

EXPLORING THE FACTORS ASSOCIATED WITH PRECONCEPTION HEALTH
BEHAVIORS AMONG WOMEN OF CHILDBEARING AGE: A NATURALISTIC
INQUIRY

A Dissertation

by

DIEULA DELISSAINT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2008

Major Subject: Health Education

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ABSTRACT

Exploring the Factors Associated with Preconception Health Behaviors among Women of
Childbearing Age: A Naturalistic Inquiry. (August 2008)

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Poor maternal health is one of the major risk factors related to adverse birth outcomes. Women entering pregnancy with poor health status are at higher risk of these outcomes. Prenatal care has been established as the standard prevention paradigm to reduce poor pregnancy outcomes. However, public health professionals are realizing that prenatal care alone is not sufficient to improve perinatal health and birth outcomes, and instead have emphasized the importance of *preconception care (PCC)*. Evidence-based studies reveal that those who received PCC services have better pregnancy outcomes than those who did not. Most published research on preconception are clinical studies, little is known about women's perception of preconception health and decision-making factor(s) to engage in preconception health practices. Existing research on preconception health behaviors have used retrospective designs, making them difficult to use in assessing the extent of women's understanding of preconception health behaviors and its relationship to the practice of these behaviors. Thus, an exploratory qualitative study was needed to examine factors associated with preconception health behaviors.

The objective of this study was to answer two research questions: (a) What are childbearing age women's knowledge, beliefs, and perceptions of preconception health/care and how do these factors influence their preconception health behavior? (b) What are the perceived factors (facilitators and hindrances) associated with these women's intention and decision-making regarding preconception health behaviors? Thirteen women were interviewed about their knowledge and perceptions about PCC and intention toward preconception health behavior practice. The results indicated that women believed PCC is important—using the analogy of preparing their house [body] for conception. Participants associated PCC with physical and nutritional behavior; few acknowledged the importance of mental health. While women believed PCC was important, the majority did not intend to engage in PCC until they became pregnant. The main motivator to engage in PCC was pregnancy. Self-described “laziness” was the most common reported perceived barrier to PCC. Implications of this study are that additional studies with improved designs are needed to clarify relationships among intentions and actual behaviors, and that health educators should focus on educating women about the importance of self-care before conception.

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NOMENCLATURE

B/CS: Bryan/College Station

PCC: Preconception Care

Preconception period: Before pregnancy

Periconception period: Include 2-3 month prior to conception and early trimester of pregnancy

IOM: Institute of Medicine

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CHAPTER I

INTRODUCTION

Statement of Problem

Despite efforts to eliminate adverse birth outcomes, the United States is ranked 29th in infant mortality rate among industrialized nations (National Center Health Statistics, 2007). Poor maternal health is documented as one of the major risk factors to preterm births, low birth weight, and infant mortality (Haas, Meneses, & McCormick, 1999; CDC, 2005a; Cone-Wesson, 2005; Goldenberg & Culhane, 2005; Haas et al., 2004; Hollander, 2005). Therefore, poor health among women of childbearing age, regardless of maternal status (e.g., pregnant, post-partum), is a problem.

Some maternal health conditions provide little opportunity for amelioration or management within the pregnancy context (Haas et al., 2004). For example, women with poor physical functioning or chronic hypertension before conception were more likely to have preterm delivery (Haas et al., 2004). Therefore, these women face additional hurdles regarding their reproductive health as well as potential adverse pregnancy/childbirth outcomes. Some health conditions that influence maternal and reproductive health are more amenable to efforts to change and/or improve. These include health conditions and/or behaviors associated with adverse birth outcomes that are initiated and/or maintained by the individual (e.g., alcohol abuse, insufficient intake of folic acid). For example, binge drinking before and during pregnancy may result in Fetal Alcohol Syndrome in infants, causing physical deformities and cognitive deficits (Coles, 1994; CDC, 2005b). Insufficient intake of folic acid before pregnancy contributes to neural tube defects (Yang et al., 2007). These types of behaviors are preventable, are open to intervention, and if ameliorated may lead to

This dissertation follows the style of *Health Education & Behavior*.

improved birth outcomes *and* improved health of women, regardless of maternal and/or pregnancy status.

Factors and behaviors that can influence health outcomes, including reproductive health, may start as early as conception. A Life Course Approach (Ben-Shlomo & Kuh, 2002) to understanding multifactorial influences on health outcomes proposes that “. . . *long-term effects . . . of physical and social exposures during gestation, childhood, adolescence, young adulthood and later adult life*” (Ben-Shlomo & Kuh, 2002, p. 285) accumulate over the lifespan. Researchers utilizing the Life Course Approach consider that social, behavioral and environmental factors may have a stronger influence on reproductive outcomes than current behaviors or social status (Lu, 2003). The cumulative effects of poor nutritional status, life events and high-risk sexual behaviors can pose a serious threat to women’s reproductive health. Given this premise, an early start to optimizing women’s health is imperative to overall health and to pregnancy outcomes.

Preconception Care

Since the release of the Institute of Medicine (IOM) report on preventing low birth weight in 1985, researchers have been calling for a new prevention paradigm—preconception care (PCC)—to reduce or eliminate adverse birth outcomes (IOM, 1985; Freda, Moos, & Curtis, 2006; Moos, 2006). Prenatal care has been established as the standard prevention paradigm to reduce poor pregnancy outcomes (Moos, 2004; Moos, 2006). However, researchers and public health professionals are realizing that prenatal care alone is not an effective strategy to improve perinatal health and birth outcomes (Fiscella, 1995; Alexander & Kotelchuck, 2001), and instead have emphasized the importance of *preconception care*.

Preconception care is defined as “a set of interventions that aim to identify and modify biomedical, behavioral and social risks to a woman’s health or pregnancy outcome through prevention and management” (CDC, 2006, p.3). General women’s health involves all aspects of women’s wellness and health issues during reproductive and non-reproductive ages (Kolander, Ballard, & Chandler, 2005). Preconception health is specifically tailored to girls and women age 15-44. This specific health care area uses a lifespan approach to focus on total women’s wellness and reproductive health before conception (CDC, 2006). Both concepts focus on optimizing women’s health.

Preconception care is important for several reasons. Unintended pregnancies can result in abortion, preterm birth, or adverse birth outcome (Finer & Henshaw, 2006). Evidence-based studies on the effectiveness of preconception care reveal that those who received preconception care services have better pregnancy outcomes than those who did not (Korenbrot et al., 2002; CDC, 2006). Women who received preconception care from their physicians or a local health department were more likely to report intended pregnancies compared to those with unintended pregnancies (Korenbrot et al., 2002; Moos, Bangdiwala, Meibohm, & Cefalo, 1996).

Women who did not plan on becoming pregnant often delay entry to prenatal care during the first trimester of pregnancy (Finer & Henshaw, 2006). Between 17 and 56 days post-conception, the major organs of the fetus begin to develop, and during this period the development of the organs may be influenced by any biological and environmental factors that could endanger the fetus (Moos & Cefalo, 1987). Thus, by the time a woman discovers she is pregnant and decides to start prenatal care, much of the fetal organs may have already developed, and structural abnormalities may also have occurred. Prenatal care will not be

sufficient to compensate for poor maternal health resulting from poor health behaviors. Hence, optimizing women's health throughout during their life course has the potential to ameliorate poor pregnancy outcomes.

A major gap in the scientific knowledge base exists, pertaining to the impact of poor *non-maternal* health behaviors on birth outcomes. In other words, little is known about women's preconception health behaviors, knowledge and perceptions about preconception care as it relates to intended pregnancy. Studies testing women's knowledge of preconception health focus mainly on the knowledge of intake of folic acid supplements to reduce neural tube defects (Frey & Files, 2006; Perlow, 2001; Quillin et al., 2000), but not on other modifiable risk behaviors associated with maternal health, infant health and pregnancy outcomes. At present, there are no reports in the literature on perceived barriers to preconception health readiness and practice, and factors associated with decision-making to preconception care among childbearing age women. Addressing this gap in the body of knowledge is important, and as a result serves as the impetus for this investigation.

Overall Goal of the Study

The objective of this study was to answer two research questions: (a) What are childbearing age women's knowledge, beliefs, and perception of preconception health/care? (b) What are the perceived factors (facilitators and hindrances) associated with these women's intention and decision-making regarding preconception health behaviors?

Aim 1: Investigate the level of knowledge, beliefs and perceptions of preconception health among non-pregnant women

The aim of the first research question is to investigate the level of knowledge about preconception health among nulliparous women ages 18-35 who intended to conceive within

5 years. If these women are knowledgeable of preconception health and preconception care, and if they understand the importance of preconception health behavior, then what are their current preconception health practices? And how much or to what extent do their knowledge, beliefs and perceptions influence their preconception health behavior? The interaction between knowledge, perception and preconception health behavior is ambiguous in the literature. Studies that tested knowledge and perception of preconception care did not explore the linkage between knowledge of preconception health and care and their preconception health behavior.

Aim 2: Clarify the perceived factors associated with their decision toward practicing preconception health behaviors

The second research question seeks to clarify the perceived factors associated with their decision to (or not to) practice preconception health. While these women may perceive preconception health as beneficial to their health and to their future birth outcomes, they may not consider cessation of certain unhealthy behaviors (e.g., smoking, alcohol consumption, unprotected sexual activities, and physical inactivity) or may have considered altering their behaviors but never decided to act upon it.

Results from these research questions will help to bridge the gap in the literature on preconception health behaviors—specifically on perceived factors facilitating and hindering preconception health practices. Findings of this study will provide a springboard to develop intervention strategies for developing health education and public health programs on a wider scale.

Several steps were undertaken to address this gap in knowledge. First, the specific problem was identified through an intensive review of the research literature, which was then

followed by an approach to address the problem (e.g., study).

A systematic review was required in order to provide a comprehensive assessment of the research performed to date on this issue, and to identify key areas requiring furthering study. The first manuscript titled “*Identification of Factors Utilized in Studies of Preconception Health Behaviors: A Systematic Literature Review*” (Dissertation Chapter II) effectively addresses this problem. Through a systematic literature review, preconception health factors which have been studied to date are identified, and key findings are highlighted. The resulting manuscript reveals conceptual and methodological gaps. Other results of the systematic review include methodological concerns regarding reviewed studies. For example, the majority of study designs were retrospective, thereby limiting causal inferences. This article presents recommendations for future study to improve internal experimental validity.

Very little is known about women’s understanding, perception and intention to engage in preconception health behavior practices, particularly among women who have not yet given birth. Improving the knowledge in this area is difficult through retrospective study designs. Prospective studies are warranted to clarify the cause-effect nature of such relationships. These can be enriched by collecting detailed qualitative information from women about their perspectives on preconception health behaviors. The second manuscript titled “*Exploring Women’s Perceptions and Decision-Making Factors to Engage in Preconception Health Behaviors: A Naturalistic Inquiry*” addresses one dimension of the above-mentioned problem by using qualitative approaches to examine preconception health factors and practices from the standpoint of women who have a stake in this topic.

Dissertation Format

This study used a journal article dissertation format. This format is comprised of 4 chapters. The first chapter consists of a brief introduction to the overall research study with the intent of providing a basic framework for the manuscripts that follow. The second chapter (Article #1) is a systematic literature review focused on identifying preconception health behavioral risk factors. This manuscript will be submitted to the *American Journal of Preventive Medicine*. The third chapter (Article #2) is a manuscript based on a qualitative study used to explore factors associated with preconception health behaviors. This will be sent to the *Maternal and Child Health Journal*. Chapters II and III are written as stand-alone manuscripts, with the intended audience and readership of the journal in mind. The manuscripts have different citation and reference styles due to differing requirements of the journals.

The fourth chapter integrates the relevance of the two stand-alone manuscripts by (1) detailing additional findings for each manuscript—particularly those that had to be excluded due to word limits, (2) interprets the combined relevance of both manuscripts in terms of their relationship in answering the overall study questions, and (3) overall study implications will be discussed. Finally, this format includes several appendices that include details relevant to the overall study, but not appropriate for inclusion within the individual manuscripts nor the summary chapter. These include sample questions, informed consent and plans for analysis.

CHAPTER II
IDENTIFICATION OF FACTORS UTILIZED IN STUDIES OF PRECONCEPTION
HEALTH BEHAVIORS: A SYSTEMATIC LITERATURE REVIEW

Introduction

The urgency to ameliorate overall women's health status and to reduce adverse birth outcomes has spurred researchers, clinicians, and policymakers to shift their attention from the prenatal period to the preconception period among women of childbearing age. Prenatal care is undeniably important during pregnancy to detect complications and fetus abnormalities; however, the prenatal period is insufficient to minimize risk factors potentially influencing pregnancy outcomes (Moos, 2004). Almost half of pregnancies in the United States are mistimed or unplanned (Finer & Henshaw, 2006). Therefore, pregnancy recognition/diagnosis typically occurs later than ideal, causing delay in prenatal care. This delay limits the window of opportunity to perform appropriate interventions designed to reduce adverse birth outcomes (Misra, 2006). Thus, optimizing women's reproductive health—regardless of pregnancy intention—is imperative.

Research on maternal behavioral factors during pregnancy on maternal/infant outcomes has clearly established that behavioral risks pose a serious threat to both mother and infant health, minimizing chances of favorable pregnancy outcomes. Yet, research emphasis on preconception health behaviors is scant. Most studies on preconception care are clinical-based with their main emphasis on the effectiveness of preconception care, management of chronic disease (s), diabetes control and hyperglycemia and folic acid supplementation. Little attention has been given to preconception health behaviors.

Preconception health behaviors subsume various types of health behaviors practiced by women of childbearing age to optimize their overall physical and mental health status and therefore, pregnancy outcomes. Preconception health behaviors include, but are not limited to, cessation of smoking and binge drinking, exercise, folic acid intake, maintenance of a balanced diet and normal weight, family planning, gynecological care including sexually transmitted infections screenings, and vaccination (e.g., hepatitis, rubella). While these critical preconception health behaviors have been identified, there remains a paucity of understanding regarding more complex aspects of preconception health behaviors (e.g., influential factors, barriers). Consequently, there is a critical need to improve what is known about preconception health behaviors. A necessary primary step is to identify and evaluate critical preconception health behaviors in order to understand women's behaviors and health practices before pregnancy.

The objective of this systematic review was to collect and synthesize the research literature focusing on factors related to preconception health behaviors. There are two major reasons for this focus: First, a previous systematic search was conducted and published on preconception care in mid-2002, with the main emphasis on evidence-based clinical trials that demonstrated the effectiveness of preconception care and preconception preventive services (Korenbrod, Steinberg, Bender, & Newberry, 2002). That systematic review excluded studies utilizing other types of research designs (e.g., quasi-experimental) from the review. Second, other published reviews on preconception health/care were mostly conceptual (i.e., not empirical studies) and commentary pieces with a broad focus on preconception health and preconception care.

At the present, no systematic literature reviews exist that identify key factors/variables associated with preconception health behaviors, nor are there reviews that critically examine the methodological relevance of research designs used in preconception health behaviors and relevant predictors and outcomes. The current systematic review sought to answer two research questions: 1) What are the factors associated with preconception health status and health behaviors? and 2) What are the major findings of these studies?

Methods

The process for this review involves rigorous methodological initiatives to generate a comprehensive analysis of the body of literature on preconception health behaviors. Below is a detailed summary of the methodology utilized for this systematic review. The major steps include: 1) A database search to identify relevant articles; 2) Development of Inclusionary/Exclusionary Criteria to select articles; 3) Performing a 4-Step Screening Process for the Identification of preconception health behavior factors among published articles; 4) Instrumentation to guide the extraction process; and 5) Data Extraction of the retrieved articles.

Database Search

A systematic search was performed to retrieve peer-reviewed articles addressing preconception health behaviors. Two major databases on health literature (biomedical, public health, and allied health), Medline (Ovid) and CINAHL (EBSCO), were searched using a variety of keywords (e.g., preconception care, pre-pregnancy, and health behavior). A medical librarian at Texas A&M University, College Station, was consulted during the search

process to ascertain appropriate databases and search terms were used. Table 1 displays the comprehensive search strategy for retrieval of articles.

