student sample showed slightly higher general knowledge about folic acid than the national sample (16 percent versus 6 percent); a finding that suggests that although awareness of folic acid was lower in the student sample, those who indicated awareness of folic acid were more likely to be knowledgeable about it and to know that it prevents birth defects. This finding might be a result of a difference between how the two surveys measured awareness and knowledge. The student survey measured awareness and knowledge in one question, "What, if anything, have you heard, read or seen about folic acid?", while the national survey measures the variables in two separate questions, "Have

you ever heard, read, or seen anything about folic acid?" (awareness) and "What have you heard, read or seen about folic acid? (knowledge). Respondents to the student survey might have been less likely to report awareness of folic acid because simultaneously, they were being asked what it was they knew about it. It is possible that if awareness and knowledge were measured in exactly the same way, the percentages of awareness in the two samples might be more similar.

Interestingly, though fewer women in the national sample reported knowing that folic acid prevents birth defects, more of these women reported taking a supplement containing folic acid on a daily basis compared with the student sample (37 percent and 25 percent, respectively). This finding suggests that the reason these women take a daily supplement containing folic acid, might not be related to an effort to prevent birth defects.

The findings for both the national sample and the student sample exhibit a pattern that is similar to the pattern that has been observed by the annual national survey of all women of childbearing age (18 to 45 years of age) reported by the March of Dimes Birth Defects Foundation, in that awareness had the highest percentage of all the variables, general knowledge was lower, and advanced knowledge was the lowest of all the variables. Daily supplementation in all samples was around 30 percent.

Relationship of Variables

In both the national and student samples, awareness and knowledge of folic acid were found to be dependent. Correlation analyses detected a positive correlation between the variables that was statistically significant, which means that as awareness levels increase, levels of knowledge would be expected to increase, and vice versa. With a

correlation coefficient of r = .213 the strength of the relationship between these two variables in the national sample is moderate. In the student sample, however, this relationship is more than twice as strong, indicated by a correlation coefficient of r = .589. Though a correlation between these two variables is reasonable, the strength of the correlation detected in the student sample compared with that of the national sample could be a result of how each of these variables was measured. In the student survey, both variables were measured based on the response to only one question, while in the national survey, two separate questions were used to measure the two variables. Because the same question was used to measuring two variables, there is a possibility that the one question is measuring only one variable; in this case, knowledge. The strong correlation coefficient, r=.589, may be indicative of this possibility.

Awareness of folic acid and daily supplementation with a vitamin containing folic acid were found to be dependent and positively correlated in the student sample. This suggests that as awareness increases, daily supplementation would also be expected to increase, and vice versa. However, though this correlation is significant, it was not particularly strong with a correlation coefficient of r = .167. Additionally, this finding was not replicated in the national sample; in that sample, awareness was found to be completely independent of daily supplementation. This means that as awareness increases, daily supplementation could not be expected to increase or decrease; one was completely independent of the other. An explanation for why this relationship was seen in the student sample but not the national sample is not evident, however, it could be related to the issue presented previously; the variation in how the two surveys measured awareness of folic acid.

In the case of general knowledge about folic acid and daily supplementation, a significant dependent relationship was again detected in the student sample while no relationship was detected in the national sample. The relationship identified by the student sample could be described as significantly positive, yet weak, with a correlation coefficient of r = .183. No relationship was detected in the national sample, however, indicating that regardless of how the number of women who knew about folic acid and its role in preventing birth defects might change, the number of women in the national sample who took a daily supplement with folic acid could not be expected to change in either direction. The presence of a relationship between general folic acid knowledge and daily supplementation in the student sample and the absence of it in the national sample are interesting, but cannot readily be explained with the information available.

Interestingly, no significant relationship between advanced folic acid knowledge, that is, that it is needed before pregnancy, and daily supplementation was detected within either sample. For a population of women who are not planning to become pregnant anytime soon, knowing that folic acid is needed *before* pregnancy to be effective in preventing birth defects might seem a logical and important piece of knowledge that might be related to their supplementation behavior. But, because a relationship between these two variables was not detected in either sample, it is reasonable to assume that those women who did take a daily supplement containing folic acid might not have been doing so for any particular reason related to folic acid and the prevention of birth defects. This assumption is supported by the findings of the qualitative data evaluation discussed below.

