An online study of undergraduates' knowledge, awareness, and attitudes of preconception care

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ABSTRACT

Background: The majority of pregnancies in the United States are unplanned. Health status and health-related behaviors such as poor nutrition, alcohol consumption, and/or tobacco use, occurring prior to conception, have been linked to poor obstetric outcomes for mothers and their offspring, many of which can result in lifelong challenges. Knowledge, awareness, and attitudes can be predictors of health-related behaviors, and preconception care and education may reduce risk of some of these poor obstetric outcomes. Undergraduate students are at an increased risk for many of these risky behaviors and for unplanned pregnancies, as compared to older individuals. However, little is known about undergraduates' knowledge, awareness, and attitudes related to optimal preconception behaviors.

Objective: To assess knowledge, awareness, and attitudes of undergraduate students related to preconception care and to explore potential differences by gender, age, sexual activity status, weight status, prior classroom exposure to pregnancy and child development, and class standing.

Methods: This was an online, cross-sectional survey, conducted among students enrolled in a basic undergraduate nutrition course, during the first week of class. The survey measured knowledge, awareness, and attitudes of pregnancy-related issues and preconception care.

Results/Conclusions: Sixty-nine students completed the survey. Overall, students demonstrated low to moderate knowledge of issues related to preconception health, with an average composite knowledge score of 50%. Those reporting exposure from friends, family, and/or healthcare providers regarding preconception care demonstrated less knowledge than those who reported little exposure. It is possible that those with greater knowledge are less likely to be aware of these cues to action, or that individuals in their lives are less concerned about issues of preconception health. However, overall knowledge scores were very low, and demonstrate need for education regardless of age or perception of cues to action. Additional research is needed to identify the most effective techniques to impact preconception health-related awareness and subsequent behaviors in this population.

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CHAPTER ONE
INTRODUCTION AND LITERATURE REVIEW

Health behaviors occurring during pregnancy, such as maternal smoking, alcohol consumption, and/or inappropriate weight gain, along with health conditions arising during pregnancy such as iron-deficiency anemia, gestational diabetes, and pregnancy-induced hypertension, have been associated with multiple poor obstetric outcomes for both mother and fetus/infant.[1] Many of these outcomes can result in lifelong challenges for the resulting child, should he/she survive.[1] In addition, the health status and health-related behaviors of individuals, occurring *prior* to conception ("preconception"), are of concern as there is likely to be a significant impact on conception itself.[2-5] Issues of concern in the preconceptive period include micronutrient status,[5-8] advanced maternal age at conception,[9] maternal weight status,[6,10] and substance use and abuse.[1,6,11] Many of these issues pertain to the father as well.[2,12]

Micronutrient Status

Micronutrient status during the childbearing years is of concern, as deficiencies in specific micronutrients put both mother and fetus/infant at risk of poor obstetrical outcomes.[12-14] In terms of the childbearing years, folic acid and iron are the primary micronutrients of concern in the U.S. population as deficient nutrient status can result in increase risk for preterm delivery and birth defects**.**[6-8]

Folic Acid

Inadequate intakes of folic acid prior to conception have been linked to increased risk of ovulatory infertility[15], as well as increased risk of neural tube defects (NTD) in the

fetus/infant.[5] NTDs include spina bifida, anencephaly, and encephalocele, and occur in approximately 3,000 births in the United States[16] annually,[17] and more than 95% of children born with NTDs are born to couples with no previous NTD-affected pregnancy.[18] Folic acid supplementation prior to pregnancy showed a reduced risk of a NTD-affected pregnancy of 42[19] to 62% in meta-analyses of randomized control trials and observational studies.[20,21]

Among those who have previously had a NTD-affected pregnancy, the reoccurrence risk is 2-3% of subsequent pregnancies.[22] For those with a previous NTD-affected pregnancy, the Medical Research Council (MCR) found in a prospective, randomized-control trial that 4000 µg of folic acid supplementation reduced, by 71%, the recurrence of NTDs, when supplementation was started before and continued during pregnancy, indicating a critical role for this micronutrient.[18]

The CDC reported, in 2007, that 81% of women were aware of the relationship between folic acid and NTDs.[23] However, only 40% reported taking a folic acid supplement daily.[23] Reasons for low use of folic acid, as confirmed by multiple studies[24-28], include low maternal education and socioeconomic status, young age, lack of a partner, and unplanned pregnancy. Preconceptive healthcare is thus proposed to improve awareness of the benefit of folic acid supplements among all women and men of reproductive age.[29]

Iron Status

Iron status during pregnancy is of concern, as pregnant women require an additional 1,000mg of iron.[6] Iron-deficiency anemia, a condition of low hemoglobin level, at the start of pregnancy increases the risk for preterm delivery and low-birthweight

infants as much as two to three times.[19] Iron-deficiency anemia preconception has also been related to a decrease in mental and psychomotor development in affected children at five years of age.[20]

In the U.S. between 9 and 16% of women that are of childbearing age (18-44 years) have iron deficiency, and poor iron status prior to conception is related to reduced fertility.[7,8] In a large prospective study it was found that nurses who regularly consumed iron supplements and plant sources of iron were 60% less likely to have ovulatory infertility than women who did not.[30]

Iron status can be improved by consuming iron supplements of 18mg/day along with regularly eating vitamin-C rich fruits and vegetables, plant sources of iron, and iron fortified cereals, and lean meats.[6] Women should enter pregnancy with sufficient iron stores to last throughout pregnancy, and preconceptive healthcare is proposed to improve upon the awareness for iron levels during pregnancy.[31]

Maternal Age at Conception

There is an increasing trend towards delaying childbearing, with women waiting to start their families well into their 30s and even 40s,[9] however, this delay is not without risk.[32-35] A systematic review by Huang and Colleagues found as maternal age at conception increased, risk of fetal genetic abnormalities, cesarean delivery, and stillbirth increases.[32] For example, Koo and colleagues in a retrospective study of Korean deliveries found adjusted odds ratio risk of chromosomal anomaly increased between 2.7 and 12.3 for women ≥35 years of age.[33] Cesarean delivery risk increased for women older than 30 years of age, but particularly women ≥35 years of age experienced a risk

increase of 1.8 (CI: 1.5-2.2).[34] Also, in a systematic review by Huang and Colleagues relative risk of stillbirth increased between 1.2 and 4.53 as maternal age increased.[35] It appears that the aforementioned risks increase around age 30 years and increase further after age 35 years.[9] Despite evidence that women are generally aware of these risks, the trend continues.