Table I: Keywords Search for Preconception Health Factors: Ovid and CINAHL

Preconception Health Factors	
1	exp Preconception Care/
2	preconcept\$ ti,ab
3	pregn\$ ti,ab
4	(pre adj1 (pregn\$ or concept\$)) ti,ab
5	(interconception or (inter adj1 conception)) ti,ab
6	or/1-5
7	exp health behavior/ or exp patient compliance/ or exp self-examination/
8	reproductive behavior/ or exp risk reduction behavior/ or exp risk-taking/
9	exp Attitude to Health/
10	exp exercise/
11	exp Awareness/
12	exp diet/
13	exp Self Efficacy/
14	exp Internal-External Control/
15	exp Intention/
16	Family Planning Services/
17	((risk\$ or health\$) adj1 (aware\$ or attitude\$ or know\$ or behav\$)) ti,ab
18	(glyc?emic adj1 control\$) ti,ab
19	or/7-18
Study Design	
20	exp "Prospective Studies"/ or exp epidemiologic studies/ or exp case-control studies/ or
	exp cohort studies/ or exp cross-sectional studies/ or exp intervention studies/ or exp
	pilot projects/ or exp sampling studies/ or exp twin studies as topic/ or exp
21	data collection/ or exp health surveys/ or exp health care surveys/ or exp questionnaires/
22	((case adj1 control) or (cohort adj1 stud\$) or (cross adj1 section\$) or (intervention\$ adj1
	stud\$) or (cross adj1 over\$ adj1 stud\$) or (time adj1 series)).ti,ab.
23	(survey\$ or questionn\$) ti,ab
24	(clinical trial, all or clinical trial, phase i or clinical trial, phase ii or clinical trial, phase
	iii or clinical trial, phase iv or clinical trial or comparative study or controlled clinical
	trial or evaluation studies or meta analysis or multicenter
25	or/20-24
26	6 and 19
27	25 and 26

Table I: Continued

Limitations	
28	limit 27 to yr="1998 - 2008"
29	limit 28 to english
30	6 and 19
31	exp africa/ or exp caribbean region/ or exp central america/ or canada/ or greenland/ or mexico/ or exp south america/ or antarctic regions/ or arctic regions/ or exp asia/ or exp atlantic islands/ or exp australia/ or exp europe/ or exp indian ocean isl
32	30 not 31
33	limit 32 to (comment or editorial or letter)
34	32 not 33

NOTES: Explanation of symbols and key words

exp: Explore these words

ti.ab.: Search for any articles with these words (e.g., prepregnancy and/or preconception) in title and abstract

\$: Truncation symbol (anything start with this word)

adjacent1: within 1 word of each other

Inclusionary/Exclusionary Criteria

Articles meeting the following criteria were selected if they: 1) were empirical peer-reviewed U.S. studies published between 1998 and 2008 in English; 2) included information on measure(s)/instrument(s) (e.g., questionnaire, self-reports) assessing preconception health behaviors; and 3) utilized human participants. All types of study designs were included (e.g., prospective designs, epidemiologic, case-control, cohort). The current study is limited to articles referring to preconception health behaviors published post-1997. Exclusionary criteria included 1) studies conducted outside the U.S., and 2) articles that could not be evaluated because they were written as reviews and commentary pieces, non-peer reviewed articles, not written in English, or published before 1998.

Screenings of Articles

The screening process involved three tiers. First, a series of screening questions needed for article retrieval was generated (see table II). Five hundred fifteen potential articles

were identified, retrieved and placed in an Endnote library. Abstracts of these articles were first screened for inclusion of a variable and/or measure(s) of preconception health behavior and year of publication. If measure(s)/instrument(s) were not described within the abstracts, the methods sections were examined for the information. Second, full articles were evaluated for fit with other inclusionary criteria. Irrelevant titles, duplicates, and narrative/commentary pieces were automatically excluded. Studies which simultaneously addressed preconception and pregnancy/prenatal period were included; however, the current study focused on measures relevant to preconception health behavior, rather than post-conception behaviors. Third, additional articles were identified by “purling”– i.e., performance of a thorough review of the references/citations of retrieved articles for publications that might have been missed through the database search. Purling is often performed to ensure that all relevant articles are retrieved (Garrard, 2004).

Table II: Screening Questions

Characteristics	Fitting of inclusionary criteria
Does the study report a measured instrument to assess preconception health behavior?	Y or N
Is it a peer-reviewed empirical study?	Y or N
Is it published between 1998 and 2008?	Y or N
Does the study focus or address preconception health behavior?	Y or N
Was the study conducted in the United States?	Y or N

Instrumentation

A coding protocol spreadsheet (CPS) was developed to standardize the data extraction methods applied to the reviewed studies. The CPS was designed to guide the identification and assessment of methodological characteristics among reviewed articles, including identification of key factors associated with preconception health behaviors, and

characteristics of the measures used to assess such factors. The CPS also details the data extraction process, the type of information extracted from reviewed studies, as well as detailing the rationale used to determine key study and methodological characteristics.

Data Extraction

Characteristics of the reviewed articles (e.g., purpose of study, study design, theoretical framework) were entered into the CPS. Articles were categorized based on similarity of study aims, and of investigated factors (e.g. nutrient intake, pregnancy intention, and alcohol consumption during the preconception period). For articles failing to state the study design, independent assessments to identify study design were performed by the lead investigator and a graduate student from an epidemiology program. The inter-rater-reliability was 1.

Extracting information about the instruments was the central component of the current systematic review. Emphasis was placed on identifying key factors associated with preconception health behaviors, and on the measures used for these factors. Several large-scale studies resulted in multiple publications, albeit not always with a common set of research questions. Examples include the Slone Epidemiology Birth Defect (de Jong-Van den Berg, Hernandez-Diaz, Werler, Louik, & Mitchell, 2005; Schaffer, Velie, Shaw, & Todoroff, 1998; Werler, Hayes, Louik, Shapiro, & Mitchell, 1999), Central Pennsylvania Women's Health Study (Weisman et al., 2006; Weisman et al., 2008), Kaiser Foundation Health Plan study (Green-Raleigh, Lawrence, Chen, Devine, & Prue, 2005; Lawrence et al., 2003) and the Alpha/Omega Study (Dempsey, Butler et al., 2004; Dempsey, Sorensen et al., 2004; Kloeblen, 1999; Kloeblen & Batish, 1999; Rudra, Williams, Lee, Miller, & Sorensen, 2006).

Results

Retrieval of Empirical Articles

Figure 1 displays the selection process for retrieving relevant articles that met the inclusionary criteria. Among the 514 articles initially identified, 26 articles met the inclusionary criteria. Eight additional articles were retrieved through purling. The final sample size for this review was 34.

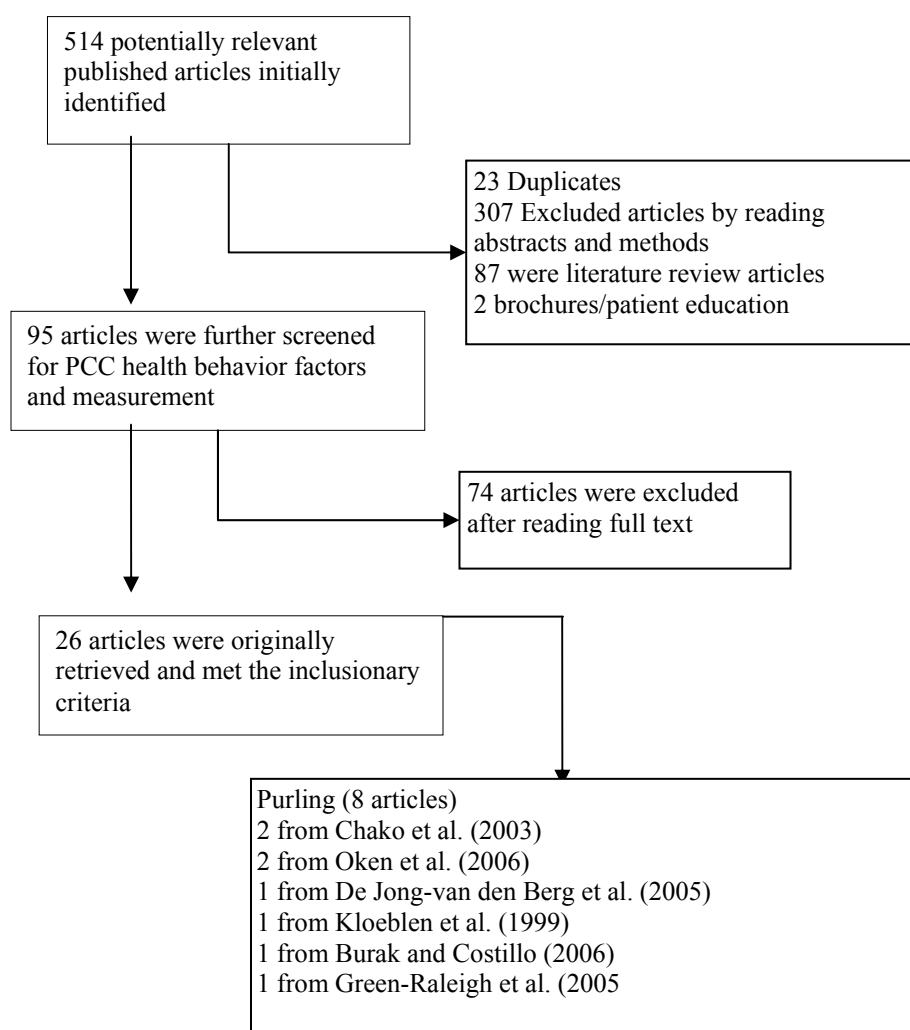


Figure 1. Selection Process of Retrieved Articles

Identification of Factors Related to Preconception Health Behaviors

Six major categories of preconception health behavior risk factors were identified in the reviewed studies: frequency of alcohol prior and during pregnancy, glycemic control/diabetes management, nutrient intake such as folic acid and vitamins, physical activity before and during pregnancy, pregnancy planning behavior, and miscellaneous other risk factors (e.g. HIV prevention practices, chronic conditions). See Table III for a display of reviewed articles' characteristics, instrument (s) used to assess preconception health behaviors, and the major findings of the investigated factors. Details of the findings are described next.

Frequency of alcohol prior to and during pregnancy. Two observational studies examined alcohol consumption behavior during the periconception period (before and during early pregnancy) among women with live-birth infants. Using the 1988 National Maternal and Infant Health Survey, a retrospective cross-sectional study examined frequency of alcohol intake before pregnancy diagnosis among women residing in 48 states of the United States (Montana and South Dakota were excluded) (Floyd, Decoufle, & Hungerford, 1999). Almost half of the participants used alcohol three months before pregnancy diagnosis. Nearly two-thirds of women did not discover they were pregnant until the fourth week of gestation. Main determinants of women who drink before and during the early weeks of pregnancy were: Non-Hispanic white, smoker, college-educated, unmarried, 25 years of age and older (Floyd et al., 1999). In a case-control study using the Pregnancy Risk Assessment Monitoring System data, women's pregnancies (unplanned or planned) during binge drinking periods were examined (Naimi, Lipscomb, Brewer, & Gilbert, 2003). Findings revealed unintended pregnancy and exposure to physical violence as outcomes of binge drinking

(Naimi et al., 2003). Predictors of binge drinking and unintended pregnancy include being non-Hispanic white, unmarried and a smoker. Unintended pregnancy was more related with binge drinking among white women than black women.

Glycemic control / diabetes management. Only 1 article with a preconceptional focus on diabetes management and monitoring glucose level was retrieved. In that study, a 10-item questionnaire was administered among a cohort of pre-gestational diabetic women. Of the 54 respondents of the questionnaire, 86% reported monitoring their glucose level at least 3 times daily. However, women with prior pregnancies while experiencing poor glycemic control were more likely to enter a subsequent pregnancy with suboptimal glycemic control (Casele & Laifer, 1998). Women who were counseled about pregnancy planning had a lower chance of entering pregnancy with poor glycemic control (Casele & Laifer, 1998).

Table III: Characteristics and Major Findings of The Reviewed Studies

Frequency of alcohol consumption prior and during pregnancy							
Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Floyd, 1999	Cross-sectional	9559	Women with live-birth infants living in 48 of the 50 U.S. states (Montana and South Dakota were excluded)	Not reported	[1] 1988 National Maternal and Infant Health Survey, [2] mailed in-questionnaire followed up by telephone, and [3] in-person interviews	[1] Average of drinks 3 months prior to pregnancy recognition, [2] length of gestation when discovered pregnancy	Almost half of the survey respondents consumed alcohol 3 months before pregnancy diagnosis. Women who were unmarried, smokers, over 25 years old, white non-Hispanic, or college educated had a higher frequency of alcohol consumption during the preconception period
Naimi, 2003	Case-control	72907	Women with live-birth infants who engaged in binge drinking before conception	Not reported	[1] 1996-1999 Pregnancy Risk Assessment Monitoring System (PRAMS) data	[1] Binge drinking, [2] unintended pregnancy, [3] birth control practice, [4] smoking, [5] exposure to violence	Women who binge drank preconceptionally were "more likely" to have an unintended pregnancy, to smoke, drink during pregnancy, and experience some form of physical violence compared to women with intended pregnancy
Glycemic control / Diabetes Management							
Casele, 1998	Cohort	54	Pregestational women with diabetes attended Magee Women's Hospital, Pittsburgh, PA, between October 1994 and March 1997	Not reported	[1] 10-item questionnaire	[1] Preconception management of diabetes, [2] pregnancy planning, [3] diet, [4] monitoring of blood glucose levels, [5] preconception counseling, and [6] preconception interventions	86% checked their glucose level a minimum 3 times per day; women with a previous adverse birth outcome were more likely to enter subsequent pregnancy with suboptimal glycemic control
Nutrient Intake: Consumption of folic acid, vitamin supplements, food rich with folate supplements							
Schaffer, 1998	Repeated cross-sectional	462	Mothers aged 40-43 residing in CA who gave birth to an infant without a birth defect between 1989-1991	Not reported	[1] interviewer-administered questionnaire; [2] 100-item food frequency questionnaire	[1] Use and frequency of vitamins, minerals, and food supplements	Approximately 25% of the respondents indicated consumption of some type of multivitamin 3 months prior to conception. Higher frequency of consumption of vitamin/mineral supplements was found among white non-Hispanic women, but was very rare among foreign-born Hispanics
Kloeben, 1999	Cross-sectional	251	WIC participants or low-income pregnant women eligible for WIC program in Atlanta, GA, from March through May 1997	[1] Four constructs of Health Belief model: perceived susceptibility, perceived severity, perceived benefits, perceived barrier; [2] Self-efficacy and intention were also used	[1] 58-item interview script	[1] Supplement use, [2] health behaviors, [3] knowledge and beliefs about folate, [4] intake of grain products	Even though 80% of the participants did not consume any form of supplements during the preconception period, most of them have heard of folate but were unable to define its source. Perceived benefits was the main determinant in their intention to take folate supplements