Qualitative Findings

Two groups of women participated in the focus groups, those who did take a supplement containing folic acid regularly ("users") and those who did not ("non-users"). Although the two groups differed with respect to their perceptions about the benefits and barriers related to vitamin-taking and the confidence they had in their ability to perform the behavior on a regular basis (self-efficacy), they were quite similar in the areas of perceived susceptibility and severity with regard to becoming pregnant and having that pregnancy be affected by a birth defect. Simply put, their comments and suggestions, in effect, explicitly and repeatedly rejected these possibilities. Whether they engaged in behavior that made them susceptible to an unplanned pregnancy or believed they were susceptible to having a pregnancy affected by a birth defect was unknown; the participants rejected the possibility of becoming pregnant so strongly that susceptibility and severity could not be fully gauged. The main finding in this regard was that none of the women in either group believed that they would have an unplanned pregnancy and therefore, preventing birth defects was not a consideration in whether they took vitamins regularly or not. This is perhaps a key explanation for why the quantitative relationship of awareness or knowledge of folic acid to daily supplementation was weak or non-existent. This qualitative finding suggests that regardless of how much awareness or knowledge these women had about the role of folic acid in preventing birth defects, it could not reliably be expected to correlate with daily supplementation behavior. Thus, promotion efforts to increase awareness and knowledge of folic acid and its role in preventing birth defects among this population could not be expected to have an effect on supplementation behavior.

Another potential explanation for the finding of weak and inconsistent correlations between awareness or knowledge and daily supplementation is that vitamin users performed the behavior regularly out of greater concern for the present than the future. This is reflected by the nature of the reasons they provided for taking a vitamin regularly; those reasons, "to feel healthier", "to prevent sickness", "to feel like I have control over my health", and others, were largely related to the benefits they perceived as being able to enjoy at the present time, to a far greater extent than to any benefits they might reap in the future. This finding reflects the idea that these women took vitamins for the here and now, not for a baby they might want to have in the future. Women in both groups seemed to assume that any future pregnancy of theirs would be planned and that they would have the opportunity to do whatever was necessary at that time to have a safe pregnancy and a healthy baby. Preventing birth defects in a baby that they might want to have sometime in the future did not seem to drive any of their current vitamin-taking behavior, in spite of the fact that they were part of the age group with the highest rates of unplanned pregnancy. This is important for health professionals to understand because they might have greater success in promoting folic acid supplementation behavior to this age group of women by promoting those benefits that women can enjoy today instead of benefits that could be realized in the future or in the event that they have an unplanned pregnancy, which most of these women reject as a possibility.

One of the most interesting differences identified between the vitamin users and non users was the important influence of their parents. Time and again, parents' influence was mentioned by the vitamin users, most notably in the areas of self-efficacy (parental modeling the behavior), perceived benefits (parental approval of the behavior) and cues

to action (parent sending vitamins or reminding the women to take the vitamins). This indicates the need for parental involvement in a folic acid promotion effort targeting this population.

Another characteristic that set users apart from non-users was users' strong belief that taking vitamins regularly was an important part of being "healthy" and keeping them healthy. Users believed that taking vitamins would prevent them from getting sick, or at least help to diminish their symptoms if they did get sick. Although the non-users mentioned this as a potential benefit, it was regarded with far more skepticism. If available, the promotion of evidence that supports illness prevention as a benefit of taking a supplement containing folic acid might help to increase daily supplementation behavior among this population.

A final important and notable difference between vitamin users and non users was the inability of non-users to overcome perceived barriers. Although vitamin users also mentioned many barriers that made taking vitamins regularly a challenge, they were far more successful in overcoming these barriers and finding solutions to the challenges they encountered. This is likely related to their self-efficacy in overcoming the barriers and performing the behavior as well as cues to action that they encountered in their lives or that they had established for themselves.

Limitations

This study has important limitations. The first limitation is related to the inability to generalize the findings to all non-contemplating women aged 18 to 24 years in the U.S. population. As mentioned previously, the student sample was one of convenience, that was taken from a particular population of women, those at a state university in Georgia,

not representative of the entire population of non-contemplating women aged 18 to 24 years in the United States. Similar studies should be conducted at many other colleges and universities around the country to determine the transferability of the findings to all 18 to 24 year old women in college.