Benzies and colleagues, completed a qualitative study with women 20-48 years of age and found that the desire to obtain a college education, increase financial stability, and/or to develop their own independence were significant reasons for the decision to delay childbirth.[9] In addition, women expressed the desire for a stable relationship to exist prior to conceiving.[9] Though increased education and establishing stable financial and emotional relationships are desirable, and are associated with positive lifelong health trajectories for mothers and infants, the risks associated with delaying pregnancy to 35 years may attenuate some of this gain.[9,32] Therefore, it is likely that preconception counseling, for both women and their potential partners, should start at an early age and include information on both the benefits and risks of delayed childbearing.[9]

Weight Status during the Child-bearing Years

Obesity affects more than one-third of adults in the U.S. and is associated with various conditions, many of which are leading causes of preventable deaths.[36] Some of the preventable deaths are heart disease, stroke, Type 2 Diabetes Mellitus, and some types of cancer.[37] Reproductive health concerns related to excess weight are increasing in the U.S.[6] It has been found in women that high body fat contributes to the absence of ovulation, the absence of menstrual cycles, delayed conception, and a reduced

response to fertility treatments.[38] Women with excess central body fat are at risk for insulin resistance and increased testosterone production.[38] Increased levels of insulin reduce sex hormone binding globulin, which then prompts the ovaries to increase production of testosterone, possibly leading to disrupted follicular development.[38] The relationship between excess weight and fertility disruption is not limited to women, as men with high levels of body fat can experience fertility problems secondary to low testosterone levels.[39] In males, testosterone is converted to estradiol, and this conversion can be high in the presence of high body fat.[6] Increased levels of estradiol inhibit luteinizing hormone and follicle stimulating hormone.[6] Both hormones are essential for testosterone and sperm production, however low levels of testosterone decreases sperm production and results in infertility.[40] Fertility issues are often reduced or resolved by weight reduction for both men and women.[41,42]

It has become evident that having a Body Mass Index (BMI) >30kg/m^2 prior to conception, categorized as 'obese', increases cardiometabolic risks.[6] For example, results from a systematic review found women with a pre-pregnancy BMI >30kg/m^2 developed more complications during pregnancy than women with a lower pre-pregnancy BMI.[1] These complications included development of gestational diabetes mellitus (GDM), miscarriage, fetal death, premature delivery, birth defects and increased need for epidural analgesia and cesarean section delivery.[29,32]

Overweight status at conception also increases the likelihood of excess maternal weight gain occurring during pregnancy, and excess gestational weight gain (GWG) has been shown to result in adverse outcomes for both infant and mother.[43,44] The Institute of Medicine (IOM) defines excess gestational weight as the total weight gained during

pregnancy that exceeds the recommended IOM upper limit for each pre-pregnancy BMI classification. [10] For example a woman with a pre-pregnancy BMI of 22.0kg/m^2 that gains more than 25-35 pounds during pregnancy would exceed the upper limit.[10] Consequences related to excess weight gain include gestational diabetes and impaired glucose, hypertensive disorders, and delivery complications.[10] In a 2010 study by Weisman and colleagues, the researchers found women who were overweight at conception (BMI 25.0-29.9kg/m^2) were more likely to exceed these IOM guidelines, a recommended total weight gain of 15-25 pounds, and thus suggested there is a need for counseling overweight women about the potential impact of their pre-pregnancy BMI status.[43] As excess weight status at conception impacts the infant's growth during the first year of life,[45] and has been associated with increased risk of childhood overweight/obesity,[46] the preconception period is an important time for education targeting reaching a normal weight and prevention of excess weight gain during pregnancy.

Gestational Diabetes

The IOM committee of 1990 found that overweight or obesity status, prior to pregnancy, is a primary determinant for excess GWG, leading to GDM.[10] According to the IOM, GDM cases, diagnosed as a glucose threshold value >140mg/dl (7.8mmol/l), increased over 100% in the U.S. population between 1989 and 2004.[10]

GDM increases the risk of delivering a macrosomic infant, defined as an infant whose weight-for-gestational-age exceeds the 90th percentile, and doing so via cesarean section.[6, 10] Infant complications that can possibly result from GDM include, but are not limited to, birth defects, very high or very low birthweight, surgical injury to

the child, low blood glucose upon delivery, jaundice during the neonatal period (defined as the first 28 days of life), and/or metabolic disorders that can appear later in life.[47] Also, infants born via cesarean section are at an increased risk for breathing problems, such as respiratory distress syndrome, a condition that occurs when fluid collects in the lungs and prevents oxygen flow to the organs.[48] The costs associated with cesarean delivery are high. For example, in 2010, it was estimated that cesarean section delivery cost approximately $27,800, versus a vaginal delivery ($18,300).[49] Moreover, it is estimated that ~30% of U.S. newborns were delivered by cesarean section in 2010, at an estimated cost of about $687 million dollars.[50]

As noted previously, excess maternal weight gain has been linked to the development of GDM. However, gaining too little weight also appears to increase risk of developing GDM.[10] Though four studies reviewed by the Agency for Healthcare Research and Quality (AHRQ) found that gestational weight gain above the IOM recommendations (as defined by pre-pregnancy BMI category) was positively associated with abnormal glucose tolerance, three other studies from this review found women whose gestational weight gain was below the IOM recommendations had a higher probability of developing GDM.[10] Results from these studies are conflicting. However, it is likely that achieving a healthy weight, whether through weight loss or weight gain, prior to conception and throughout the childbearing years will reduce risk of developing GDM.

Pregnancy-induced Hypertension

Hypertensive disorders affect 6 to 10% of pregnancies worldwide and contribute to maternal mortality, stillbirths, and newborn deaths.[51] Several types of hypertensive

disorders during pregnancy have been identified and include chronic hypertension, gestation hypertension, preeclampsia-eclampsia, and preeclampsia superimposed on chronic hypertension.[6] Various factors such insulin resistance[52-55], increased inflammatory activation[56,57], and genetics, such as polymorphisms of sFlt1 and VEGF[58], influence hypertension during pregnancy.[6,59]

Women with chronic hypertension, defined as hypertension present before pregnancy or diagnosed before 20 weeks of pregnancy, tend to have good pregnancy outcomes.[60] However, there are risks associated with chronic hypertension. For example, preeclampsia will affect approximately 20% of women with chronic hypertension, versus 4% of the general population of pregnant women.[6] In addition, preterm delivery, fetal growth retardation, placenta abruption, and cesarean delivery risks increase in women of this population.[60]

The risk for preeclampsia begins before and very early in pregnancy, but currently this no reliable way to determine if a woman will develop the condition.[61] Though some research indicates that multivitamin and mineral supplementation, in the months leading up to and within the first months of pregnancy, may reduce risk of preeclampsia, this is far from conclusive at present.[62,63] Educating individuals at a relatively young age may increase awareness of these issues, and may ultimately reduce the risk of developing these life threatening conditions.[6]