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Kloeblen, 1999	Cross-sectional	251	WIC participants or low-income pregnant women eligible for WIC in Atlanta, GA, from March-May, 1997	[1] Six constructs of Health Belief Model: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues	[1] 15 minute interview with 58-item interview script	[1] Supplement usage, [2] pregnancy-related behaviors, [3] attitudes and beliefs about folate, [4] intentions to permanently follow a high folate diet, [5] typical consumption of enriched grain products	Most of the participants were unfamiliar with folate and NTDs. A significant number (70%) of the participants was unknowledgeable of foods that contained folic acid. Of those that were pregnant, over 70% had never talked to anyone about folate
Vele, 1999	Case-control	859	Women who gave birth to a singleton or stillborn baby during the period of June 1st, 1989, and May 31st, 1991, or women who aborted an NTD-affected fetus from February 1st, 1989, to January 31st, 1991	Not reported	[1] In-person interview, [2] 98-item food questionnaire	[1] Vitamin and supplement intake 3 months before pregnancy, [2] medical, reproductive, and family history	Increasing consumption of maternal zinc is related to a decrease risk in neural tube defects
Werler, 1999	Case-control	963	Mothers with infants who had birth defects as case group and mothers with infants who did not have birth defects as control group in metropolitan areas of Boston, Philadelphia and Toronto from 1993-1996	Not reported	[1] Questionnaire	[1] Frequency of vitamin use from 2 months before last menstrual cycle to end of pregnancy, [2] reproductive and medical history, [3] medication, alcohol, and cigarette use, [4] dietary intake	Consumption of vitamin containing folic acid after the last menstrual cycle and pregnancy recognition were associated with decreased risk of cleft palate and urinary tract defects
Quillin, 2000	Intervention	71	College women enrolled in undergraduate psychology program at Virginia Commonwealth University. Participants' age was between 17-50	[1] Health Belief model using 4 constructs: perceived susceptibility, perceived seriousness, perceived benefit, and perceived barriers; [2] Locus of Control	[1] Pre- and Post-test questionnaire, [2] Subcategories of Fetal Health Control of Locus Scale: Internal control (reliability, .88), chance (reliability, .83), and powerful others (reliability, .76)	[1] Awareness/beliefs of folic acid and NTD [2] multivitamin intake, [3] perceived benefits, perceived barriers, and perceived threat of folic acid [4] locus of control for maternal behavior	Most of students were not aware of folic acid and NTD before intervention. Awareness/knowledge of folic acid significantly increased after intervention. However, awareness/knowledge of folic acid and locus of control were not related to vitamin intake

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Suarez, 2000	Case-control	306	Data collected among Mexican-American women with NTD-affected pregnancies living in Texas-Mexico border as case studies, and Mexican-American women with normal live births as control group from January 1995 to February 1999	Not reported	[1] In-person interview, [2] 98-item food questionnaire administered in both English and Spanish	[1] Intake of either prenatal vitamins, multivitamins, or single-ingredient folic acid tablets from 3 months before pregnancy to 3 months after pregnancy. Brand name of supplements was also recorded. [2] Frequency of food rich with folate over the 6-month preconceptional period	Intake of daily preconceptional supplements was low among both case and control group. Furthermore, more than 40% of women in both groups did not take folic acid during the preconceptional period
Callender, 2001	Cross-sectional	21	Women who were pregnant in 1996 or 1997 with a NTD fetus while residing in Colorado	Not reported	[1] Telephone administered questionnaire	[1] Vitamin consumption before and during pregnancy in 1996 or 1997, and during any subsequent pregnancy, [2] current vitamin use, [3] birth control use, [4] knowledge of folic acid recommendations	All of the participants became aware of the folic acid recommendations either during pregnancy or after pregnancy. About 24% reported consumption a of vitamin containing folic acid at least 1 to 3 months prior to conception. None of the women took the recommended amount of folic acid during a subsequent pregnancy
Perlow, 2001	Cross-sectional	315	English- and Spanish speaking pregnant women who sought care at the Phoenix Perinatal Associates between March through August 1998	Construct: Knowledge	[1] Survey	[1] Intake of vitamins preconceptionally, [2] knowledge regarding the benefits of preconceptional folic acid	Preconceptional Spanish-speaking women were "less likely" to take vitamins than Preconceptional English-speaking women. English-speaking women were "more likely" to be aware of the role of folic acid
Alozie-Arole, 2003	Stratified random sample	7252	Women who had live births between 1996-1999. Classified as black or non black. A random group of 200 women was selected every month	Not reported	[1] Live births reported to Michigan's Pregnancy Risk Assessment Monitoring System, [2] questionnaire	[1] Folic acid awareness, [2] pregnancy planning, [3] demographic information, [4] parity, [5] timing of prenatal care, [6] Medicaid enrollment	68.5% were aware of folic acid benefits over the length of the study. 77% decline in folic acid awareness among women with no high school education. Black women were less likely than other races to be aware of folic acid. Parity, prenatal care, and medicaid status were not associated with folic acid awareness
Chaco, 2003	Evaluation	387	Young minority women (72% black, 28% Hispanic) participated in a folic program at 3 urban clinics in Houston, TX, between 1999 and 2000	Construct: Knowledge	[1] Assessment questionnaire	[1] Demographic information, [2] sexual activity in the past 3 months, [3] pregnancy history, [4] contraceptive practice, [5] awareness of folic acid, [6] adequate consumption of folic-acid fortified foods	At the beginning of program, participants had limited or inadequate amount of vitamins and folate-rich foods. Post-intervention, daily multivitamin consumption increased from 9% to 88%
Hilton, 2002	Nonexperimental, descriptive survey	42	Female college students ages 18-24	Construct: Knowledge	[1] Survey	[1] Demographic data; [2] knowledge of folic acid; [3] Dietary intake (e.g. green leafy vegetables, citrus fruits and vegetables)	Only one-third of the participants reported daily consumption of multivitamins. All of the 42 participants were not taking adequate folic acid and food-containing folic acid.

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Lawrence, 2003	Quasi-experimental interrupted time series with a non-equivalent interrupted group	3,438	Females aged 18-40 who were members of the Kaiser Foundation Health Plan (KFHP)	[1] Social marketing theory, [2] Health belief model, and [3] Transtheoretical model of change	[1] Telephone survey using questions from the March of Dimes/Gallup Survey of folic acid/multivitamin, [2] Behavioral Risk Factor Surveillance System survey	[1] Frequency of consumption of multivitamins and other supplements	A small percentage of multivitamin consumption increased among the KFHP members; however, the increase faded after intervention
De Jong-van den Berg, 2005	Cohort	16,555 to 7555	Ascertained pregnant women with either malformed or not malformed infants in Boston, Philadelphia and Canada	Not reported	[1] Face-to-face interview, [2] data between 1998 and 2002 from the Slone Epidemiology Center Birth Defect Study	[1] History of medication use 2 months prior conception and during pregnancy, [2] Awareness and use of folic acid	Awareness and intake of folic acid has significantly increased from 1988 to 2002. Education is the main determinant of awareness and use of folic acid
Green-Raleigh, 2005	Repeated cross-sectional	≈2000 (year)	Women of childbearing aged 18-45	Not reported	[1] March of Dimes Birth Defects Foundation / Gallup Organization	[1] Awareness of folic acid, [2] knowledge of folic acid, [3] behavior regarding folic acid, [4] source of knowledge, [5] source of folic acid	Percentage of consumption of folic acid increased from 28% in 1995 to 33% in 2005
Burak, 2006	Cross-sectional	313	College women enrolled at midsized suburban New England State College	Construct: Knowledge	[1] 50-item self-administered survey. Correlation coefficient for item-by-item (N=20) is between .51 to 1.0	[1] Frequency of consumption of various fish, [2] bread/grain and vegetable intake, [3] 7 items on vitamins intake, [4] perceived severity about birth defects	There is a positive significant correlation between multivitamin consumption beliefs, the importance of healthy eating, and having taken a college-level health course. Intake of leafy green and colorful vegetables was significantly associated with knowledge of birth defects and with having taken a college-level health course
Hilton, 2007	nonexperimental descriptive correlational investigation	88	44 young women aged 18-24 attending college and 44 of those who sought medical care in the county health facility	Not reported	[1] Two surveys (demographic data sheet and dietary intake assessment), [2] Validity- (folic acid) measure based on the known levels of it in food included on the dietary intake assessment, [3] correlation coefficient for instrument was .61	[1] Folic acid awareness and its relationship with birth defects, [2] diet (folic consumption), [3] pregnancy intention	Members of group 1 were more likely than those in group 2 to purposely increase their folic acid intake. 90% of the women increased their folic acid consumption during pregnancy; (48%) could correctly identify folic acid supplementation & the type of birth defects it could prevent. Group 1 knew some specific birth defects folic acid prevents while 73% of group 2 stated that FA prevent certain diseases. Only 5% of the women knew the actual recommended daily allowance of the vitamin

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Kannan, 2007	Intervention	301	Hispanic women of childbearing age between 19 to 50 years old	[1] Consumer information processing mode, [2] revised version of the theory of reasoned action (TRA) model, with the addition of a sensory and enabling component	[1] A 12-item 1-page (2 sided) survey for the women, [2] product availability checklist to survey supermarket and grocery owners	[1] Knowledge and awareness of folic acid and its sources, [2] current supplement use, [3] preferred type of nutrition information, [4] postintervention behavioral intent, [5] assessment of product availability in grocery stores/ supermarkets	Most of the survey respondents (71%) were aware of folic acid. Those who were aware of folic acid were "more likely" to select good sources of folic acid from food. Pre-intervention: 26% consumed daily multivitamin and 17% consumed multivitamin sometimes. Post-intervention: 96% (153) of the women intended to modify their folic acid consumption and 89% of the 153 women intended to consume folic-acid rich foods on a daily basis
Yang, 2007	Stratified multistage probability design in NHANES 2001-2002	1685	Nonpregnant women aged 15-49 of non-Hispanic white, non-Hispanic black, and Hispanic origin	Not reported	[1] National Health and Nutrition Examination Survey, 2001-2002 (NHANES)	[1] Use of dietary supplements (e.g. multivitamins, herbs, folic acid), [2] frequency of days in a month	Non-Hispanic black women (19%) and Hispanic women (21%) had a lower percentage of taking the recommended amount of 400 µg of folic acid compared to non-Hispanic white women (40.5%)
Physical activity before and during pregnancy							
Dempsey, 2004	Case-control	541	Cases: women with a diagnosis of GDM; Controls: women who were not diagnosed with GDM and pregnancy-induced hypertension	Not reported	[1] In-person interview using questions from the Minnesota Leisure-Time Physical Activity Questionnaire	[1] Frequency of recreational activity before and during the first 20 wks of pregnancy, [2] walking pace and number of miles walked, [3] information on height and weight 3 months prior to the study, medical, reproductive, and lifestyle characteristics	Regular physical activity before and/or during pregnancy is associated with decreased risk of GDM compared to inactive women. Also, women who engaged in frequent/intense physical activity and daily stair-climbing had a lower chance of being diagnosed with GDM
Dempsey, 2004	Ongoing prospective cohort study	909	Non-diabetic pregnant women and/or nulliparous women living in Seattle and Tacoma, Washington, during the period of 1996-2000	Not reported	[1] Structured questionnaire, [2] 121-item semi-quantitative food frequency questionnaire	[1] Medical records and reproductive histories, [2] type/frequency/intensity of recreational physical activities participated in the year prior to pregnancy and 7 days before interview	Results reveal a statistical significance between recreational physical activity before and during pregnancy and risk of GDM. Women who were physically active before conception were 66% less likely to be at risk of GDM

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Rudra, 2006	Dual design: 1998-2002 case-control study and 1996-2002 prospective cohort	1166	Pregnant women with a diagnosis of gestational diabetes and women with risk factors for preeclampsia	Not reported	[1] Stanford Seven-Day Physical Activity Recall, [2] Minnesota Leisure-Time Physical Activity Questionnaire, [3] Borg scale	[1] Involvement of any type of sports and recreational activity before pregnancy, [2] frequency and duration of physical activity before pregnancy, [3] report of level exertion in physical activity	Women who participated in strenuous physical activity were at lower risk of gestational diabetes than those who did not. Perceived exertion has a "direct inverse" association with risk of gestational diabetes
Oken, 2006	Cohort	1805	Women with either normal glucose tolerance, abnormal glucose tolerance, or gestational diabetes who had an appointment at one of eight urban and suburban obstetric offices in eastern Massachusetts from 1999 to 2002	Not reported	[1] Physical Activity Scale for the Elderly (PASE)	[1] Physical activity one year prior conception, [2] average weekly hours spent in walking, light to moderate physical activities, and vigorous physical activities, [3] weekly avg of number hours spent watching television or videos	Women who engaged in vigorous/light to moderate physical activity before pregnancy had a lower chance of being at risk of GDM and abnormal glucose tolerance. Risk of GDM or abnormal glucose tolerance is not related to television viewing before or during pregnancy
Pregnancy intention, Pregnancy planning, Unintended pregnancy							
Hellerstedt, 1998	Case-control	7174	Pregnant women at the Group Health Cooperative of Puget Sound in Washington or Park-Nicollett of Minnesota	Not reported	[1] Telephone health behavior survey	[1] Pregnancy intendedness, [2] consumption of caffeinated drinks, [3] alcohol intake, [4] vitamin use, [5] cigarette smoking	Not a strong relationship exists between pregnancy intention and behavioral changes. Women with intended pregnancies were more likely to engage in preconception health behavior (vitamin use, less caffeine intake)
Holling, 1998	Case-control	85	Diabetic women with planned and unplanned pregnancies who gave birth at one of the hospitals in Washington state between June and October 1994	Not reported	[1] Self-administered questionnaire, [2] Marital Satisfaction Scale, [3] Multidimensional Health of Control Scale, [5] Semi-structured interview	[1] Contraceptive use, [2] pregnancy planning behavior, [3] desire for motherhood, [4] partner relationship, [5] health locus of control, [6] knowledge about diabetes and pregnancy, [7] medical advice received, [7] relationship with healthcare providers	More than half of participants did not have a planned pregnancy. Unplanned pregnancy is related to locus of control attributing to doctors. Women who were discouraged to conceive were more likely to have an unplanned pregnancy. Most of the women did not use contraception because of low perceived risk of conception
Rosenberg, 2003	Repeated cross-sectional	1629	Oregon women with live infant births between Nov. 1998 through Oct. 1999	Not reported	[1] Oregon PRAMS	[1] Pregnancy intention, [2] intake of folic acid of days/month before conception	Intended pregnancies were associated with periconceptional folic acid consumption. Adolescent mothers with unintended pregnancies were "much less likely" to take periconceptional folic acid

Table III: Continued

Lead author, year (ref)	Study Design	N	Population	Theoretical framework	Type of Instrument (s) & its reliability	Factors Measured	Major findings of main factors investigated
Green-Raleigh, 2005	Quasi-experimental interrupted time series with a non-equivalent interrupted group	2886	Data was collected from 1998 through 2000 among non-pregnant, childbearing women aged 18-40 who are members of KFHP	Not reported	[1] Telephone survey using questions from the March of Dimes/Gallup Survey of folic acid/multivitamins, [2] Behavioral Risk Factor Surveillance System survey	[1] Pregnancy planning, [2] cigarette smoking, [3] multivitamin use, [4] folic acid, [5] alcohol consumption, and [6] healthcare use	Women who intended to conceive within the next year were "more likely" to take multivitamins regularly and "less likely" to smoke cigarettes compared to those planning a pregnancy later (more than one year)
Anderson, 2006	Repeated cross-sectional	10066	Preconceptional women and pregnant women	Not reported	[1] Used the 2002 and 2004 Behavioral Risk Factor Surveillance Systems (BRFSS) survey	[1] Risk factors and behaviors that include knowledge of HIV prevention and practices, alcohol and tobacco use, and nutrition	About 55% of the women in the preconception period consumed alcohol frequently, smoked, and didn't have an HIV test, versus pregnant women. Almost half of the preconception women have not taken vegetables and folic acid, compared to 20% of the pregnant women
Frey, 2006	Cross-sectional	499	Childbearing age women between 18 to 45 who sought annual well-woman exam in Mayo Clinic Arizona during the period of August 2004 through July 2005	Construct: Knowledge and Beliefs	[1] 4 page questionnaire	[1] Pregnancy intendedness, [2] knowledge and attitudes about preconception care, [3] preferences about sources of info on preconception care	Women acknowledged the importance of being healthy before conception. Those who are interested in acquiring PCC information prefer to receive it from their doctor. Most of the women were knowledgeable about the impact of substance on pregnancy outcome, but not the effect of fish consumption
Weisman, 2006	Cross-sectional	2002	Reproductive age women: Preconceptional, interconceptional, and postconceptional living in a rural county in Central Pennsylvania	Not reported	[1] SF-12v2TM Health Survey, [2] 12-item questionnaires using Norm-based scoring, [3] behaviors questions adapted from Behavioral Risk Factor Surveillance, [4] Center for Epidemiologic Studies Depression Scale, [5] Prenatal Psychosocial Profile Hassles Scale (Cronbach alpha = .69), [6] Conflict Tactics Scale (Cronbach alpha = .83)	[1] Chronic and acute conditions, [2] periodontal disease, [3] types of gynecological infections, [4] health behaviors (cigarette smoking, binge drinking, vegetable consumption, use of multivitamin with folic acid, physical activity, and frequency of vaginal douching in the past 12 months), [5] stress level (money worries, problem with friends), [6] and experience with intimate partner violence	Preconceptional women reported highest percentage of binge drinking, limited consumption of vegetables and folic acid. Older preconceptional women (ages 35-45) had poorer health status (suffer chronic disease) than younger preconceptional women. Preconceptional women reported "overloaded" stress due to job
Weisman, 2008	Cross-sectional	614	Nonpregnant women with intention of future pregnancy living in a rural county in Central Pennsylvania	Construct: Locus of control (perceived internal control)	[1] Internal Control of Birth outcome Scale (cronbach alpha = .72), [2] SF-12v2TM Health Survey, Physical component, Mental component were used to assess health status, [3] Center for Epidemiologic Studies Depression Scale, [4] 12-items questionnaires on stressors from the Psychosocial Hassles Scale; [4] "Access to health care"	[1] Perceived control of birth outcomes (e.g. "There is nothing I can do to make sure my child is born healthy," "It is my job as a mother to make sure my child is born healthy,") and [2] preconceptional control ("There are things I can do before I become pregnant to make sure my child is born healthy")	Older, educated, and married women were more likely to "perceive they can control their birth outcomes." Mental health status, depressive symptoms, psychosocial stress, or healthcare access were not associated with perceived control of birth outcome.