Similarly, the national sample of 18 to 24 year old non-contemplators is likely not representative of all 18 to 24 year old non-contemplating women in the U.S. The sample was limited to only those women who had household phones, listed telephone numbers, and who could hear, understand, and speak English; thus, non-contemplating women in this age group from low socioeconomic groups and speakers of other languages were unrepresented in the national sample. Also, women who use only a cellular phone in lieu of a home landline, an ever growing trend among the college age population, were excluded as a result of the methodology used by the national survey. Future surveys should employ a methodology that includes cell phone only users, speakers of other languages, and those of very low socioeconomic status without telephone access.

Also of note, with close to 70 percent of the national sample having completed at least some college, a college degree, or a postgraduate degree, this sample is far more educated than the rest of the U.S. population and therefore may have a higher prevalence of awareness, knowledge, and supplementation than non-contemplating women of this age group in the U.S. overall. Though the national sample was population-based, it cannot claim to be nationally representative, thus limiting the transferability of the findings to all 18 to 24 year old non-contemplating women in the U.S.

Racial and ethnic minorities were severely underrepresented in the national sample with Caucasian women making up about 80 percent. Similarly, over half of the

student sample was Caucasian (66 percent). Future surveys should aim to achieve greater representation of all races and ethnicities.

Another important limitation to this study is that although the questions used to measure each of the variables were similar between the national survey and the student survey, they were not identical, and measurements might have been affected by the way in which the variable was measured. This is of particular concern with the measurement of folic acid awareness. While the national survey measured awareness and knowledge with the use of two distinct questions, the student survey used only one open-ended question. In the student survey, lack of awareness was indicated if the subjects' response to the question "What, if anything, have you heard, read or seen about folic acid?" included "nothing at all" or "I don't know/I don't remember". If the response included anything else about folic acid, the response was coded as having awareness, even if what was reported about folic acid was inaccurate, which would then be considered in the measurement of folic acid knowledge. However, an "I don't know" or "I don't remember" response was coded the same and to indicate a lack of awareness because of their inability to provide any information about folic acid. This is problematic because an "I don't know/I don't remember" cannot be assumed to indicate that they have never heard, read or seen anything about folic acid, nor can it be assumed that they had heard, read or seen something about folic acid, but that they simply could not remember or didn't know what it was. Coding the "I don't know/I don't remember" responses as lacking awareness, however, may explain the relatively low levels of folic acid awareness and the presence of a correlation between awareness and daily supplementation in spite of the absence of a correlation in the national sample, but this potential explanation

cannot be confirmed or rejected with the information that is available.

Finally, the qualitative data examined in the study was limited in that, aside from vitamin supplementation behavior, age, and student status at the University of Georgia, no other characteristics or demographic information was collected from the participants. Thus, it is not possible to determine whether or not the participants were representative of the population. Furthermore, there was an unequal amount of available qualitative information about vitamin users and non-users. Qualitative data from only one focus group with vitamin users was available to be evaluated compared with that from three non-user groups. The single group of vitamin users might not have been as representative of all users in this population.

Further Research

In addition to research studies of folic acid awareness, knowledge, and consumption that use methodologies that achieve greater representation of racial and ethnic minorities, speakers of other languages, women who do not have household telephone landlines, and women from lower socioeconomic and education segments of the population, three other important areas for further research were identified. First, sociodemographic characteristics associated with folic acid supplementation for women in the 18 to 24 year old age group have not been identified. Doing so may be helpful in describing who in this age group is likely to supplement with folic acid and who may need to be targeted by future efforts to promote supplementation. Second, a closer examination of the relationship of parental influence in vitamin-taking behavior for this age group of women is warranted to determine the validity of the finding that parents' behavior and encouragement played an important role among women who were

successful at regular vitamin-taking. Exploring this influence further may identify possible intervention strategies involving parents. And finally, research should be done to determine the plausibility of adding folic acid to foods and other products that don't currently contain folic acid, or of increasing the amount of folic acid that is currently added to products commonly consumed by this age group of women. If women were able to consume more easily the recommended amount of folic acid through common food choices, the need for additional supplementation with folic acid with vitamin pills could potentially be eliminated. Examples of products that should be investigated include birth control pills, popular beverages including soft drinks and other popular bottled beverages, and healthy snacks that this age group commonly consumes.