Substance Use and Abuse

Substances such as caffeine, tobacco, and alcohol, inhaled or consumed prior to pregnancy, have been shown to negatively impact conception, or possibly result in

spontaneous abortion, congenital malformations, or neuro-developmental deficits in surviving children.[1]

Caffeine

The effect of caffeine on conception is unclear, as research is conflicting.[64] One study conducted in Europe found that women consuming over four cups of coffee a day (500mg caffeine), who were having unprotected intercourse within a 10-month interval, were half as likely to conceive as women who consumed less coffee (≤3 cups of coffee, <500mg caffeine).[11] Another study found that intake of >300 mg of caffeine from various sources such as soda, coffee, or tea, had the potential to decrease chances of conception by 27% per cycle, compared to consumption of little to moderate amounts of caffeine (<300 mg of caffeine/day).[65] During pregnancy, caffeine consumption has been suspected of adverse outcomes for the mother as it is increases heart rate, acts as a diuretic, and stimulates the central nervous system.[65,66] Caffeine passes from the maternal blood to the fetus/infant blood and lingers in the fetus/infant blood longer than the maternal blood as the fetus/infant metabolizes caffeine slower.[65,66] Although recent studies have found benefits of moderate consumption of caffeine, the definition of moderate consumption is highly variable and increases the difficulty of issuing recommendation.[67] As findings are inconclusive, the March of Dimes recommends caffeine consumption be no more than 200mg/day, which is equal to the caffeine content of one 12-ounce cup of coffee.[68] Nevertheless, until more research can be conducted, limiting caffeine consumption for women of childbearing age should be a component of preconception care (PCC).[6]

Smoking

Smoking is another concern for women of reproductive age. Most research in this area focuses on the periconception period, defined as the weeks or months before and around conception, making it difficult to tease out any specific impacts of smoking on conception itself. [6] However, maternal smoking, overall, has been associated with increased risk of miscarriage[6], the loss of a conceptus during the first 20 weeks of pregnancy, intrauterine growth retardation (IUGR)[6], fetal undergrowth that can result from any causes and often develops disproportionality in weight, length, or weight-for-length percentiles, premature delivery[69] (delivery before 37 weeks of pregnancy) and/or delivery of a small-for-gestational-age infant[6] (a newborn with weight <10th percentile for gestational age).[70-75]

Limited research has indicated that smoking, specifically in the preconception period, has been associated with an increased risk of premature delivery (OR 2.2; 95% CI: 1.29-3.75)[69,76], defined as the birth of an infant before 37 weeks gestation.[1] In addition, smoking, during the periconception period, has been associated with increased risk of congenital heart defects (OR 1.9; 95% CI:1.2-3,1)[77], orofacial defects (OR 1.6; 95% CI:1.0-2.4)[78,70] , and gastrointestinal malformations (OR 4.3; 95% CI:1.5-12.3)[78], as the first trimester is when congenital anomalies originate.[79] Premature delivery, IUGR, and small-for-gestational age increase the risk for neonatal distress, and permanent deficits in growth and neurocognitive development for the child.[70-75] One study, conducted in 2006, reported that paternal smoking increased the risk of childhood leukemia, while maternal smoking did not, and it is likely that more research should occur in this area.[80] Given the negative impact of smoking on fetal and child health, individuals of childbearing age should be educated about the adverse

consequences of tobacco use, specific to pregnancy, and PCC should likely include screening for, and treatment of, nicotine dependence.[1]

Alcohol Consumption

Alcohol consumption before pregnancy is of concern, as it possibly can decrease estrogen and testosterone levels and also disrupt menstrual cycles and testicular functions, in turn reducing fecundity.[81] In a study of Danish couples, women who consumed 1 to 5 alcohol-containing beverages per week had a 39% lower chance of conception during a six-month period.[82] Results showed the more alcoholic beverages consumed, the more the risk increased, with consumption of 10 or more beverages having a 66% decrease in the probability of conception.[82] Not all studies have found an effect of alcohol intake on fecundity, and some results are only in women and men with very high intakes of alcohol.[83-85] As results are conflicting it is likely more research will need to be completed.

Alcohol consumption, before or around the time of conception, has also been correlated with a 30% increase in spontaneous abortion, a 24% increase in neural tube defects (NTDs), a 20% increase in gastrointestinal malformations, and an increased likelihood of having a child that experiences one of an array of fetal alcohol spectrum disorders (FASD).[1]

FASD is also known as alcohol-related neurodevelopmental disorder (ARND), alcohol-related birth defects (ARBD), and fetal alcohol syndrome (FAS).[86] ARND may result in intellectual disabilities and problems associated with learning, behavior, attention, coping, impulse control, and learning.[86] These outcomes can lead to the subsequent child having abnormal mental development later in life.[87] In 2004, a study

found that 14% of children and 61% of adolescents and adults with ARND had a disrupted school experience.[88] Those with ARND are at risk for suspension, expulsion, or dropping out of school due to behavioral issues.[88] Behavioral issues include difficulty developing relationships with peers and teachers, which may lead to the disrupted school experience.[86] FAS is one of the most prominent ends of the fetal alcohol spectrum with fetal death being the most extreme outcome from alcohol consumption during pregnancy.[86] Problems from FAS can include problems with: learning, memory, vision, and communication. FAS has been estimated to cost a child born in the U.S. $2 million dollars over his/her total lifetime (calculated in 2002).[89]

The CDC reports that 50% of women of childbearing age (18-44 years) report alcohol use and/or episodes of binge drinking.[29] Approximately 10% of college graduates were among the highest estimates of reported alcohol use among pregnant women, with those aged 35-44 years, and not married following.[90] Furthermore, the CDC also reports that one in 10 U.S. women, age 18-44 years, reports alcohol consumption within the previous 30 days in 2011-2013.[91] In addition, three percent of pregnant women reported binge drinking (7.5 drinks on one occasion).[91] Thus, approximately one third of pregnant women who consume alcohol during pregnancy are binge drinking (> 4 drinks on one occasion).[91] Specifically, excess alcohol consumption (>7drinks/week or >3 drinks on 1 occasion) at preconception led to a 20% greater risk of NTDs, and alcohol and drug usage led to a 35% greater likelihood of developing maternal depression.[90] Currently there is no safe amount of alcohol that can be consumed during pregnancy.[86] During the first four weeks of pregnancy, the infant's brain, spinal cord, and heart have begun to form.[92] After eight weeks of conception, all

major organs and external body structures have begun to develop, including sex organs.[92] However, many women are unaware of their pregnancy during the first four to six weeks of gestation.[90] Despite the possibility that PCC that includes counseling targeting alcohol consumption may reduce this behavior, it is evident that the increased use of contraception due to PCC during this time period could result in fewer negative outcomes associated with an unplanned conception.[1]