Nutrient intake (e.g., vitamin consumption, folate supplements). More than half of the reviewed studies (N=34) addressed issues related to awareness, knowledge, beliefs about neural tube defects (NTD), NTD prevention practices (e.g., folic acid intake, consumption of foods rich with folate supplements, and frequency of these consumptions), and other nutrient intakes. Three major types of measures were used among the reviewed studies focusing on nutritional behavior: 1) questionnaires developed by the investigators (face-to-face interview, telephone survey, or self-administered interview questionnaire); 2) a 98-item food frequency questionnaire; 3) national dataset questions adapted from the March of Dimes/Gallup Survey of folic acid/multivitamins, Behavioral Risk Factor Surveillance System survey, and National Health and Nutrition Examination Survey, 2001-2002 (NHANES). The interview questionnaire was mainly used to assess past and current use of folate supplements, knowledge of folic acid and neural tube defect prevention practices. The 98-item food frequency questionnaire was used to assess source of knowledge and consumption of foods containing folic acid. Studies with population of women with birth defects infants gathered information on target population's medical and reproductive histories (Velie et al., 1999; Werler et al., 1999).

Eight cross-sectional studies (Burak & Costello, 2006; Callender, Rickard, Miller, & Rinsky-Eng, 2001; de Jong-Van den Berg et al., 2005; Green-Raleigh, Carter, Mulinare, Prue, & Petrini, 2006; Kloeblen, 1999; Kloeblen & Batish, 1999; Perlow, 2001; Schaffer et al., 1998) and three case-control studies (Suarez et al., 2000; Velie et al., 1999; Werler et al., 1999) investigated awareness and consumption of folic acid, vitamins, other folate supplements among various populations and relationships between maternal nutrient intake and reduction of NTDs. Reduction of NTD is associated with an increased consumption of

maternal zinc (Velie et al., 1999); other birth defects such as urinary tract deformities and cleft palate are also associated with the lack of intake of vitamins containing folic acid (Werler et al., 1999). One article reported findings of a retrospective repeated cross-sectional study that investigated nutrient intakes three months before conception. The study focused on foreign- and U.S. born Latina mothers and white non-Latinas aged 40-43, who were residing in California with an infant without birth defects during the period of 1989 and 1991 (Schaffer et al., 1998). Interviews and a self-administered 100-item food questionnaire were utilized to gather information on medical, reproductive, family and lifestyle histories of the participants, and to examine their preconception nutritional behaviors. Among all three ethnic groups, fewer than half of consumed 5 servings of fruits and vegetables daily. Approximately 25% (N = 462) of the survey respondents took some types of multivitamin 3 months prior to conception. White non-Latina women had higher frequency of consumption of vitamin/mineral supplementation, whereas such intake was literally nonexistent among foreign-born Latinas (Schaffer et al., 1998).

Other studies also reported low consumption of folic acid among Latina women. In a case-control study among Mexican-American women with NTD-affected pregnancies living on the Texas-Mexico border, preconception intake of daily supplements was low among both case and control women (Suarez et al., 2000). Furthermore, more than 40% of case and control women did not take folic acid during the periconception period (2-3 month prior to conception for those intending conception, and early trimester) (Suarez et al., 2000). Comparisons of English versus Spanish-speaking women in a cross-sectional study revealed Spanish-speaking women were “less likely” to take vitamins (Perlow, 2001).

Latina women are not the only population with low awareness and consumption of folic acid. Results from a stratified multistage probability design study using National Health and Nutrition Examination Survey (NHANES) 2001-2002 revealed that among a multi-ethnic sample of 1,685 non-pregnant women aged 15-49, fewer non-Hispanic black women (19%) and Hispanic women (21%) took the recommended amount of folic acid than compared to non-Hispanic white women (40.5%) (Yang et al., 2007).

Findings from a retrospective cross-sectional study found that 80% (N = 251) of WIC participants and WIC-eligible pregnant women did not consume any type of supplement during the preconception period (Kloeblen, 1999). While these women were aware of the recommendation to take folate supplements, paradoxically they failed to do so. A study utilizing a stratified random sample of 200 black and non-black women with live births between 1996 to 1999 revealed black women scored lower in folic acid awareness compared to non-black women (Hilton, 2007). In another study of college population, most respondents were not aware of folic acid and the role of folic acid on preventing NTD (Burak & Costello, 2006; Quillin, Silberg, Board, Pratt, & Bodurtha, 2000). However, consumption of multivitamins and intake of green and colorful vegetables was associated with knowledge of birth defects and with past enrollment in a college-level health course. Despite the number of studies reporting low awareness and consumption of folic acid among their target population, two retrospective cross-sectional studies reported an increased awareness and intake of folic acid from 1988 to 2002 among women with malformed infants and non-malformed infants (de Jong-Van den Berg et al., 2005), and an incremental trend in consumption of folic acid from 28% in 1995 to 33% in 2005 among women of childbearing age 18-45 (Green-Raleigh et al., 2005).

Among the 34 studies retrieved, three were intervention-based and one was an evaluation (survey sub-project based on an intervention study) aimed at increasing awareness, knowledge and consumption of folic acid among childbearing age women. The first intervention targeted undergraduate females enrolled in a psychology program at a southern university (Quillin et al., 2000). The main outcome measures for this intervention were awareness and beliefs about folic acid and NTD, perceived benefits, perceived barriers and locus of control for maternal behavior. Pre- and post-test questionnaires were used to assess these measurable constructs. This intervention utilized the health belief model and locus of control (using the Fetal Health Control of Locus Scale) for theoretical guidance. The majority of participants were unaware of folic acid pre-intervention; however their knowledge and awareness about this issue significantly increased post-intervention. Despite the belief that folic acid is important to prevent NTD, it was not associated with folic acid and multivitamins consumption.

Another intervention study sought to promote consumption of multivitamins and/or other supplements among childbearing women aged 18-40 who were members of the major health plan (Lawrence et al., 2003). About 50,000 starter kits with 100 multivitamins were mailed to health plan members. Social marketing theory, the health belief model, and the Transtheoretical model of change were the theoretical frameworks used for this intervention. A telephone survey was administered to assess the outcome of the intervention. A small proportion of participants increased their daily multivitamin use; however the change did not persist at post-intervention assessment.

A third intervention study focused on educating Hispanic/Latina women ages 19 to 50 about folic acid, its benefits in the prevention of NTDs, and source of foods containing folic

acid (Kannan, Menotti, Scherer, Dickinson, & Larson, 2007). This intervention was also grounded in the consumer information processing model and a modification of the theory of reasoned action (TRA) model. A survey was administered to assess post-intervention behavioral intent, knowledge and awareness of folic acid, and consumption of supplement use. Consumption of multivitamin daily vitamin increased from twenty-six percent pre-intervention to ninety-six percent post-intervention. Furthermore, the majority (89%) of the women (N=153) who increased their multivitamin consumption reported intentions to consume folic-acid rich foods on a daily basis. An evaluation was performed on an intervention program designed to increase awareness and consumption of folate, which targeted 387 young minority women (72% Black and 28% Hispanics) at three urban clinics in Houston, TX (Chacko, Anding, Kozinetz, Grover, & Smith, 2003). A questionnaire used to evaluate the effectiveness of this program (Chacko et al., 2003) revealed that daily multivitamin consumption increased from 8% (pre-intervention) to 88% (post-intervention).

Physical activity before and during pregnancy. Four types of studies investigated the impact of preconception physical activity on the risk of gestational diabetes mellitus (GDM). The studies used various designs, including cross-sectional case-control (Dempsey et al., 2004), prospective cohort (Dempsey, Sorensen et al., 2004), cohort (Oken, Taveras, Popoola, Rich-Edwards, & Gillman, 2007), and dual design (both cohort and cross-sectional) from two large projects (Rudra et al., 2006). Various measures and protocols were used across the studies reported among the selected articles. In-person interviews using questions from the Minnesota Leisure-Time Physical Activity Questionnaire, Stanford Seven-Day Physical Activity Recall, Borg Scale, and Physical Activity Scale for the Elderly (PASE) were used to assess past and current activities, in addition to frequency activities among women diagnosed

with GDM or at risk of GDM. Preconception health behavior factors investigated among the four reviewed articles included (but was not limited to) frequency of physical activity (preconception and during pregnancy), and intensity of physical activity (see Table III).

Findings were similar across all four studies that examined the impact of preconception physical activity on the risk of developing gestational diabetes mellitus. Regular physical activity before and/or during pregnancy is associated with decreased risk of GDM (Dempsey, Butler et al., 2004; Dempsey, Sorensen et al., 2004; Oken et al., 2007; Rudra et al., 2006). Women who engaged in intense physical activity (e.g., daily stair climbing) had a lower risk of GDM diagnosis (Dempsey et al., 2004). Women who engaged in vigorous, and in light to moderate preconception physical activity had lower risk of both GDM and abnormal glucose tolerance. Risk of GDM or abnormal glucose tolerance was not related to television viewing before or during pregnancy (Oken et al., 2007).

Pregnancy intention, pregnancy planning, and unintended pregnancy. Four retrieved articles reported findings on pregnancy intention as a predictor of behavior change, and on the relationships among intended pregnancy, unintended pregnancy, and preconception health behaviors (Green-Raleigh et al., 2005; Hellerstedt et al., 1998; Holing, Beyer, Brown, & Connell, 1998; Rosenberg, Gelow, & Sandoval, 2003). In a cross-sectional cohort study, a health behavior survey was administered by telephone to pregnant patients of the health cooperatives located in the Northwest and Great Lakes regions. Women with intended pregnancies were more likely to engage in preconception health behavior (e.g., vitamin use, less caffeine intake), albeit the relationship was somewhat weak (Hellerstedt et al., 1998). In one study using non-equivalent group cohort design, the investigators sought to understand factors associated with pregnancy planning behaviors among 85 diabetic women. Self-

administered questionnaires and semi-structured interviews were applied to examine these factors. Findings revealed that women who were advised against pregnancy by their doctors were more likely to conceive unintentionally. Most did not use contraception because of low perceived risk of conception held by these women (Holing et al., 1998).

The relationship between pregnancy intention and periconceptional folic acid consumption was investigated in a repeated cross-sectional study among 1,629 women. Results suggest that women with intended pregnancies were more likely to consume folic acid during the periconception period than those with unintended pregnancies. Periconceptional folic acid consumption was measured by self-reported use of folic acid “most days in the month” prior to conception.

Pregnancy planning and health behaviors were investigated among 2,886 non-pregnant women of childbearing age between the ages of 18-40 who were planning to conceive in the future. The study design utilized a quasi-experimental interrupted time series with a non-equivalent interrupted group. A telephone survey using questions from the March of Dimes/Gallup Survey of folic acid and multivitamins and the Behavioral Risk Factor Surveillance System survey were administered among non-pregnant women. Those who intended to conceive within the next year were "more likely" to take multivitamins regularly and "less likely" to smoke cigarettes comparing to those who had plans for pregnancy more than one year in the future. Also, women who planned to conceive within one year were most likely to disengage from certain health behaviors (e.g., alcohol consumption, smoking) than women who were planning to conceive in more than one year.

Other risk factors investigated among preconception health behaviors. Using the 2002 and 2004 Behavioral Risk Factor Surveillance Survey, risk factors for adverse birth

outcomes were assessed among women in both preconception and pregnant stages (Anderson, Ebrahim, Floyd, & Atrash, 2006). Compared to pregnant women, over half of the preconceptional women smoked, drank alcohol frequently, and had not being tested for HIV. At the time of the interview survey, nearly half (45%) of preconception women had not consumed folate-rich vegetables or folic acid compared to 20% of the pregnant women (Anderson et al., 2006). Similar findings were reported from a population-based cross-sectional study of women representing different reproductive stages (Weisman et al., 2006). Compared to pregnant women, higher proportions of preconceptional women reported binge drinking and limited vegetable and folic acid consumption (Weisman et al., 2006). Older preconceptional women (ages 35-45) had poorer health status (e.g., suffered with chronic disease) than younger preconceptional women (Weisman et al., 2006). Perceived control of birth outcomes (as an influential factor) was also assessed among non-pregnant who wished to conceive in the future. Higher perceived control of birth outcomes was associated with increased age (i.e., among older women), higher education levels, and marital status (married) (Weisman et al., 2008). Mental health status, depressive symptoms, psychosocial stress, or health care access were not associated with perceived control of birth outcomes (Weisman et al., 2006).

Knowledge and beliefs about preconception health behaviors among women of childbearing age 18 to 45 were assessed using a 4-page questionnaire (Frey & Files, 2006). All women acknowledged that preconception care was important, and indicated a preference to receive information about preconception care from their doctor. Most (98%) were knowledgeable about the impact of substance use on pregnancy outcomes, but were unaware of the effect of fish consumption on pregnancy outcomes (Frey & Files, 2006).

Discussion

Through in-depth analyses of the retrieved articles, factors examined among studies of preconception health behaviors studies have been identified and described. The current study employs a comprehensive systematic review of the body of literature on preconception health behaviors conducted in the United States during the period of 1998 and 2008. Findings of this systematic review demonstrated that a number of preconception health behavioral factors have been investigated, with the majority of the scope of reviewed studies focusing on awareness, knowledge, and consumption of two factors—folic acid and multivitamins. Based on this review, it is evident that the main emphasis of research on preconception health behaviors focuses on nutrient intakes associated with decreasing the risks of neural tube defects. Little attention, however, has been paid to other risk factors with the potential to influence birth outcomes. These include preconception health behaviors such as alcohol consumption, management of diabetes, maintenance of a balanced diet and physical activity. Preconception knowledge and other cognitive factors with potential influence include pregnancy intentions, pregnancy planning and other factors that might lead to behavioral changes (e.g., health beliefs, perceived control of birth outcomes).

A critical finding of this review relates to the myriad preconception health behaviors that were not examined or reported in the literature. This includes, but is not limited to, gynecological care (e.g., Pap smear, STI screenings), immunization, infectious disease screenings, obtaining family history and genetic screenings. Health status factors not covered in the literature include weight status (e.g., overweight and underweight) and oral health. Awareness and other cognitive domains not covered among existing research on preconception health include knowledge and consumption of other nutrients (exclusive of

folate) important to preconception and prenatal health, and knowledge of the effect(s) of prescription drugs on reproductive health. Preconception health behavior studies should focus in the near future on addressing the larger array of risk factors associated with birth outcomes.

While not the primary aim of this review, it was important to identify various measures used among the studies, as such information provides the reader some understanding of how various researchers might be conceptualizing and operationalizing the critical variables in their respective studies.