Conclusions

The findings of this study suggest that simply knowing about the role of folic acid in preventing birth defects is not *half the battle* when it comes to daily supplementation with a vitamin containing folic acid among non-contemplating women aged 18 to 24 years. Among a national sample of these women, awareness and knowledge of folic acid was not associated with daily supplementation with a vitamin containing folic acid. In the student sample, significant associations were found between these variables however, the correlations were weak. These findings suggest that efforts to increase knowledge and awareness of folic acid among non-contemplating women aged 18 to 24 years cannot reliably be expected to increase daily supplementation with a vitamin containing folic acid, thus supporting Green and Kreuter's (2000) claim that "changes in knowledge and awareness alone cannot be assumed to translate into changes in behavior". In short, these young women cannot be expected to take a vitamin containing folic acid daily regardless

of how much they know about folic acid and its role in preventing birth defects. This is likely due, in part, to their denial of the possibility of having an unplanned pregnancy, their "here and now" mentality, and the abundance of perceived barriers and lack of perceived benefits related to vitamin-taking behavior. Thus, folic acid promotion efforts that take an education-only approach with these at-risk women can not be predicted to result in an increase in daily supplementation with folic acid, and therefore are unlikely to reduce the number of folic acid-preventable neural tube defects.

Recommendations

Efforts to promote the consumption of folic acid among non-contemplating women 18 to 24 years of age for the prevention of neural tube defects should not focus solely on education about folic acid and its role in preventing birth defects, but rather, take an ecological approach that addresses the perceptions of the target audience related to each construct of the Health Belief Model (HBM).

A truly ecological approach to the promotion of folic acid supplementation would move beyond education-only at the individual level, by addressing interpersonal, social, environmental, political, and other factors affecting folic acid supplementation behavior. By focusing on peripheral influences, an ecological approach can also address many of the perceptions of vitamin-taking that have been uncovered by the HBM and presented in this study. For example, an intervention to address the HBM construct of *cues to action* at the interpersonal level could involve parents and friends in a creative way to provide personal reminders for daily vitamin taking. Or, to address the construct of *perceived barriers* to vitamin taking at the environmental level for women in college, an intervention could include making inexpensive multivitamins available for purchase

outside dining halls or other easily-accessible common areas; while a policy change to address *perceived barriers* could limit breakfast cereals in the dining halls to only those cereals that contain 100% of the daily value for folic acid. To address the HBM construct of *perceived benefits* by taking a social influence approach, an intervention could include partnering with the vitamin industry and encouraging them to increase marketing efforts to women 18 to 24 years of age. This may be an unconventional approach for public health professionals, but there is no surprise that marketing has a very strong influence on behavior. This study found that women notice that vitamins are usually only marketed to very young children and older adults, and therefore, they perceive that the benefits of taking a vitamin are only for those age groups. A partnership aiming to increase the perception of benefits among women 18 to 24 years of age could prove beneficial to both parties involved in the partnership. This effort could produce a strong influence at the societal level that could effect 18 to 24 year old women's perceptions about the benefits of vitamin-taking and potentially lead to higher levels of daily supplementation. These examples are just a few of many possibilities for how one can take an ecological approach to promoting daily supplementation that goes beyond simply increasing awareness and knowledge about the role of folic acid in birth defect prevention.

When taking an ecological approach to promoting daily supplementation with folic acid among this age group of non-contemplators, those planning interventions might also want to consider some of the findings of this study's review of qualitative information, by (1) finding creative ways to involve parents and peers in interventions, as their influence is important to vitamin-taking behavior, and reminding health professionals of their role in promoting folic acid supplementation; (2) providing

alternatives and solutions to identified barriers related to vitamin-taking (including the promotion of other complete sources of folic acid such as cereals); (3) using creative, non-traditional, varied, and multiple outlets to promote folic acid supplementation; (4) when promoting the benefits of vitamin-taking, focusing on those that are unrelated to pregnancy and can be reaped at the present time; and (5) avoiding messages that have a sole or primary focus on pregnancy and birth defects as this approach is unlikely to appeal to or capture the attention of non-contemplators in this age group. These considerations may help increase the likelihood of success of an intervention targeting 18 to 24 year old non-contemplating women, though their effectiveness is currently unknown and should be evaluated in the future.

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