Preconception Care

While healthcare providers, such as physicians have incorporated discussions about birth control and cervical cancer screenings into the routine care of women, it is likely that there are several issues that need to be addressed.[9] Disseminating information about preconception behaviors such as optimal age of childbearing, achieving and maintaining a healthy weight, the importance of maintaining a normal blood glucose level among those at-risk of or diagnosed with diabetes, optimal nutritional intake, and substance use/abuse issues could increase the chances of optimal preconception status and ultimately lead to positive reproductive outcomes.[9]

PCC describes education that targets the preconception and early pregnancy periods, and addresses optimizing current health status and relevant lifestyle behaviors.[93,94] Because approximately 50% of U.S. pregnancies are unplanned, and because there is some indication that young adults may be largely unaware of many health and lifestyle factors that potentially influence reproductive health and child-bearing,[93] the CDC encourages all individuals of childbearing age, whether or not they are planning a pregnancy, to participate in preconception care.[29] Though this is an important initiative, most research about PCC targets the prenatal period,[29,95] and more

work needs to be completed among those who are not planning, or thinking about, becoming pregnant. By increasing awareness and knowledge of health issues and behaviors related to poor pregnancy outcomes prior to conception, public health interventions can possibly reduce adverse outcomes for both the woman and fetus. However, as research advances and the topography of the health status of the nation changes, it is likely that the current preconception knowledge base and content of education targeting individuals who may someday become parents should be continuously evaluated and updated.[96]

Lack of Knowledge among Undergraduates about Preconception Care

Reaching women of reproductive age prior to conception is challenging, as more than half of pregnancies in the U.S. are unplanned, and often individuals in this demographic do not believe they are a target for PCC.[5,93,97] Yet, secondary education institutions and public ad campaigns have succeeded in informing young people about healthy lifestyle behaviors, such as reducing alcohol consumption, suggesting that similar methods could be used to increase awareness of other issues related to preconception health.[98]

Recently, the CDC has focused on improving preconception health among those of reproductive age by enhancing knowledge, attitudes, and behaviors towards PCC, as recent studies have shown a lack of knowledge in this area.[29,93] In a study by Delgado, focusing on undergraduate students' knowledge of issues related to PCC, awareness of dangers associated with substance abuse was high among both males and females, yet awareness of sexually transmitted diseases, optimal prenatal development, and issues related to health (i.e., over- or underweight) was moderate to low.[92] To capture this

information, Delgado created a questionnaire focused on knowledge and awareness of issues related to preconception health and pregnancy.[92] In addition, the knowledge of need for preconception folic acid consumption and pregnancy spacing was found to be lacking (with 32% and 13% responding correctly, respectively).[92] The questionnaire was part of a research requirement fulfillment in an introductory psychology course for undergraduates attending the University of Miami. This lack of knowledge reflects the need for preconceptive counseling among males and females, as folic acid supplementation prior to pregnancy has been shown to be instrumental in reducing risk of neural tube defects.[1]

Partners can support and influence one another to adopt healthy behavior changes in areas such as folic acid supplementation, increased exercise, and reduced alcohol consumption and smoking.[99] In a study that utilized focus groups among expectant parents of various demographics, fathers were found to be motivators to improve the woman's overall health.[100] This study also found that men also present barriers to women's' health.[100] Hence, interpersonal communication between both partners can lead to positive or negative attitudes about health behaviors and towards behavior change.[99] Improving knowledge and awareness on preconception health topics would assist those of reproductive age in making informed decisions about their health, as preconception health is focused on achieving and maintain healthy individuals, and therefore all can benefit.[10,29]

Theoretical Framework

The social cognition models that may best explain and predict family planning behaviors are the Health Belief Model (HBM), the Theory of Reasoned Action (TRA),

and the Social Cognitive Theory (SCT).[101] These three theories describe significant cognitive variables and their interrelationships underlying health behaviors, such as predicting family planning.[101]

The HBM is the theory that health behaviors are influenced by personal beliefs, or perceptions about diseases, and the individual's ability to decrease their occurrences.[101] The HBM suggests that the probability of a person performing a particular health behavior is dependent upon their perceptions of their own susceptibility, the severity of the disease, potential benefits of their efforts, their ability to overcome barriers (real or perceived), cues to action, events, people, or things that drive them to act, and self-efficacy.[102,103] The combination of these factors drives an individual's readiness to act. Additionally, the HBM measures the impact of these specific factors on intention to perform behaviors, such as preconception planning behaviors.[101] Though this model has been shown to increase self-efficacy and cues to action of pregnancy awareness among diabetic female adolescents,[104] the HBM fails to incorporate social cognitive variables such as individual intention or the influence from a significant other, factors which have been found to be highly predictive in other models, such as the TRA.[105-107]

The TRA hypothesizes that all behaviors are based on intentions, and intentions are driven by two forces.[108] These two forces include the individual's attitude toward taking the action and their perceived social expectations in regards to that behavior. For example, in a study completed in Australia with diabetic women attending outpatient care for diabetes and pregnancy, researchers found the TRA to be a significant predictor of preconceptive care.[109] Those who participated in preconceptive care

programs were more likely to have expressed intent to participate than those who did not participate.[109] The subjective norm, or social expectations, can be considered a gauge for the social pressure an individual may feel to perform a targeted behavior, in regards to PCC. Avoiding detrimental substances would be an example. The belief one has in him or herself can further be explained by the SCT.

Self-efficacy is an important component of the Social Cognitive Theory (SCT), first proposed by Bandura.[110] The SCT describes a causal model that posits that behavior, cognitive function, personal factors, and environmental events interact to determinant behaviors.[110] Three components of the SCT are especially relevant: developing skills by modeling; strengthening ones' belief in their ability to make better use of their talent; and using goal systems to improve self-motivation.[110] The SCT suggests that an individual's expectations regarding a specific action or behavior may lead to a specific outcome.[101] This action-outcome expectation directly impacts behavior through their intent to act on this behavior. By combining the constructs of these social cognition models (HBM, TRA, and SCT), researchers may be better able to understand factors that affect preconception care decision-making.[101] This understanding of decision-making may supplement current preconception care interventions, thus potentially increasing their effectiveness.