Five large datasets were employed in some of the reviewed studies, using measures developed for national survey research, such as Behavioral Risks Factors Surveillance Systems (BRFSS), Pregnancy Risk Assessment Monitoring System (PRAMS), National Health and Nutrition Examination Survey (NHANES), and questions adapted from the March of Dimes/Gallup Survey of folic acid and multivitamins. The remainder of the instruments used were surveys and other assessments constructed by the investigators.

All of the reported instruments were administered either as face-to-face interviews or via telephone. The reliability of the instruments was not reported for the majority of the instruments used, making it difficult to assess the validity of the findings. While psychometric properties for the national measures can be obtained by the reader, it is good practice for authors to include such information in their publications. This is especially relevant for those measures developed by the researchers, as there are no sources to cross-check the validity and reliability of the measures. Only four studies reported the reliability of their instruments (Burak & Costello, 2006; Judith J. Hilton, 2007; Quillin et al., 2000; Weisman et al., 2006). It is also worth noting that there is not a standardized instrument for

preconception health behaviors studies. Having a comprehensive standardized instrument is strongly encouraged to measure all spectrums of preconception health behavior factors, and to enable cross-study comparisons.

Most of the data collected using national measures are dated (i.e., collected late 1980's to mid 1990's). For example, one study utilized data collected 20 years ago (1988) with the National Maternal and Infant Health Survey. It was used to measure frequency of drinking prior to pregnancy recognition (Floyd et al., 1999). Another study used the 1996-1999 PRAMS data to assess relationships between binge drinking and unintended pregnancy. Four studies that focused on factors related to folic acid used data collected between late 1980's to mid 1990's (Callender et al., 2001; Schaffer et al., 1998; Velie et al., 1999; Werler et al., 1999). The time period for the data analyzed for the majority of the reviewed studies was late 1990s to early 2000s (Chacko et al., 2003; de Jong-Van den Berg et al., 2005; Green-Raleigh et al., 2006; Kannan et al., 2007; Kloeblen, 1999; Kloeblen & Batish, 1999; Lawrence et al., 2003; Perlow, 2001; Suarez et al., 2000; Yang et al., 2007). Information on time frame when data were collected was not reported for 2 studies among college women (Burak & Costello, 2006; Quillin et al., 2000). Therefore, the age of the data is unknown. Data collected for the other investigated categorical factors (e.g., pregnancy intention, physical activity) were more recent, ranging from 1999 to 2005. Differences in findings around these factors could be explained (particularly among studies on folic acid) by the type of instruments used, time period of data collection, and population characteristics. With the exception of the instrument, cohort effects related to time period and population characteristics can evolve and consequently give concern to the current generalizability of findings. It should also be noted that findings for some of these review studies were derived

from the same data of multiple large projects. Therefore multiple publications result from a single data source, yet those multiple studies give the impression of distinct studies with similar findings.

Other Methodological Concerns

Of the 34 reviewed studies investigating preconception health behaviors, 18 were retrospective studies. Therefore, these studies are limited to self-report and recall biases. Findings should be interpreted with caution. Furthermore, 16 of the reviewed studies used cross-sectional designs to gather information on prevalence of factors among childbearing age women. The nature of the cross-sectional design limits making conclusions on causal relationships. Prospective research designs linking preconception health behavior to relevant outcomes are needed in order to clarify the relationships and the directions of influence among women's perceptions, and beliefs about the importance of preconception care and their intention toward preconception health and pregnancy planning behavior. Furthermore, qualitative studies are recommended to enrich understanding about how women contextualize preconception care practices for future pregnancies. It is difficult to determine whether intention to pregnancy leads to preconception health behavior when using retrospective study designs. Some studies assessed only beliefs and knowledge of preconception care and other risk factors but added little new knowledge regarding the influence of these factors on preconception health behavior.

Various statistical data analytic techniques were used among the reviewed studies, with most utilizing multivariate techniques to examine complex relationships among independent and dependent variables. However, nine studies applied univariate statistical techniques (e.g., descriptive frequencies, t-test, chi-square, and analysis of variance). Using

only univariate statistical techniques hinders the ability to adjust for multiple factors that may be related to preconception care and limits the ability to determine the causal relationships among the investigated factors. There is a possibility that advanced statistical techniques may not have been suitable for some of those datasets; however, these investigators failed to justify the logic behind using only univariate statistical analysis.

Atheoretical research processes were also found to be a problem. The majority of studies were not grounded in a theoretical framework, with the exception of intervention studies. Only 2 cross-sectional studies were grounded in a theoretical framework, in both cases using the Health Belief Model (Kloeblen, 1999; Kloeblen & Batish, 1999). Four cross-sectional studies used one or more constructs: knowledge (Burak & Costello, 2006; Frey & Files, 2006; Perlow, 2001) and locus of control (Weisman et al., 2008). One of four intervention studies applied only the “knowledge” construct (Chacko et al., 2003). An added concern was the lack of construct definitions among the articles. The majority of studies failed to report how preconception care or the periconceptional period was defined. Among those articles in which the time frame was defined, there was inconsistency across studies. For example, the start of periconceptional period varied by several months (e.g., 2 months before conception for one study, 3 months before conception for another). There is a need for future studies to either standardize definitions of preconception care and preconception health behavior among studies or clearly describe how preconception health behaviors were conceptualized and operationalized.

Strength/Limitation of the Study

The objective of this systematic review was to collect and synthesize the research literature focusing on factors related to preconception health behaviors. This systematic

review critically examined the literature on preconception health behaviors, with main emphases on identification of factors specific to preconception health behaviors and analysis of research approaches used (e.g., design). Implications of this study are that it offers a comprehensive analysis of the various factors or foci for preconception health behavior research. This study enables the identification of gaps in the knowledge base of preconception health behavior research. Despite this study's usefulness, the review has some limitations. First, there is a possibility of articles not retrieved due to the search strategies employed. During the identification and screening process of potential articles, some may have been overlooked. Second, this systematic review focused on studies conducted in the United States. A comparative analysis of preconception health behavior studies in the U.S. with other countries might lead to some additional findings. Despite the potential limitations of this review, it provides researchers and health professionals with guidance and direction for future research, interventions, and preconception health behavior practices.

CHAPTER III

EXPLORING WOMEN'S PERCEPTIONS AND DECISION-MAKING FACTORS TO ENGAGE IN PRECONCEPTION HEALTH BEHAVIORS: A NATURALISTIC INQUIRY

Introduction

Reducing adverse pregnancy outcomes and optimizing women's health have been a main focus of public health agendas. This is largely due to current recommendations on preconception care initiatives by the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registries Preconception Work Group (CDC, 2006). There have also been calls for the adoption of preconception care practices in the past. In 1985, the Institute of Medicine (IOM) urged women to plan ahead for pregnancies in order to minimize risk factors influencing adverse birth outcomes (IOM, 1985; Moos, 1987). Promoting preconception health behaviors among childbearing age women is an integral component of these initiatives. Preconception health behaviors have the potential to influence maternal health, pregnancy outcomes and the health of the fetus. Risk behaviors associated with adverse birth outcomes can have lifelong effects on the mother and the child.

Numerous published studies exist on preconception care; however, the majority is clinical-based—focusing on chronic diseases management, and assessing effectiveness of preconception health care services. While clinical intervention studies have increased our understanding of the significant impact of preconception health on pregnancy outcomes, little is known about women's perception of preconception health and decision-making factors that lead them to engage in preconception health behaviors.

The non-clinical studies utilized experimental designs that do not improve our understanding of the non-quantitative aspects of health behavior. For example, little is

known about how women conceptualized preconception health, what meanings they associate with preconception health or preconception care, nor about their beliefs and perceptions toward preconception care.

Few studies have tested factors that influence preconception health behavior, such as women's beliefs, attitudes and knowledge of preconception care (Frey & Files, 2006); perceived control of pregnancy outcomes (Weisman et al., 2008); and perceptions of preconception health risk factors associated with adverse birth outcomes (Weisman et al., 2006). Studies testing women's knowledge of preconception care have focused mainly on women's knowledge of folic acid supplementation to reduce neural tube defects (Perlow, 2001; Quillin et al., 2000; Shaw et al., 1995), but not on other modifiable risk behaviors associated with maternal health, infant health, and pregnancy outcomes (e.g., contraceptive practices, cessation of tobacco consumption).

At present, there are no published reports on perceived barriers to preconception health readiness and practice, nor on factors associated with women's decisions to engage in preconception care. Studies examining knowledge and perceptions of preconception care do not explore the linkage between knowledge of preconception care and preconception health behavior. Therefore, the interaction between knowledge, perception and preconception health behavior is still ambiguous.

The purpose of this study was to explore childbearing age women's knowledge, beliefs and perceptions of preconception care, and the perceived factors and hindrances associated with participation in preconception health behaviors. This study is shaped by two research questions: 1) What are childbearing age women's knowledge, beliefs, and perception of preconception health and preconception care? and 2) What are the perceived

factors (facilitators and hindrances) associated with women's intentions and decisions to engage in preconception health behaviors? These two questions will help bridge the gap in the literature on preconception health behaviors—specifically on clarifying aspects of perceived factors facilitating and hindering preconception health practice.

Methods

Research Design

This exploratory study used a naturalistic approach to address the concept of preconception health and preconception care. Qualitative methodology is appropriate and applicable for exploration of concepts that have not been thoroughly examined or comprehended, as is the case for preconception health behavior (Denzin & Lincoln, 2000). Only through examining the social context of individuals—how they view preconception health, their attitudes and knowledge of preconception health—can researchers comprehend and evaluate women's understanding of preconception health and preconception health behaviors (Denzin & Lincoln, 2000).

Sample, Sampling Method, & Recruitment Procedures

A purposive sampling was used to recruit women of different racial/ethnic groups from the Bryan/College Station, Texas metropolitan area. Participants were eligible for the study if they were English-speaking, nulliparous childbearing women aged 18-35 years old, had not undergone a hysterectomy or tubal ligation, and have intentions to conceive within 5 years. Individuals were excluded if they were non-English speakers, had given birth to at least one child, had a hysterectomy or tubal ligation, were aware of personal fertility issues (e.g., fibroid tumors, or sterility), or were not planning to conceive within the next 5 years. Women under age 18 years or above 35 years were also excluded. The age range restriction

was warranted because of 1) extensive variability between adolescents and adults' preconception readiness, and 2) women over aged 35 having a different set of preconception issues (e.g., fertility issues, multiple chronic diseases) compared to younger women (Ziadeh, 2002). Despite the restriction in age range, there was still sufficient variability in perceptions, beliefs, and knowledge among this range to yield data rich enough to be informative. Data saturation—the point at which additional interviews or units yield little new information pertinent to the topic of interest—was reached at the thirteenth interview (Holsti, 1969; Lincoln & Guba, 1985).

Traditional recruitment approaches (e.g., flyers, direct approach) were somewhat challenging given the large numbers of women in the required age range with children. Snowball sampling was used to recruit some participants, particularly Hispanics and Asians who were difficult to recruit due to language and cultural barriers.

Instruments

Three types of instruments were used: human instrument, semi-structured open-ended interview questions, and a demographic questionnaire. Utilizing the researcher (i.e., the human) as the instrument enables the researcher to perform data collection, immediately process data as it becomes available, formulate hypotheses or theories, and test these hypotheses on the spot (Lincoln & Guba, 1985). A series of semi-structured, open-ended interview questions were developed based on the needs of the research questions, factors identified in the literature on preconception health, and perceived gaps in the literature. Women were asked to *define* preconception care and preconception health, state their *beliefs* about preconception care, describe factors that would facilitate and those that would hinder

their decisions (i.e., intentions), *and* their ability to acquire preconception care (i.e., ability to engage in preconception health behaviors).

Data Collection

Intensive semi-structured interviews were conducted at various settings (e.g., home, office, public places), and were scheduled based on participants' availability. At the onset of each interview, participants underwent the informed consent protocol to ensure the protection of their rights. Those who provided written consent next completed a demographic questionnaire. All interviews were audiotaped using a digital recording device, except for one participant who was uncomfortable about being recorded. Handwritten notes were taken for that participant, and for the other 12 interviewees. These notes augmented the audio recordings of the interviews.

Each interview lasted approximately 30-40 minutes. Interviews were transcribed verbatim. An audit trail was kept. An audit trail is a collection of sources and documents used during data collection and analysis to establish credibility (i.e. internal validity), trustworthiness and to determine the rigor of the study. All records of the study (e.g., recruiting procedures, interviews, field notes, transcripts) were secured in a locked cabinet. Interviewees received a \$25 major retailer gift card upon completion of the interview. This study was approved by the Institutional Review Board at Texas A&M University, College Station.

Data Analysis

Content analysis and comparative constant method were applied to analyze the content of the inquiry data. Content analysis serves as a tool to gain knowledge and new perspectives of a phenomenon (Krippendorff, 1980; Lincoln & Guba, 1985; Miles &

Huberman, 1994). It involves coding texts (interviews) into units. The constant comparison method involves categorically coding units or events, and constantly comparing these categories for similarities and dissimilarities. Constant comparison method serves as a pipeline for generating grounded theory which explains factors associated with individuals' decision-making toward preconception health behaviors. Memoing, a component of the analytical process in naturalistic inquiry, was performed for every 3 to 5 interviews. The memoing process involves write-ups formulating and conceptualizing emerging themes based on the categorical codes of the interview data (Patton, 1990). It also involves developing ideas on how to approach the write-up of the interview reports. Triangulation of qualitative data sources was applied to ensure credibility of findings acquired from data collected, and to verify consistency of findings produced with other published preconception health behaviors studies (Patton, 1990).

Results

Characteristics of the Interviewees

A diverse group of thirteen childbearing aged women (ages ranging from 20 to 32 years) were interviewed, including 5 African-Americans, 3 Caucasians, 2 Asians, and 3 Hispanics (Mexicans-Americans) (See table IV). The majority (69%) of the participants were college educated. Marital status was bimodal, with two categories represented at 46% each (married, and never-married single women). Fifteen percent had an annual income of less than \$15,000, and thirty-eight percent had annual income between \$15,000 and \$29,000. While all participants plan to have children within 5 years, 1/3 expressed their intention to conceive relatively soon (i.e., within the next 2 years).

Table IV: Sociodemographic Characteristics

Age		Intention to have a baby within...	
18-23	15.4	The next 12 months	7.7
24-29	69.2	The next 2 years	30.8
30-35	15.4	The next 5 years	53.8
Race/Ethnicity		Preconception Health Behaviors	
Caucasian/White	23.1	Smoking	7.7
Black/African American	38.5	Exercise	7.7
Hispanic/Latino	23.1	Binge Drinking	7.7
Asian	15.4	Alcohol consumption	7.7
Education		Contraceptive use/birth control	15.4
High School / Diploma/GED	23.1	Condom use	69.2
2-year College Degree	7.7	Folic acid intake	23.1
4-year College Degree	15.4	Daily fruit and vegetable consumption	69.2
Master's Degree	38.5	Health Problems	
Doctoral Degree	7.7	Underweight	7.7
Trade/Vocational Degree	7.7	Overweight	15.4
Marital Status		Bulimia	7.7
Single, never been married	46.2	Depression	7.7
Single, cohabitating	7.7	Bipolar	7.7
Married	46.2	Asthma	7.7
Religion		Endometriosis	7.7
Catholic	7.7	High cholesterol	7.7
Christianity	69.2	Sexual Transmitted Infections Screenings	
Lutheran	7.7	Yes	100
Agnostic	7.7	Sexual Transmitted Infections Diagnosis	
Buddha	7.7	No	100
Annual Income		Frequency of doctor visit per year	
Less than \$15,000	15.4	Once a year	38.5
\$15,000-\$29,999	38.5	Twice a year	23.1
\$30,000-\$44,999	15.4	As frequently as necessary	38.5
\$45,000-\$59,999	7.7	Frequency of dentist visit per year	
\$60,000+	23.1	None	30.8
Occupation		Once a year	7.7
Student	30.8	Twice a year	61.5
Management (business, sales/services mgmt)	15.4	Frequency of pap smear in the past year	
Professional	15.4	Once a year	100
Service (Food preparation, cashier)	7.7	Drugs Taken the past 6 months	
Sales (retail sale, representative sale)	23.1	Lexipro	7.7
Media	7.7	None	92.3
<i>Note: Zero responses are not included in this table. Frequency numbers are reported in %</i>			

Thematic Results

Identification and classification themes from the interviews were based on similar and dissimilar thematic characteristics. Dialogues on preconception care dominated with beliefs

that preconception care—the notion of preparing your body before pregnancy—was important. The major themes are described as follows:

Knowledge of and Meanings Associated with Preconception Care (PCC)

Participants were asked to describe (1) what preconception care means to them and (2) what preconception health consists of. The women associated preconception health and preconception care with physical checks-up, cessation of smoking, moderate drinking and being physically, emotionally, and mentally healthy. For example, “eating healthy” or “eating good” was operationalized as higher consumption of fruits and vegetables in lieu of the “fried stuff.”

While most interviewees described preconception health as being in a healthy state, and the minimization of risk factors, one interviewee included sexual behaviors in her description.

I think of condoms, birth control those would be the top two. And then I think about pregnancy, sexually-transmitted diseases. Those are the things that I think about when considering preconception health.

Hence, specific reference was made to the practice of responsible sexual behavior and avoidance of sexually transmitted infections as elements of preconception health. Participants were asked about their perceptions of testing for sexually transmitted infections (STIs) before conception. All concurred that testing for STIs is essential to avoid transmitting virus to the infants.

Related to Knowledge, another participant described preconception care as

...anything that you can do in preparation for getting pregnant rather than care that you do while you're pregnant...from eating more fruits and vegetables to exercising

regularly...taking folic acid, regularly...stop smoking before you ever get pregnant and cut the alcohol consumption to a minimal level.

Folic Acid Knowledge. Very few of the participants stated they had heard of folic acid through various sources (e.g. magazine, Today's show), but they were unaware of the reasons women should take folic acid. Only three among thirteen women were taking folic acid in lieu of multivitamins.

Preconception care subsumes a number of interventions to minimize risk factors influencing adverse pregnancy outcomes. These women's responses regarding preconception care demonstrated that their level of understanding varies and the sophistication of their responses is an indicator of how well/how little they understand. While one person viewed preconception health and preconception care as sexual health and/or family planning, most associated preconception care and preconception health with nutritional behavior intake and physical preparation (e.g. exercise).

Beliefs and Perceptions of Preconception Care

“Preparing your house” before entering pregnancy was an emergent concept, illustrating how women symbolize preconception care using nesting-related analogies to relate their beliefs regarding preconception care. For example the terms “cleaning your house,” or “preparing an apartment” before inviting or allowing someone to come over arose. The women believed it is important for childbearing-aged women to prepare their bodies along all dimensions (physically, mentally, and emotionally) before pregnancy. The comments below are illustrative of this concept:

Participant A on the importance of preconception care:

I feel that you should [do preconception care] because once you are pregnant you are going to have to take more care of yourself. Babies get sick when you get sick...they have to feed off whatever you're feeding off of.

Participant B using analogy to describe beliefs about preconception care:

That's a big change for your body to go through, carrying double the stress. It's so sensitive once it's in there. You just can't do the same things that you did. You have to prepare your body, just like you have visitors coming over. You have to prepare your house. You can't let them come in there and it be all messy.

Participant C usage of analogy:

...Your body's supposed to be your temple. It's supposed to be cleaned and cleansed. And if you want to bring somebody into the world, it's like an apartment. You don't want an apartment that's trashy and everything. You don't want to live there. You want something that's clean and ready to be moved into. Same thing with your baby you want your body to be clean and ready to hang out in for the next 9 months.

Other women were asked about their perceptions regarding the analogy used by previous interviewees, the notion of preparing your body before becoming pregnant. As noted by one participant:

Like they said, your body is your temple. And you should be able to take care of yourself before you can bring somebody else into this world to take care of them. That's why I think a lot of it comes down to your mental stability. Like emotional problems, depression or anger problems

Another woman reacts to this analogy by saying:

I see the analogy. I think that kind of makes sense. To me if I just relate it back to planning, just being prepared, I think you owe that to the life you're bringing in. Clean, I don't know if that's the best analogy, but emotionally, educationally, you need to be cleaned or prepared in all of those areas to bring a child into that house.

Starting Preconception Care

Since the importance of preconception care was shared among respondents, a question was posed regarding when women should start preconception care. Responses varied among interviewees. Twenty-three percent of the women believed preconception care should start one year prior to pregnancy, thirty-one percent stated 6 months, fifteen percent stated 2 years, and twenty-three percent stated that they believe women should start when they become sexually active, and 8 percent believed that preconception care should be lifelong.

Participant comment:

I think it's lifelong, actually. . . . I think that some of the factors that affect a healthy pregnancy, that affect a healthy baby, things like your weight and your smoking or your drinking status or your substance-use status, a lot of those things, you don't just wake up one morning and say, "Oh, I can reproduce now. Now I'll think about it." . . . you start before they're even capable of it. . . And if not lifelong, then as soon as you start thinking about having a baby you should try to get rid of some of those risk factors.

The majority (69%) of the women's beliefs about timing of preconception care are in agreement with national recommendations. However, despite the acknowledgement of

preconception care as important, some of the women believed that preconception care should start at least 6 months before conception, and one year might be too long to engage in preconception care. While six months still provide some opportunity to reduce risks (e.g. gestational diabetes) and prevent birth defects by taking folic acid and multivitamins, it lessens the chance of preventing other risk factors such as chronic diseases.

Perceived Factors (Facilitators and Hindrances) to Engage in Preconception Care

Deciding factor to engage in PCC. As previously noted, all of the women believed that PCC is important, and the majority indicates that women should start PCC at least 6 months to a year prior to conception. Yet, most stated they did not intend to engage in preconception health behavior until becoming pregnant. Conception is the main motivator to start preconception care. One participant stated *it (pregnancy) hasn't happened yet.*

Whenever I know something's going to be there, I know everything I eat and everything I intake is actually going to affect it. I'd pay more attention to it that way. Another participant provided a similar response regarding her plan to engage in preconception care:

. . . I will start preconception care when I know that I'm pregnant. I would immediately start. And also, I guess that's probably the biggest stimulus for me.

Age appears to be a decision-making motivator, as presented by one participant:

I'm 32 years old. I'll be 33 in 2 months. And while everybody says that your risk for Down's syndrome and certain conditions goes up at age 35, if you check, it actually starts going up around age 33, 34. So I'm already almost at that popularly known danger zone. I've certainly known women who've had healthy pregnancies, healthy babies, healthy outcomes, defect-free, who got pregnant at 35 or older. But that's no

guarantee for me...that's not to say I will have the same outcome. I thought it a good idea to just start planning.

While most interviewees reported pregnancy as the motivation to engage in preconception care (PCC), obtaining and achieving optimal health was also important:

. . . most of it is just being healthy for me, so that's the major motivation right now, just to make sure that I get healthy for myself, especially with the whole weight thing... I think that has a lot to do with pre-conception health, just making sure that I'm healthy, I'm eating right, and I have good habits. I guess if I were really just actively trying to work on getting ready to have a baby, I'd stop drinking. I don't drink a lot. But I'd have to stop drinking altogether. Taking that folic acid and things like that, but like I said, unless we sat down and set a definite date, I don't think there would be much to just push me over the edge and make me say, "OK, you need to start thinking about preconception health."

This participant is focused on overall health, but not on preventive measures from a preconceptional perspective. Other factors associated in decisions related to actively seeking/engaging in preconception care include “decision to have a baby” or “make up my mind,” complete advance degree (bachelor’s and master’s), the desire to have a healthy child, and family history. Family history is a stimulus for those who are contemplating preconception care. Most were aware of their family medical history, particularly their family reproductive history.

Perception of preconception care vs. prenatal care. To clarify participants’ ability to discern between preconception care and prenatal care (PNC), women were asked to discuss

the difference between PCC and PNC. Below are two examples of how women differentiate PCC vs. PNC:

I guess maybe preconception health would be when you're sexually active but not planning to have a baby. But prenatal would be when you're looking to get pregnant, so at that time you're taking the prenatal vitamins and adding to what you've already done in the prior years. Increasing the prenatal vitamins and all that....

Another one said:

You have more room to mess up when you're in preconception, whereas when you're pregnant, you can't. You can have a beer when you're not pregnant. You can't have a beer when you're pregnant. There is a difference, I guess. But you want to be healthy before you get pregnant so the pregnancy is easier and you can continue to work out and do all those things while you're pregnant.

Women's understanding of PCC may be influenced by traditional beliefs of entering prenatal care once become pregnant. Their understanding may also be shaped by social norms of entering prenatal care to have a healthy child.

Perceived Barriers to preconception Care. A number of potential factors could hinder women's decisions to enter preconception care. Self-described laziness, hectic schedule, and time constraints are the most common barriers to preconception care. One woman stated:

Just laziness - laziness and not realizing that the primary goal is to be a healthier me and realizing that a baby has to pass through me and trying to have a healthy baby.

Time and hectic schedules were also expressed as barriers by the participants.

My biggest hindrance is energy level. I'm just kind of tired all the time. That extra weight makes me not want to do anything. But obviously getting my weight down is a

big priority. I don't see that a lot would kind of hinder me from wanting to do things to take care of myself... Really the biggest thing for pre-conception care would be things like folic acid and things like that. Like I said, I don't really see the point in taking it until I'm ready to get pregnant.

Laziness is the main perceived barrier stated by the women. Financial difficulty was not perceived as a deterrent for the women. Some women felt that daily stressors (e.g., jobs, school) prevented them from focusing on preconception health behaviors. Others just never thought about PCC.

Perceived sense of urgency. The women were asked about their sense of readiness or urgency to start preconception care. One woman responded:

That there was not necessarily a sense of urgency, but I am starting to — I know I need to get healthy, so that is a big part of it. But it's [PCC] not any big priority for me right now because I have just so many things going on to have a child. If we accidentally got pregnant, since we are just using condoms... That would be immediate. I'd be like, "OK, now I need to make sure I'm healthy while I'm pregnant." Of course it wouldn't be an easy switch just like that. But really, mostly I'm going to start really thinking about the whole preconception health in about two years.

It is obvious that the sense of urgency to start preconception care is related to conception. If women were to become pregnant, then the pregnancy would spur them to engage in “preconception health” or seek “preconception care,” which will most likely be prenatal care and not preconception care. Another reason stated by the women is that they were not sexually active or involved in an intimate relationship. Therefore, they perceived themselves

at low risk of becoming pregnant. These responses clearly demonstrate that there is a shared perception among the women that preconception care is associated with becoming pregnant. Until pregnancy, there is not a perceived sense of urgency to start or seek preconception care.

Influence of religiosity/spirituality on seeking preconception care. To some degree, religiosity or faith in God influences women's decision not to practice preconception health behaviors. One of the women illustrates the influence of her religious affiliation as this:

I'm a Lutheran. I was baptized Lutheran. I don't go to church though. . . . But it's kind of a tough question because on one hand, cleanliness is next to Godliness, in all senses. But on the other hand, I smoke and I drink. I'm hoping, from faith, that the Lord will say, "I forgive you," and let me into Heaven or give me a good child or something.

From her repeated statements during the interview, it appears this participant is "clinging to hope" to have a healthy child. However, while religiosity or spirituality may seem to influence some of the women's perception, the majority of the women did not view spirituality as a stimulus to focus on preconception care. One woman viewed religion as a part of "background growing up", but not a big factor in seeking preconception care.

Most of the women perceived that they have control over the birth outcome. As one of the women stated:

I know that I have a lot of control over it [birth outcome]. We're not smokers. That's a good thing. I know that drinking, lack of exercise, lots of stress, not eating the right foods and taking the right vitamins can all affect the baby's health and development. That's something I know I can control. As long as I'm taking care of those things, the rest is up to God, really.

Discussion

This study explored knowledge, beliefs, perceptions about PCC, and perceived facilitators and barriers to preconception health behaviors among childbearing aged women. Figure 2 displays a summary of the main findings of the data. Findings revealed that the majority of participants were somewhat knowledgeable about PCC, and they associated it with physical and nutritional behavior. Whereas knowledge does influence the women's beliefs and perceptions about the importance of preconception care and when to begin preconception care, possession of this knowledge does not lead to engaging in preconception health behaviors. Misperceptions still exist about the timing and importance of PCC; however, most of the participants were aware of the need to begin early and most expressed understanding of the importance of preconception health behaviors.

The literature suggests that women of all ages should start PCC at preadolescence and not end until one is perimenopausal (Reynolds, 1998). The younger age of initial sexual activity renders women more vulnerable to conception at a younger age (U.S. Public Health Service, 1989). Moreover, pregnancy in the United States is often unplanned, minimizing the chance of identifying risk factors that could potentially impact birth outcomes. The U.S. Public Health Service recommended in 1989 that couples have a risk assessment performed to identify medical and reproductive factors (including genetic risk factors) within one year of planning pregnancy (U.S. Public Health Service, 1989), thus minimizing risk factors influencing adverse birth outcomes. Presently, researchers and public health professionals are calling for women's general wellness services to consolidate all spectra of women's health, both reproductive and non-reproductive health, into a "continuum of care" throughout women's life course (Reynolds, 1998). The preconception visit limited to one year

preconceptionally is not a sufficient health promotion strategy and disease preventive measure to optimize women's health before conception.

Despite the expressed beliefs that preconception care should start at onset of sexual activity or at least a year before conception, the timing horizon for these women to start PCC is upon conception. Women's intention to become pregnant did not motivate them to engage in healthier behaviors—even though they recognized that these behaviors could affect pregnancy outcomes. Rather, the actual event of conception, or the knowledge that they were pregnant was the deciding factor to *begin* healthy behaviors. These findings suggest that pregnancy, rather than intended pregnancy, drive women to engage in preconception care. This is a major concern given that almost half of pregnancy in the United States is unplanned (Finer & Henshaw, 2006) and such time horizon (at the pregnancy stage) is not sufficient time for the women to clean up their act. Such evidence illustrates the importance of promoting awareness of preconception health through various channels (e.g. media, family and social networks). There is a need to emphasize the urgency to act on preconception care for both pre-contemplators and contemplators of preconception care.