Charron-Prochownik developed a theoretically based Reproductive Health Attitudes and Behavior (RHAB) instrument, founded upon the Health Belief Model, Theory of Reasoned Action, and Social Cognitive Theory, for examining perceptions and attitudes of preconception planning among type 1 diabetic adolescent females, which could lead to increased preconception care.[101] The items for this instrument were

modified from the previously validated “Pregnancy and Diabetes Interview Schedule”, which is currently unavailable for access.[101] Content validity was received by the original author for the instrument from the corresponding theorists, Becker, Fishbein, and Bandura.[101] The instrument was first designed to measure knowledge, attitudes, social factors, and reproductive health behaviors of adult pregnant women with type 1 diabetes.[101] To our knowledge, this is the only published survey instrument incorporating health belief/behavior theories into an assessment of knowledge and attitudes related to preconception health issues. The Pregnancy Issue Questionnaire (PIQ), developed by Delgado, addresses appropriate weight gain during pregnancy for a healthy woman and as well as outcomes that are not associated with obesity. However, these instruments do not incorporate questions regarding preconception weight status and appropriate gestational weight gain, which are emerging as critical factors associated with maternal and infant health outcomes.

Conclusion

Efforts are being made worldwide to reduce adverse pregnancy outcomes. In recent years, there have been many medical and prenatal care advances. However, with many infants still being born early or at an unhealthy birth weight, PCC has been proposed to improve adverse pregnancy outcomes.[111] PCC is important for all potential parents, not just individuals planning a pregnancy. Achieving and maintaining a healthy lifestyle is beneficial for all ages, but especially for men and women of reproductive age. The CDC urges all individuals of childbearing age to make healthy living a priority. With most pregnancies being unplanned, preconception health care could assist with reducing adverse pregnancy outcomes for both mother and infant.[111] Increasing PCC

knowledge among young people has the potential to reduce risk factors associated with poor obstetrical outcomes. Reducing these risk factors could ultimately improve the health of future generations of women, infants and families. As discussed, many risk factors can be identified, managed, or treated prior to conception.[112] Thus, PCC is a promising form of healthcare to improve perinatal risk factors. Evaluating current gaps in knowledge and current attitudes of individuals of childbearing age would inform development of more targeted PCC concepts. Therefore, this project, which combines aspects of the PIQ and RHAB, will attempt to answer the following research questions:

1. Are there differences, by various characteristics such as gender, age, and BMI, in the level of preconception care knowledge of undergraduates?
2. Are there differences, by various characteristics such as gender, age, and BMI, in the level of awareness of concepts of preconception care among undergraduates?
3. Are there differences by, various characteristics such as gender, age, and BMI, in preconception care attitudes of undergraduates?

CHAPTER TWO
MANUSCRIPT

Introduction

Health behaviors and other health conditions occurring prior to and during pregnancy have been associated with obstetric outcomes.[1,6] Factors such as nutrient status, preexisting health conditions, and exposure to harmful substances can result in infertility, pregnancy loss, infant death, birth defects, or other complications for both the mother and resulting infant.[6-8,10,30,38,40,45,47,65,69,76,81,113-115] Some of these outcomes have the potential to result in lifelong challenges for both the mother and subsequent infant.[16,39]

Preconception care (PCC) targets the time period before and during early pregnancy to address potentially harmful lifestyle behaviors, increase awareness of family planning tools, and optimize current health status of both males and females.[28,93] The Centers for Disease Control and Prevention (CDC), in recent years, has increased efforts to improve preconception health of men and women.[28] As preconception health status plays a fundamental role in determining if the pregnancy will result in adverse outcomes[28] increasing knowledge and awareness prior to pregnancy is imperative.[28,93,98,115]

Interventions to reduce risks of adverse pregnancy outcomes have focused on improving nutrient status[12-14,29], management/treatment of health conditions[40,41], and prevention of substance abuse or use.[6,67,97,116,117] However, to be successful, implementation of PCC must occur prior to pregnancy.[1,6,16,28] Reaching women prior to pregnancy is challenging, as half of pregnancies in the United States are unplanned[33] and many of the individuals within this demographic do not believe they need PCC.[5,118]

While some PCC information is specific to pregnancy, much of the information is beneficial for achieving and maintaining a healthy lifestyle regardless of pregnancy status. Therefore PCC information provided to all men and women of reproductive age may have multiple beneficial outcomes.

Recent studies have sought to identify the current knowledge and awareness of PCC topic areas among undergraduate students, most of whom are of reproductive age.[28,119,120] In 2008, Delgado found that while many undergraduate students were aware of issues related to folic acid, tobacco, and alcohol consumption during pregnancy, many were unaware of other lifestyle choices or health factors that influence pregnancy, such as rate of weight gain.[92] Prior to developing and disseminating information to increase knowledge and awareness, more information is needed to understand the attitudes of undergraduate students and their current knowledge and awareness levels. The objective of this study was to identify if differences exist in PCC knowledge, awareness and attitudes by varying characteristics (*gender, age, BMI, past, present, and future sexual activity, prior class exposure, and class standing*).

Methods

Participants and Recruitment

Undergraduate students enrolled in an online, introductory nutrition course during the first summer session of 2015, and who were at least 18 years of age, were eligible to participate. Recruitment occurred within the first week of class, via an email from the course instructor informing students of the opportunity to receive 3 extra credit points for completing a survey about undergraduates' thoughts about PCC. Those choosing not to

complete the survey had the option of completing an equivalent alternative extra credit opportunity.

A link to the survey, hosted by the *Qualtrics 2015* online platform, was embedded in the email, and was active for the subsequent Friday, Saturday, and Sunday. Clicking the link delivered potential participants to a screen displaying the Student Information Sheet (see **Appendix**), which also served as the informed consent document and confirmed the student was 18 year of age or older. Potential participants then had the choice to proceed to the survey itself or to exit. By proceeding to the survey students were considered to have provided consent to be enrolled in the study. *Qualtrics* allows researchers to select 'hide IP address', making this information unavailable to researchers. As no identifiers were collected on the survey, responses were considered to be anonymous. At survey completion, students were reminded of the opportunity to receive extra credit and were prompted to take a screen shot of the 'Survey Complete' page. This screen shot was then provided to the course instructor to receive the extra credit. To limit the amount of missing data, responses to survey questions were set up as 'forced'. However, students were able to select 'choose not to respond', or a similar response, if relevant. Questions were designed to elicit close-ended or scaled Likert-like answers focusing on facts and scenarios surrounding PCC. The complete survey consisted of 77 questions, and the estimated completion time was 10-25 minutes. The University of Tennessee Institutional Review Board approved all study procedures prior to implementation.

Measures

The demographic data collected included: gender, age, self-reported height and weight, race, ethnicity, class standing, sexual activity (past, present, and future plans), and current status as a parent. Height and weight measurements were used to calculate body mass index (BMI). The survey also included questions selected from two previously published surveys: the Reproductive Health Attitudes and Behavior (RHAB) questionnaire[100] and the Pregnancy Issues Questionnaire[92] (PIQ) (see **Appendix** for both instruments). Both instruments were previously used to assess attitude and knowledge, respectively, among young adults.[92,100] Permission to use both instruments was obtained.