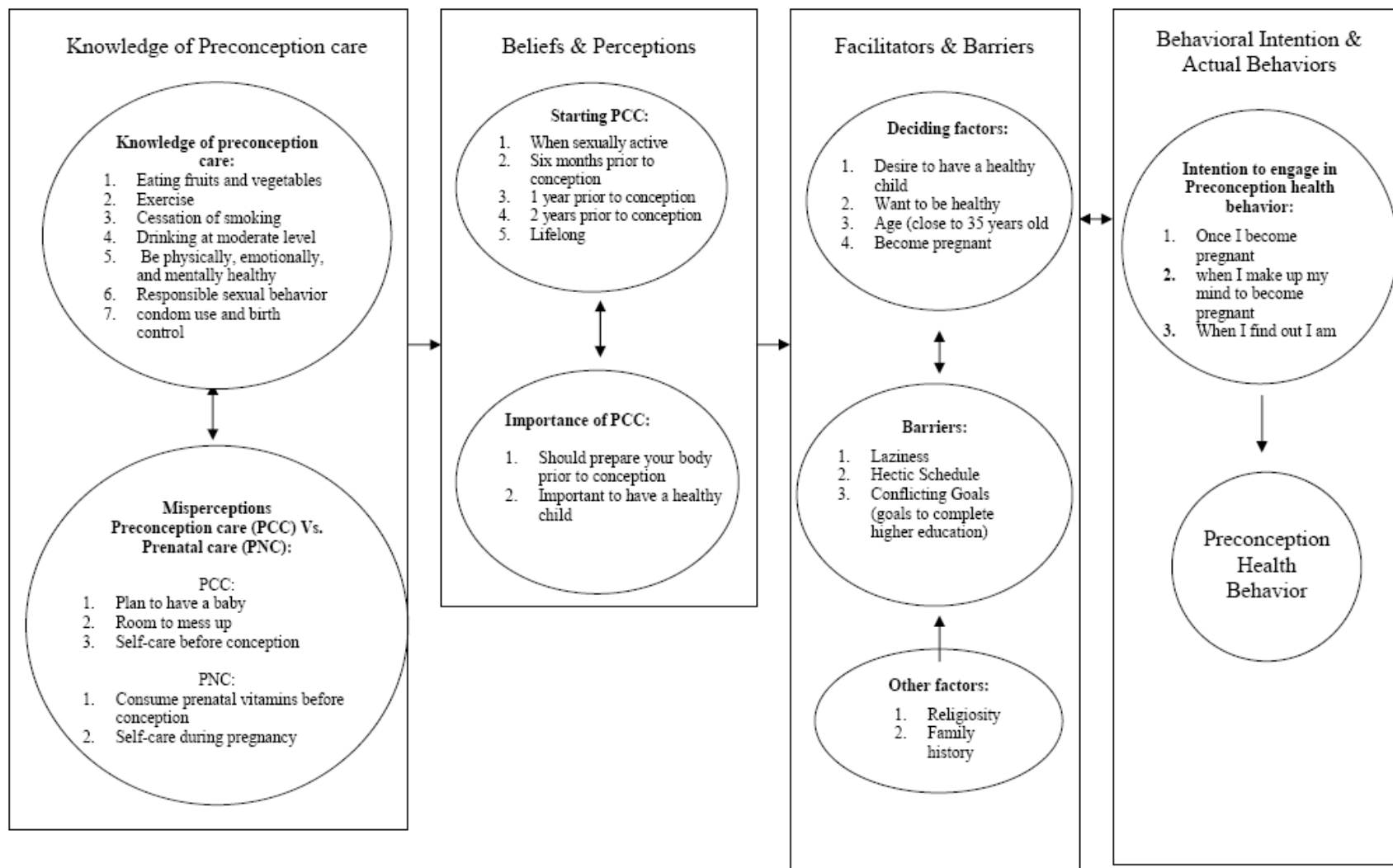


Figure 2. Main Findings of Data

Women's intention to practice preconception health behaviors during the conception period may also be influenced by several factors: 1) misunderstanding about the difference between preconception and prenatal care, 2) perception that the prenatal time period is the critical period influencing health outcomes for mother and child, and 3) social norms of prenatal care. Findings of this study clearly demonstrate that there is a misperception between prenatal care and preconception care. Prenatal care has been the traditional prevention paradigm, and is heavily influenced by the social norms of taking prenatal vitamins and initiating doctor visit at conception. These findings may explain why certain interventions (e.g., folic acid) are not sustained; women did not perceive an urgent need to begin practicing preconception health behaviors.

Triangulation of data sources was applied to cross-check findings from this study with other published findings. Some of the current results regarding how women defined PCC and their preconception health behaviors are supported by the literature. For example, other findings confirm that changing behavioral lifestyle (e.g., smoking cessation, binge drinking, exercising, and eating a healthy diet) as an element of preconception care (CDC, 2006). Pregnancy intention was not related to behavioral changes (Hellerstedt et al., 1998).

Participants in this study believed they have control over birth outcomes, similar to other investigations on locus of control among non-pregnant women (Weisman et al., 2008). Our findings also revealed while some women plan to conceive as early as next year, and some are already trying to conceive, they had not modified their behaviors accordingly and in spite of the awareness to make behavioral changes. These findings are consistent with other outcomes—preconceptional women who were not planning to conceive for over a year tend to engage in unhealthy behaviors (e.g. smoking, binge drinking) and disengage in

preconception health behaviors (consumption of folic acid, vegetables) (Green-Raleigh et al., 2005).

The strength of this study is that it provides insight into various perception and decision-making factors regarding preconception care among nulliparous women. Use of qualitative methods enables researchers and health professionals to gain a different perspective not normally acquired through traditional experimental methods and measurements. Implications are that public health professionals with future research and interventions must increase awareness of preconception care and risk factors associated with adverse birth outcomes among women who are most likely to be affected.

Despite the strengths of this study, there are some limitations. The study focused on women ages 18-35. Given that older women have different sets of issues (e.g., chronic diseases, fertility issues), the readiness and urgency to act on preconception care may be more appealing to them than to younger groups. Therefore, the findings may not apply among older nulliparous women. In addition, a small sample size was used. In naturalistic inquiry, there are no set standards for sample size (Holsti, 1969; Krippendorff, 1980; Lincoln & Guba, 1985). The required sample size depends on the nature of the data and the types of questions being investigated (Holsti, 1969; Krippendorff, 1980; Lincoln & Guba, 1985). Increasing sample size does not necessarily provide significant and critical information once data saturation is reached. Contrary to quantitative research where sample size influences generalizability of findings, it is not an issue for qualitative research (Patton, 1990). Naturalistic inquiry is idiographic, not nomothetic, which describes the social context of a phenomenon and/or the reality of individuals--how they view and express a phenomenon (Patton, 1990). Another potential limitation is that over half of the participants were college

educated, which does not represent the U.S. population of childbearing age women as a whole. However, college education did not increase women's knowledge about preconception care, nor influence their intention to engage in preconception care before conception.

This study identified a need for health educators and other health professionals to promote awareness about preconception health, inform childbearing aged women about the availability of preconception care services, and address the consequence of not practicing preconception health behaviors. Furthermore, health educators need to emphasize the distinction between preconception care and prenatal care, and to clearly describe the perceived severity and urgency to engage in preconception care. Culturally-sensitive messages targeting preconceptional women should be designed to focus on the importance of self-care and optimizing health prior to pregnancy. Furthermore, messages, health promotions, and health interventions should be tailored to meet the needs of preconceptional women of different ages, culture, race/ethnicity, and socioeconomic status.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Introduction and Problem Restatement

Preconception care has been at the forefront of public health agenda to reduce infant mortality and other adverse birth outcomes. Research shows that women who employ preconception care are at lower risk of poor pregnancy outcomes than women who do not. While a number of empirical clinical-based studies investigated preconception care, little is known about women's understanding of preconception health and their intention to practice preconception health behaviors. The purpose of this study was to explore nulliparous women's knowledge, beliefs, perceptions about preconception health, their intentions to practice preconception health behaviors, and decision-making factors related to preconception health behaviors. These objectives were accomplished in two-ways: 1) A systematic literature review was performed to identify factors investigated in preconception health behavior studies, and the measures used to examine these factors; and 2) the use of a naturalistic inquiry approach was performed to assess women's knowledge and perspectives associated with preconception health and preconception care.

Summary of Manuscript 1: Systematic Literature Review

The systematic review (Manuscript 1, chapter 2) sought to answer two research questions: 1) What are the factors associated with preconception health status and health behaviors? and 2) What are the major findings of these studies? Characteristics of the reviewed studies were extracted using a coding sheet references in the manuscript (see Appendix A for coding sheet guidelines). Factors identified from the systematic review were classified into six major categories: Frequency of alcohol consumption prior and during

pregnancy, glycemic control / diabetes management, nutrient intake such as folic acid and vitamins consumption, physical activity before and during pregnancy, pregnancy planning behavior, and a miscellaneous category of other risk factors (e.g. HIV prevention practices, chronic conditions). This systematic review demonstrated that limited preconception health behavior risk factors have been investigated. The majority of these studies focused on awareness, knowledge, intention, and consumption of folic acid. Additionally, several methodological issues were raised in the review, and are detailed in a latter section of this chapter (Methodological and Conceptual Concerns).

In summary, the results of the systematic literature review clarified the gaps in the knowledge base regarding research on preconception health behaviors. It also helped to define the direction of the next step necessary to address the problem.

Summary of Manuscript 2: Qualitative Study of Preconception Health Factors

Results of the systematic review prompted an exploratory study (Manuscript 2, chapter 3) to investigate how women's perception and beliefs of preconception health influence their preconception health behaviors. This exploratory study sought to answer two research questions: 1) What are childbearing age women's knowledge, beliefs, and perception of preconception health and preconception care? and 2) What are the perceived factors (facilitators and hindrances) associated with women's intentions and decisions to engage in preconception health behaviors? A multiethnic group of thirteen women were interviewed to discuss their view regarding preconception care issues.

The outcome of this phase of the study revealed that while most participants had substantial knowledge of preconception health and believed preconception care is important, their knowledge and beliefs appeared not to be a strong predictor of engaging in

preconception health behaviors. Most stated that pregnancy was the facilitator for seeking preconception care. These findings – specifically those pointing to pregnancy as the motivator (i.e., the cue to action) to engage in preconception care - is a major concern given that nearly half of pregnancies in the United States are unplanned (Finer and Henshaw, 2006).

Planning to start preconception care *during* pregnancy provides insufficient time to reduce adverse birth outcomes. Participants acknowledged access to enabling resources for preconception health practices. Yet they still failed to enact the behaviors. Interestingly, formal education level did not play a big role in women's knowledge of preconception care and their intention to start preconception care. Therefore, the reasons women fail to act are still unclear, and certainly warrant further investigation to clarify the tipping point between decisional balance and action.

For most participants, family and friends were not major factors influencing their decisions to engage in PCC. However, this may be mediated by the types of behaviors (e.g., health harming versus health promoting) and how it affects perceived risk. For example, one participant noted that her friends and a sister-in-law smoked and drank before and during pregnancy, yet still bore healthy babies. This experience shaped her beliefs about not being rushed to employ preconception health. The health literature is rife with examples of how negative modeling of health behaviors is adopted more quickly and is more difficult to change than positive models of health behaviors. These findings point to the need to better understand the mechanism of behavior influence and change, and to tailor the research specific to health behaviors such as preconception care.

There were no notable differences among racial and ethnic groups in their perceptions and intention to engage in preconception health behaviors, albeit the sample size does not allow for definitive conclusions. Nevertheless, there were some interesting trends to note. Hispanic participants mentioned that pregnancy planning behavior is not something performed within their culture. Their reported beliefs are that most pregnancies are unintended, but not necessarily unwanted. Upon pregnancy recognition/diagnosis, the expectant mother is then encouraged by kin to seek prenatal care. Therefore, discussions of “preconception health,” (e.g., taking prenatal vitamins and/or seeking health care) occurred *after* pregnancy is known. The discussion of sexual health was virtually none existent in the Hispanic culture, according to respondents.

While few major ethnic/cultural differences were found, this outcome should be interpreted with caution. First, the sample was not collected with racial/ethnic and/or cultural representation in mind, and indeed is too small to derive any firm conclusions in this area. Nevertheless, interesting outcomes were noted, such as the avoidance of discussion of sexuality among Hispanics. This indicates the need for further study to help identify culturally appropriate means to deal with an important health topic such as preconception health.

Methodological & Conceptual Concerns

One important finding related to the overall aims of the study pertains to methodological concerns. The systematic review of the literature revealed biases toward quasi-experimental designs utilizing quantitative measures, and data collection protocols focusing on the perspective of expectant mothers or women who have already given birth. In other words, journals tended to publish studies representing clinical and healthcare

practitioner-focused orientations. One approach to dealing with this concern is to include and promote the use of qualitative research methods. Another is to expand the participant base to include preconceptional women, regardless of intentional status to conceive. In other words, promote preconception health care as the standard for general women's health care. Women of childbearing age are most directly impacted by the issue because of the high rates of unplanned pregnancies. Indeed, efforts should be made to increase their understanding and the sense of urgency to employ preconception health practices throughout their life reproductive cycle.

Other concerns related to the conceptual limitations of these studies. As seen in table 4 of Chapter II, few studies identified their theoretical underpinnings. Some used constructs from theories, but failed to explicitly describe which theories. Others did not provide explicit information concerning the theoretical basis of their studies or the use of the theoretical constructs.

While it is appropriate in some qualitative study designs to suspend the use of a particular theory, none of the reviewed studies were qualitative, and therefore should have some theoretical underpinnings to help explain relationships. Application of theory in reproductive and preconception health research in the quantitative paradigm provides empirical support and ease of interpretation of findings to understand the multiple constructs influencing preconception health behaviors (Fisher, 1998). It also provides a glimpse of how overall study and instruments of measured variables were constructed. Hence, the lack of theory utilization was found to be a problem among the reviewed articles.

Several published studies reviewed used retrospective designs. Criticism of the use of retrospective study designs are that such approaches are subjected to self-report and recall

biases—both of which raise concern about the validity of findings as well as the generalizability of results. Finally, the review revealed that the majority of these studies did not report about the reliability of the instruments used. This poses problems for many reasons, including casting doubt on the validity of the findings when little is known about the instrument, as well as creating problems for future replicable investigations. In this case, the lack of psychometric information limits the ability to evaluate the instruments for use in replication studies.

Application of Theory

As stated previously, the lack of explicit theory utilization was a problem found among the quantitative studies. However, lack of theory is not necessarily a problem for qualitative investigations because theory is generated or grounded based on data findings. Nonetheless, grounded theory can not be forced if there is not sufficient information to create grounded theory. For the current study, grounded theory was not developed due to insufficient data.

One means of assessing appropriateness of theories and frameworks is to examine data fit to theoretical constructs. Constructs of existed health behavior theories can be applied to explain/clarify factors influencing women's readiness to preconception health behaviors.

Although most of the health behavior theories do not fit with the findings of this data, constructs of theoretical frameworks were used to explain these women's intention to employ preconception care, their current stage of change, and to discuss implications for health educators. Specific to the current study, several comparisons were made. Attitudes, social norms, and perceived behavioral control are constructs of the Theory of Planned Behavior (TPB) utilized to illustrate how attitudes and social normative perceptions influence intention

to engage in preconception health behaviors. Knowledge of preconception care does not lead to intention to engage in preconception care or to actual performance of the behavior.

Despite participants' knowledge about preconception health, knowledge alone was not associated with performance and execution of preconception health behaviors. Social norms of prenatal care as the standard prevention paradigm are influenced by these women's knowledge and beliefs of preconception health behaviors. Although the women did not plan to employ preconception health practices until conception, they perceived that they have control over birth outcomes. Their perceptions of having control over their behaviors are shaped by knowledge and beliefs in that adapting healthy behavior will increase the likelihood of having favorable birth outcomes. The participants did not perceive themselves susceptible to adverse birth outcomes.

One explanation for the lack of association between knowledge and behavior performance is concept confusion. In other words, women might view preconception care and prenatal care as a single concept, and therefore do not perceive a sense of urgency to engage in preconception care immediately. This explanation is supported by the findings associating pregnancy with the cue to action.

Some components of preconception health and prenatal care do overlap. For example, certain behaviors (e.g., exercise, consumption of folic acid, and prenatal vitamins) are appropriate for both preconception and prenatal periods. Furthermore, many general women's health services are equivalent or similar to preconception care services. Therefore, women may believe there is no need to explicitly practice preconception health care, given the overlap.

The precontemplation and contemplation phases are two constructs of the Transtheoretical model (TTM) that can be used to explain women's stages of readiness to start preconception health behaviors. TTM emphasizes that change in health behaviors occurs over time, and individuals move through different stages of change (precontemplation, contemplation, preparation, action, and maintenance) to adapt to healthy behaviors (Prochaska & Diclemente, 1983). Constructs of the Precaution Adoption Process Model (PAPM) can also be utilized to investigate women's current stages of change to employ preconception health practices. Findings of this study reveal that some participants were at precontemplation phase, with no intention to perform anything related to preconception health. Other participants were at the contemplation phase, indicating their intentions to make a firm decision about preconception care after they make a positive decision about pregnancy.

Promotion of Preconception Care

Preconception care can be promoted in several ways: 1) television, magazines, the internet; 2) family and social networks; and 3) health care providers. Participants expressed interest in having information about preconception care disseminated through the media. Media sources may serve as an indicator of importance. Participants reported that information about preconception care coming through news sound bites would be perceived as important.