Reproductive Health Attitudes and Behavior (RHAB) Questionnaire

The RHAB instrument measures perceptions about health beliefs regarding preconceptive care, using three constructs: the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), and Social Cognitive Theory (SCT).[100] The HBM suggests that the probability of a person performing a particular health-related behavior will depend on their perceived susceptibility to a health threat, the perceived severity of the health threat, the benefit of taking action, and the cost of/barrier to participating in the behavior.[121] These perceptions can be influenced by internal and external "cues to action", such as an individual's perception of symptoms, the degree of social influence felt by the individual, and health education campaigns to which the individual has been exposed.[122] The TRA postulates that intention can be influenced by an individual's attitude toward taking action to participate in a particular behavior (e.g. 'behavioral norm') and view of social expectations in regards to participating in that behavior (e.g., 'subjective norm').[100] Finally, the SCT states that self-efficacy can influence

preconception planning behavior by influencing how much effort is spent on the action and the length of time an individual will contribute to achieving a certain result.[123]

Because the RHAB originally targeted adolescent females with type 1 diabetes mellitus, only 39 of the original 48 questions were considered to be relevant to the normal, healthy population and were selected for inclusion in the survey. These questions were subsequently modified to also be relevant to the male/partner, as noted in the **Appendix**.

Pregnancy Issues Questionnaire (PIQ)

The PIQ, originally developed for undergraduates in an introductory psychology course, contains items on knowledge, self-perception of awareness, and awareness of content related to healthy preconception status. Twenty-six of the 32 original questions were retained, as these were considered most directly relevant to the current research question and the method of implementation. The retained questions explore knowledge and awareness of concepts related to preconception care. Questions were in multiple choice or checklist format (see **Appendix**). The six questions not included were a combination of open-ended and check-list questions that were not relevant to the research questions.

Data Analysis

Survey responses were imported into IBM SPSS 22.0. Frequencies and means were used to describe demographic characteristics and responses to individual questions. Normality was assessed for continuous variables (*knowledge, awareness, and attitudes*). The response option, ‘choose not to respond’, was considered missing data. Therefore, the sample size of individual responses to questions varied. When

appropriate, multi-categorical or continuous variables were dichotomized. Cronbach's alpha was used to assess the internal reliability of responses to the RHAB sub-constructs. Chi-square analyses were used to examine relationships between two categorical variables. Nonparametric testing was utilized to assess relationships between variables, as most were not normal. For example, Spearman's correlation was used to assess relationships between preconceptive knowledge and RHAB subscales. Mann-Whitney U tests were used to examine differences between dichotomous categorical variables, such as gender, and continuous, non-normal variables such as RHAB subscales. An alpha level of $p<0.05$ was set for all analyses, to determine statistical significance.

Results

Participants

A total of 86 students were enrolled in the class, and 71 consented to participate in the survey. Responses from two subjects were dropped from analysis as less than 80% of the survey was completed. Therefore, the final sample size was 69.

Secondary to a lack of variability, the race variable was dichotomized into 'White' and 'other' and age was dichotomized into 'less than 20 years of age' or '21 years or older', as 20 years of age was found to be the median age (**Table 1**).

Table 1**.** Participant demographics and characteristics of undergraduate students from a large university in the southeastern United States (n=69)

Variable	n	%
Gender		
Female	53	77
Male	16	23
Age		
≤20 years	35	49
>20 years	34	51
Race (n=68)		
White	60	88
Other	8	12
Currently Sexually Active		
Yes	46	67
No	21	30
Have been sexually active in past 6 months		
Yes	53	79
No	14	21
Planning to be sexually active in next 6 months		
Yes	51	77
No	15	23
Choose not to respond	2	3
Sexual Orientation		
Heterosexual	64	93
Other (Homosexual, Bisexual)	5	7
Class Standing		
Lower	25	36
Upper	44	64
BMI* (n=66)		
Normal Weight (BMI 18.5-24.9 kg/m^2)	44	67
Overweight/Obese (BMI 25.0-≥30 kg/m^2)	22	33

*Calculated based on self-reported height and weight

Additionally, sexual orientation was dichotomized into 'heterosexual' or 'other', and year in school into either 'upper classman' or 'lower classman'. BMI was initially categorized into 'underweight' (<18.5kg/m^2; n=3), 'normal weight' (18.5-24.99 kg/m^2), 'overweight' (25-29.99 kg/m^2), or 'obese' (≥30 kg/m^2). However, secondary to sample size issues, BMI was further categorized into 'normal weight' (18.5-24.99 kg/m^2) or 'overweight/obese' (≥25 kg/m^2) (n=66). Therefore, the three underweight participants were dropped from analyses using this variable. The majority of students were White (88%), female (77%), and of normal weight (68%)**.** The average student was 20 years of age and reported being currently sexually active (67%). Only one third of the sample (33%) reported having previously completed a health-related class.

Preconception Knowledge (PIQ)

Responses to knowledge questions were recoded as either 'correct' (1) or 'incorrect' (0). The percentage of correct responses to individual knowledge questions are listed in **Table 2**. Students scored the highest on questions regarding alcohol exposure during pregnancy, with 88% or more answering these two questions correctly. To create an overall knowledge score, 'correct' responses were then summed and divided by the total number of questions. Preconception care knowledge scores ranged from a low of 23% to a high of 86%, with an average score of 50%. Because this variable was not normally distributed, non-parametric statistics were used in bivariate analyses.

Awareness

Two questions assessed awareness (**Table 3**). Forty-eight percent of students felt moderately to extremely aware of behaviors and other factors that are potentially

dangerous to a developing fetus during pregnancy, while 42% reported being slightly aware, and 6% reported not being aware at all. Fifty-five percent of students reported being moderately to extremely aware of the positive behaviors and other actions pregnant women can take to increase their odds of having a healthy pregnancy and infant, 38% reported being slightly aware, and 4% reported not being aware at all.

Table 2. Percentage of Undergraduates from a large university in the southeastern United States Responding to Preconception Care *Knowledge* Questions (n=69)

Question	n (%)	
	Correct	*Incorrect*
Sally and her husband have decided to start trying to get pregnant. When should Sally schedule her first visit to the obstetrician?	54 (78)	15 (22)
During which of the following periods of pregnancy is the developing baby at the greatest risk from exposure to harmful substances (such as prescription or illegal drugs) or environmental toxins (such as arsenic or mercury)?	26 (38)	43 (62)
The likelihood of a child being born with a chromosomal abnormality	37 (54)	32 (46)
Which of the following has been proven effective in reducing the risk of neural tube defects such as spina bifida?	27 (39)	42 (61)
Herbal supplements and herbal teas are typically considered safe to consume during pregnancy?	21 (30)	48 (70)
Mother with which of the following diseases/disorders is most likely to have a baby that is born heavier than normal at birth?	34 (49)	35 (51)
Women who will deliver a baby at age ____ years or older are considered to have a high risk pregnancy?	24 (35)	45 (65)
Women of normal weight prior to becoming pregnant are advised to gain a total of ____ during pregnancy.	27 (39)	42 (61)
Compared to pregnant women of normal weight, obese pregnant women are at increased risk for all of the following EXCEPT	40 (58)	29 (42)
Exposure to large amounts of alcohol during pregnancy is associated with which of the following	64 (93)	5 (7)
Serious birth defects can be caused by a pregnant woman binge drinking (5 or more drinks) on one occasion even prior to the time that she realizes she is pregnant.	61 (88)	8 (12)
By ____ weeks from conception all of the baby's organs and body systems have formed.	22 (32)	47 (68)
For women who want more than one child, it is recommended that at least ____ elapse between the birth of one child and becoming pregnant with the next to allow the mother's body time to physically recover	8 (12)	61 (88)

Table 3**.** Percentage of Undergraduates from a large university in the southeastern United States Responding to Preconception Care *Awareness* Statements (n=69)

	n(%)			
	Extremely aware	*Moderately aware*	*Slightly aware*	*Not aware at all*
To what extent do you feel you are aware of the behaviors and other factors that are potentially dangerous to a developing baby during pregnancy?	3 (4)	30 (44)	29 (42)	4 (6)
To what extent do you feel you are aware of the positive behaviors and other actions pregnant women can take to increase their odds of having a healthy pregnancy and a healthy baby?	4 (6)	34 (49)	26 (38)	3 (4)

Attitudes (RHAB)

For each sub-construct, or subscale, a mean subscale score was calculated by summing responses to individual statements and dividing this amount by the number of individual statements in the subscale. **Table 4a** lists each subscale, the number of statements relevant to each subscale, and the Cronbach's alpha and mean score for each. All of the subscales demonstrated acceptable internal reliability (0.61-0.91), with six of the nine subscales demonstrating good internal reliability consistency (>0.70).[124] *Intention* included one question and therefore was analyzed by individual responses, results of which can be seen in **Table 4b**.

Perceived susceptibility of future offspring to health threats was measured on a 5-point scale, with '1' indicating a lack of feeling that future offspring would be susceptible to health threats and '5' indicating a high sense of this susceptibility. This sample of students reported a mean score of 2.3 (SD 0.9). Perceived severity of health risks to future offspring was measured on a 5 point scale, with '1' indicating a lack of perceived severity and '5' indicating that health threats to future offspring would be severe. The perceived benefit of taking action to protect the health of future offspring was measured on a 5 point scale, with '1' indicating no perceived benefit and '5' indicating a great deal of benefit. The perception that one experiences barriers to taking action to protect the health of future offspring was measured on a 5 point scale, with '1' indicating perceiving experiencing no barriers and '5' indicating perceiving experiencing a lot of barriers. Personal attitudes, assessed on a scale of 1 through 7, indicated the level of positivity toward participating in a health behavior that may be beneficial to future offspring, where lower scores indicated more negative attitudes. Subjective norms, assessed on a scale of 1 through 6, indicated the degree of desire an individual

would have to participate in a positive health behavior as encouraged by an important individual in his/her life.

Table 4a. Results of RHAB Subscales administered to undergraduate students from a large university in the southeastern United States (n=69): Number of questions in subscales, range of potential responses, Cronbach's alphas, and means and standard deviations for each subscale.

Subscale	Number of relevant statements or questions	Range of Potential Responses	Cronbach's alpha	Mean subscale score
Health Belief Model				
Susceptibility	4	'Not at all' (1) to 'A lot' (5)	0.703	2.3 (0.9)
Severity	3	'Not serious at all' (1) to 'Very serious' (5)	0.71	3.3 (1.2)
Benefits	3	'Not at all' (1) to "A lot' (5)	0.757	4.0 (1.0)
Barriers	4	'Not at all' (1) to 'A big problem' (5)	0.853	2.1 (1.1)
Cues to Action	4	'Yes' (1) or 'No' (2)	0.658	1.6 (0.5)
Social Cognitive Theory				
Self-efficacy	4	'Not confident at all' (1) to 'Absolutely confident' (10)	0.779	7.1 (2.6)
Theory of Reasoned Action				
Personal Attitude	3	'Extremely unnecessary', 'Extremely difficult', or 'Extremely dangerous' (1) to 'Extremely necessary, 'Extremely easy', or 'Extremely safe' (7)	0.612	5.8 (1.5)
Subjective Norm	11	'Does not apply' (1) to 'All of the time' (6)	0.916	3.4 (1.4)

Table 4b**.** Results of Theory of Reasoned Action (TRA) Intention question administered to undergraduate students from a large university in the southeastern United States (n=69).

	Response n(%)						
Statement	*Extremely unlikely*	*Quite unlikely*	*Moderately unlikely*	*Neither likely nor unlikely*	*Moderately likely*	*Quite likely*	*Extremely likely*
When I have sex, I intend to use a birth control method that gives me full protection against unplanned pregnancy.	3 (4)	2 (3)	1 (1)	8 (12)	6 (9)	10 (14)	33 (48)

Bivariate Analyses

The results of Mann-Whitney U tests showed *Preconception Knowledge* did not differ by any of the characteristics considered, as shown in **Table 5**. Mann-Whitney U tests were also used to compare responses to subscales by demographic factors (**Table 6**). Those who reported being sexually active at the time of the survey scored significantly higher on the *Susceptibility* subscale (median=2.2 5;SE=0.14) compared to those who reported not being sexually active at present (median=1.6; SE=0.18)(p=0.009). The attitude subscale *Barriers* revealed students who were overweight (32% BMI ≥ 25) were significantly more likely to perceive that they would have health barriers to overcome in regards to PCC and pregnancy (median=2.3; SE=0.3) than those who were normal weight (median=1.4; SE=0.1). Responses to the attitude subscale *Cues to Action* differed by gender. Although similar, male undergraduate students were significantly more likely than females to report having not been informed of PCC or birth control use to prevent a pregnancy, by a healthcare professional or others (females median=1.3; SE=0.1, males median=2.0; SE=0.1; $p<0.05$). Responses to the *Subjective Norm* subscale differed by gender as well. This subscale identified that females (median=3.8; SE=0.2) were more likely to be influenced by parents, friends, and partners, than males (median=1.8; SE=0.4). Lastly, the *Self-Efficacy* subscale reported females were significantly more confident than males in terms of obtaining counseling, convincing their partner to use birth control, delaying sex, and indicating they would use birth control each time they had sex (median=8.3; SE=0.3; $p<0.05$).