Social norms are also an important indicator of women's view of self-care before and during conception. Traditionally, prenatal care has been mainstreamed as the main intervention point to deliver a healthy child and reduce adverse birth outcomes. This may explain why women are unaware of preconception care. Differences between prenatal care

and preconception care must be emphasized, and the role of each concept in having a healthy baby. Therefore, modification of social norms is one potential approach to promote awareness about the importance of preconception care. For example, a “Telling-A-Friend” campaign to project preconception messages within friends and family could help promote awareness of preconception health at a faster pace. It is also important to encourage family to engage in dialogue regarding preconception health behaviors, including health care providers discussing preconception care to their patients.

Recommendations / Future Directions in Applied Settings

Health promoters and health educators need to introduce a sense of urgency to engage in preconception care. During information process, data on factors causing adverse birth outcomes and the rate of adverse birth outcomes should be made available specific to age, culture, and religiosity. Also, barriers identified by these participants (e.g., laziness, stress, and hectic schedule) should be addressed to assist with finding alternative options to overcome obstacles that are hindering their decision to engage in preconception care.

There is a need for educational and communication campaigns to increase women’s knowledge and their perceptions about the importance of preconception care. Campaigns should use perceived severity and perceived susceptibility as motivational elements of health messages (e.g., highlighting the extent of having gestational diabetes mellitus or neural tube defects as consequence of not employing preconception health). Some participants noted that information about preconception health from the media (e.g., internet, news sound bites) would be perceived as important and would spur them to start preconception care. Thus, mass media can be an informative tool to help facilitate knowledge and awareness of preconception health behaviors.

For future research, efforts should be made to design comprehensive intervention studies that address the array of preconception health care, including treatment, counseling, and health education specific to preconception health practices. Currently, interventions on preconception health behaviors mainly promote awareness of folic acid and consumption of folic acid, but not the spectrum of preconception health factors. Intervention studies should target both health care providers and reproductive age women. Furthermore, more qualitative studies are needed to obtain richer data not only from the perspectives of the women but from the healthcare providers.

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APPENDIX A

CODING SHEET GUIDELINES

This coding sheet provides a summary of how data were extracted and entered in an excel matrix file.

Author, Year of pub, Name of Study/Source of Data used, Location, Design: This section includes name of investigators, target population characteristics of the study, location and time period of data collection, and study design. NOTE: Study designs were determined (based on description of studies) for articles that failed to report study design. Information on population characteristics, location, and time period of data collection will provide researchers with future directions on what populations have been studied and the time frame used.

Author: _____

Year of Pub: _____

Population/Data Source/Name of Study: _____

Types of studies/Study design: _____

Purpose: To describe the aim or objective of each the reviewed studies

Theoretical framework: This section includes type of health behavior theory or constructs measured were investigated.

Theory/constructs: _____

PCC: To describe how preconception health/care is conceptualized and operationalized within each reviewed study. Information on definition helps to determine whether PCC has been defined /conceptualized consistently throughout preconception health behavioral studies, and whether there is a need to have a standardized definition of PCC.

Definition of PCC: _____

Instrument: This section sought to understand the type of measures used to investigate factors of preconception health behaviors. Report of reliability instruments is also included in this section.

Name of Instrument (s): _____

Reliability of Instrument (s) _____

Risk Factors/Behaviors being investigated:

- Awareness/Knowledge of PCC:
- Attitudes/Perception:
- Intention:
- Folic acid intake:
- Multivitamin use:
- Consumption of certain fish:
- Physical activity (e.g., Exercise):
- Smoking (i.e., primary, secondary)
- Alcohol consumption/Binge drinking
- Glycemic control/ Diabetes management:
- Mental health (e.g., Depression, Stress management):
- Gynecological care (e.g., pap smear, STI screenings):
- Contraceptive practice (e.g., condom use)
- Pregnancy planning/outcome (pregnancy prevention, unintended pregnancy)
- Oral health:
- Adherence to phenylalanine diet:
- Medication use (prescription, nonprescription):
- Illicit drug use/substance use:
- Tobacco use:
- Immunization (e.g, rubella and others):
- Infectious disease screening:
- Family history/genetic history/genetic carrier screening:
- Healthcare use:

Intervention Studies: Include information on type of interventions and how interventions were conducted.

Type of interventions:

- Television:
- Radio:
- Newspaper:
- Posters :
- Brochures:
- Newspaper:

Data Analysis: Type of statistical analysis performed is reported

The aim is to understand the rigor of statistical analysis performed in preconception health behavior studies.

Data Analysis: _____

Findings: Major findings/outcomes of the investigated preconception health behaviors factors are extracted. Collection of findings on preconception health behaviors enable us to identify what the already known and the unknown factors on preconception health behaviors are.

Limitations: Report the investigators' comments or perceived limitations of their study.

APPENDIX B

IRB Approval**TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE**

1186 TAMU
College Station, TX 77843-1186
1500 Research Parkway, Suite B-150

979.458.1467
FAX 979.862.3176
<http://researchcompliance.tamu.edu>

Institutional Biosafety
Committee

Institutional Animal Care and Use
Committee

Institutional Review Board

DATE: 15-Feb-2008

MEMORANDUM

TO: DELISSAINT, DIEULA
77843-3578

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Initial Review

**Protocol
Number:** 2008-0080

Title: Exploring the Factors Associated with Preconception Health Behaviors Among
Women of Childbearing Age: A Naturalistic Inquiry

Review Category: Expedited

Approval Period: 15-Feb-2008 To 14-Feb-2009

Approval determination was based on the following Code of Federal Regulations:

45 CFR 46.110(b) (1) - Some or all of the research appearing on the list and found by the reviewer(s) to involve no more than minimal risk.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation or quality assurance methodologies.

(Note: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b) (2) and (b) (3). This listing refers only to research that is not exempt.)

Provisions:

This research project has been approved for one (1) year. As principal investigator, you assume the following responsibilities

1. **Continuing Review:** The protocol must be renewed each year in order to continue with the research project. A Continuing Review along with required documents must be submitted 30 days before the end of the approval period. Failure to do so may result in processing delays and/or non-renewal.
2. **Completion Report:** Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the IRB Office.
3. **Adverse Events:** Adverse events must be reported to the IRB Office immediately.
4. **Amendments:** Changes to the protocol must be requested by submitting an Amendment to the IRB Office for review. The Amendment must be approved by the IRB before being implemented.
5. **Informed Consent:** Information must be presented to enable persons to voluntarily decide whether or not to participate in the research project.

This electronic document provides notification of the review results by the Institutional Review Board.

***Are you a woman between 18-35 years old
who has never given birth before?***

***Are you planning to get pregnant
within the next five years?***

If so, you are invited to join a research study to examine health behaviors that women engage in before pregnancy.

If you:

- ▶ Are a woman living in the Bryan/College Station area
- ▶ Are between 18 and 35 years of age
- ▶ Do not have any children, but do intend to conceive within the next 5 years.

We would like to hear your feelings, beliefs and knowledge about what a woman should do for her health before pregnancy.

**Each
participant
will receive a
\$25 gift for
participating**

**All information
will be kept
strictly
Confidential**

For more information or to sign up contact:

(979) 845-3290

RECRUITING SCRIPT

Hi, my name is Dieula Delissaint. I am a student at Texas A&M University, and I am conducting a study to understand women's knowledge and beliefs of preconception health. Preconception health involves the steps that a woman takes to take care of herself before she becomes pregnant.

The only thing you will need to do in the study is talk to me for about 1 to 2 hours about your own views of preconception health. There will be no cost to you except for a few hours of your time and study participants will receive a \$25 Wal-Mart gift card or \$25 Target gift card at the end of the interview.

Are you interested?

If no -

Thank you for your time and have a nice day.

If yes:

Great, in order to conduct this study, I need to talk to women who fit a certain description. Can I ask you a few questions to determine your eligibility for this study?

Screening Questions:

Are you between ages 18 and 35?

Yes or NO

Do you have intentions of (or are you planning to) get pregnant within the next 5 years?

Yes or NO

How many times have you given birth? (If answer ≥ 1 , then disqualified)

Have you had a hysterectomy and/or tubal ligation?

Yes or NO

Are you aware of any personal fertility issues that may influence your reproductive outcomes? Yes or NO

If yes, what are they? _____

INFORMED CONSENT FORM

Purpose:

I have been asked to participate in an interview, as part of an exploratory study on preconception health/care. This study is under the direction of Ms. Dieula Delissaint, a graduate student at Texas A&M University, Department of Health and Kinesiology. This interview seeks to assess your knowledge, perception, and how perceived factors (facilitators and hindering) influence preconception health behaviors among childbearing age women.

Eligibility:

I am being considered as a participant of this study because I am English-speaking, ages between 18-35 years old, have not had a child, have not had hysterectomy or tubal ligation.

My rights as a participant:

I understand that if I agree to participate in the study, my participation is entirely voluntary, and that I am free to stop participating in the study at any time without penalty of any kind. I am also entitled to refuse to respond to any questions that make me feel uncomfortable. Participation in this study will not affect my current or future relationship with Texas A&M University.

Protocols/procedures on data:

I will be asked to speak openly about my perception on preconception health/care. My response to the interview questions will be kept confidential. I will NOT be identified in any sort of published report. To protect my identity, a matched ID will be employed on all study records (i.e. consent form). All records will be securely stored and only Ms. Dieula Delissaint will have access to these records (including audiotapes).

The data will be gathered through face-to-face interviews. Each interview session will last approximately 1 to 2 hrs. An audiotape will be used solely to collect information. The interviewer will also be taken hand notes. The purpose of the audiotape is to assist the interviewer with any gap in her handwritten notes during the interview process. I am free to request not to record my interview.

Potential risks:

The risk to the study is very minimal. Potential risk could be my discomfort of discussing a particular issue or my disclosure about an issue.

Benefits:

There is no benefit for my participation to the study, other than exposing to the concept of preconception care. A \$25 gift card will be provided as incentives for my participation in the study.

Other relevant information:

This study has been reviewed and approved by the Institutional Review Board at Texas A&M University. If you have any questions, please do not hesitate to contact me. I can be contacted either by phone, 979-845-3290 (office), (254) 644-4182 (cell) and/or email, didelissaint@hlkn.tamu.edu.

I understand that by signing below, I give informed consent to the principal investigator to proceed with this study. I have read and understand this consent form.

I, _____, hereby consent to the conditions described above.

Signature

Date

DEMOGRAPHIC INFORMATION

1. What is your age?
 - A. _____years

2. What is your marital status?
 - A. Single, never been married
 - B. Single, cohabitating
 - C. Married
 - D. Divorce
 - E. Separated
 - F. Widowed
 - G. Other (Please specify) _____

3. Please indicate your race / ethnicity (circle all that apply)
 - A. Caucasian / White
 - B. Black / African American
 - C. Hispanic / Latino
 - D. Asian
 - E. Native American / Alaska Natives
 - F. Native Hawaiian and other Pacific Islanders
 - G. Other (Please specify) _____

4. Please indicate your religious affiliation
 - A. Catholic
 - B. Christianity
 - C. Judaism
 - D. Muslim
 - E. Other (please specify) _____

5. What is the highest grade of school or year of college have you completed?
 - A. Less than High School
 - B. High School/ Diploma/GED
 - C. Some College
 - D. 2-year College Degree (Associates)
 - E. 4-year College Degree (B.A., B.S.)
 - F. Master's Degree
 - G. Doctoral Degree
 - H. Professional Degree (MD., JD.)
 - I. Trade / Vocational Degree
 - J. Other (please specify) _____

6. Which of the following best describes your annual income?
- A. No income
 - B. Less than \$15,000
 - C. \$15,000 to \$29,999
 - D. \$30,000 to \$44,999
 - E. \$45,000 to \$59,999
 - F. \$60,000+
7. What is your current occupation?
- A. Student
 - B. Homemaker
 - C. Management (business, financial operations, and sales/service management)
 - D. Professional (architectural, computer & mathematical, engineering, life sciences, social & behavioral sciences, legal occupations, education, health diagnostics and treatment)
 - E. Service (healthcare support, protective service, food preparation, maintenance, personal care).
 - F. Sales (retail sales, representatives, travel agents)
 - G. Administrative (financial clerks, information/records clerks, office administrative support).
 - H. Farming (agricultural workers, fishers, forest/logging and conservation workers)
 - I. Construction Trades (carpenters, drywall installers, sheet metal workers)
 - J. Installation (electrical/electronic installer & repairs, vehicle mechanics, appliance installation & repairs).
 - K. Production (assemblers/fabricators, food processing, printing, plant & system operators)
 - L. Transportation (motor vehicle operators, rail & water transportation)
 - M. Military/Armed Forces
 - N. Unemployed
 - O. Other (please specify) _____

Preconception Health Behaviors

8. Do you intend (plan) to have a baby within...?
- A. The next 6 months
 - B. The next 12 months
 - C. The next 2 years
 - D. The next 5 years
9. Do you currently perform any of the followings? (circle all that apply)
- A. Smoke
 - B. Exercise
 - C. Binge drink
 - D. Street (illicit) Drug use
 - E. Contraceptive use / Birth control

- F. Condom use
- G. Folic acid intake
- H. Daily fruit and vegetable consumption
- I. Other (please specify) _____

10. Do you have any of the following health problems? (circle all that apply)

- A. Weight Problem
 - i. Underweight
 - ii. Overweight
- B. Eating disorders
 - i. Anorexia
 - ii. Bulimia
- C. Heart disease
- D. Diabetes
- E. High blood pressure
- F. High cholesterol
- G. None of the above
- H. Other (please specify) _____

11. Have you ever been diagnosed with any of the following sexually transmitted infections? (circle all that apply)

- A. Chlamydia
- B. Genital Herpes
- C. Gonorrhea
- D. Hepatitis
- E. HIV/AIDS
- F. HPV (Human Papillomavirus)
- G. Syphilis
- H. None of the above
- I. Other (please specify) _____

12. How many times have you gone last year to visit a physician?

- A. Once a year
- B. Twice a year
- C. Once a month
- D. As frequently as necessary

13. How many times have you gone last year to see a dentist?

- A. 0
- B. 1
- C. 2
- D. 3+

14. How many Pap smear have you had in last year?

- A. 0
- B. 1

- C. 2
- D. 3+

15. Have you taken any of the following drugs within the last 6 months? (circle all that apply)

- A. Cocaine
- B. Accutane
- C. Captopril
- D. Lithium
- E. Corticosteroids
- F. Phenobarbitol
- G. Thalidomide
- H. Valproic acid
- I. None of the above
- J. Other (please specify) _____

INTERVIEW QUESTIONS

Belief/Perception/knowledge

1. What is pre-conception care? What comes to mind when you think of “pre-conception care”?
2. What is pre-conception health? What does pre-conception health include?
3. How did you hear about PC? Where do you get your source of information?
4. How do you feel about pre-conception care?
5. Why do you think PCC is important?
6. When do you think a woman should start pre-conception care?
7. What is the difference between preconception care vs. prenatal care?
8. What type of discussion do you have with your doctor regarding preconception care?
 - a. Have you talked to your doctor about birth control practices?
9. Do you seek out information that will help you? If so, Where?
10. What is your thought on “building your house first before becomes pregnant”?
11. Why do you think a woman should be tested for STI? Have you been tested for STI?

Intention

12. When do you plan to start engaging in pre-conception care?
13. What is your plan toward preconception health behavior?
14. What makes you start thinking about preconception care or contemplating preconception care?

Decision-making toward preconception health

15. What makes you start thinking about preconception care or contemplating about preconception care?

16. What type of action are you currently taking to engage in preconception health behavior?
17. What factors facilitate your decision (or to act) to preconception health behavior?
18. What factors motivate you to engage in self-care prior to conception?
19. What prevent you from focusing on taking care yourself?
20. What role do your family and peers play in your current health behaviors?
21. What could help you engage in or maintain your preconception health practice (s)?
22. How does your faith or your spirituality influence your decision to engage (or not) in preconception health behaviors?

VITA

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Education: B.S., Forensic Science, Baylor University, 2002
M.P.H., Health Policy & Management, Texas A&M University
School of Rural Public Health, 2004
Ph.D., Health Education, Texas A&M University, 2008

Professional Experience:

2007 – Present Graduate Research Assistant, Child & Adolescent Health
Research Lab, Division of Health Education, Department of
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6/2005-2/2007 Graduate Research Assistant, Center for the Study of Health
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770.