Table 5. Results of independent Mann-Whitney U Tests, comparing *Preconception Knowledge* scores by demographic factors in a sample of undergraduate university students enrolled in an online basic nutrition course (n=69)

Variable	*Preconception Knowledge* Score Median (SE)
Gender	
Male	46 (3.8)
Female	46 (1.9)
Age	
≤ 20 years	54 (2.0)
>20 years	46 (2.6)
BMI	
Normal Weight	46 (2.0)
Overweight/obese	50 (2.9)
Currently Sexually Active	
Yes	46 (2.1)
No	54 (2.6)
Planning to be sexually active in next 6 months	
Yes	46 (2.0)
No	54 (2.9)
Have been sexually active in past 6 months	
Yes	46 (2.0)
No	54 (2.7)
Prior exposure to pregnancy and child development content	
Yes	46 (3.0)
No	46 (2.0)
Class Standing	
Lower	54 (2.6)
Upper	46 (2.1)

[a] $p<0.05$

Table 6. Results of Mann-Whitney U Tests, comparing Attitude subscales by demographic factors in a sample of undergraduate university students enrolled in an online basic nutrition course (n=69)

	Subscale Median (SE)							
	Susceptibility	Severity	Benefit	Barrier	Cues to Action	Personal Attitude	Subjective Norm	Self-efficacy
Gender								
Female	2. 0 (0.1)	3.7 (0.2)	4.0 (0.1)	1.6 (0.2)	1.3 (0.1)	5.0 (0.2)	3.8 (0.2)[a]	8.3 (0.3)[a]
Male	2.0 (0.1)	2.3 (0.4)	4.0 (0.4)	1.4 (0.3)	2.0 (0.1)[a]	5.7 (0.2)	1.8 (0.4)	5.1 (.06)
Age								
≤ 20 years	2.5 (0.2)	3.3 (0.2)	4.0 (0.2)	1.8 (0.2)	1.7 (0.1)	5.3 (0.2)	3.8 (0.2)	7.6 (0.4)
>20 years	2.0 (0.2)	3.7 (0.2)	4.0 (0.2)	1.6 (0.2)	1.3 (0.1)	4.7 (0.3)	3.4 (0.2)	8.3 (0.4)
BMI								
normal weight	2.3 (1.0)	3.3 (0.2)	4.0 (0.2)	1.4 (0.1)	1.3 (0.1)	5.4 (1.1)	3.9 (0.2)	7.8 (0.4)
overweight	2.3 (0.9)	3.8 (0.3)	4.0 (0.2)	2.3 (1.3)[a]	1.7 (0.1)	4.8 (1.2)	3.2 (0.3)	8.3 (0.5)
Current sexually active								
yes	2.2 (0.1)[a]	3.3 (0.2)	4.0 (0.2)	1.6 (0.2)	1.5 (0.1)	5.3 (0.2)	3.8 (0.2)	7.9 (0.4)
no	1.6 (0.2)	4.0 (0.3)	4.3 (0.1)	1.6 (0.2)	1.3 (0.1)	5.2 (0.3)	3.7 (0.3)	8.0 (0.5)
Planning to be sexually active in next 6 months								
Yes	2.1 (0.1)	3.3 (0.2)	4.0 (0.2)	1.6 (0.2)	1.3 (0.1)	5.3 (0.2)	3.7 (0.2)	7.6 (0.4)
No	2.0 (0.3)	4.0 (0.3)	4.0 (0.1)	2.0 (0.3)	1.7 (.01)	5.2 (0.4)	3.4 (0.4)	8.5 (0.7)
Have been sexually active in past 6 months								
Yes	2.3 (0.1)[a]	3.3 (0.2)	4.0 (0.1)	1.6 (0.2)	1.3 (0.1)	5.3 (0.2)	3.8 (0.2)	8.0 (0.4)
No	1.5 (0.2)	3.7 (0.3)	4.0 (0.2)	1.5 (0.3)	1.8 (0.2)	5.0 (0.3)	3.0 (0.4)	6.0 (0.7)
Prior exposure to pregnancy and child development content								
Yes	2.3 (0.2)	2.8 (0.3)	4.3 (0.2)	1.8 (0.3)	1.3 (0.1)	5.3 (0.2)	3.7 (0.3)	8.0 (0.5)
No	2.0 (0.1)	3.7 (0.3)	4.0 (0.2)	1.4 (0.1)	1.3 (0.1)	5.3 (0.2)	3.6 (0.2)	7.6 (0.4)
Class standing								
Lower	2.0 (0.2)	3.7 (0.2)	4.0 (0.2)	1.6 (0.2)	1.3 (0.1)	5.7 (0.3)	3.7 (0.2)	7.6 (0.4)
Upper	2.1 (0.1)	3.3 (0.2)	4.0 (0.2)	1.5 (0.2)	1.7 (0.1)[a]	5.0 (0.2)	3.5 (0.2)	8.3 (0.5)

[a] $p<0.05$

Spearman correlations where used to assess relationships between individual RHAB subscales. *Cues to Action* was significantly, moderately and negatively correlated with *Personal Attitude* (r=-.43), *Self-Efficacy* (r= .51), and *Subjective Norm* (r=.561) subscales (p< 0.01 for all). Responses to the *Benefits* subscale were significantly, and moderately positively correlated with responses to the *Personal Attitude* subscale (r=.448, p<.05). Responses to the *Personal Attitude* subscale were significantly, and moderately positively correlated with responses to the *Self-Efficacy* subscale (r=.51,p<.05).

Discussion

Knowledge scores overall were very low, with most students only correctly answering about half of the questions. Students appeared to understand the relationship between alcohol consumption and risk of negative fetal effects, as around 90% correctly answered questions related to this concept. This is similar to previous findings from Delgado, who found 81% correctly answered questions related to this concept.[92] Thus undergraduates were considered highly aware of dangers associated with substance use during pregnancy, such as alcohol, and this population further understood the risks of alcohol during pregnancy, and the possible outcome of birth defects.[92] Similarly, Charafeddine and colleagues, reported results of an intervention in a convenience sample of ~7200 Lebanese high school students, found that ~72% of students could accurately identify alcohol, smoking, and illicit drug use at pretest administration.[125] While alcohol awareness strategies continue to target young people, and samples of this target population appear to be aware of these issues, the CDC has

found that drinking to excess, and consuming alcohol during pregnancy continue to occur.[28,90,128]

Although participants appeared to be educated about the risks associated with alcohol consumption, many were unaware of the harms that could occur very early in pregnancy. For example, the finding that less than one third of students appeared to understand the critical nature of the very early period of pregnancy reflects the findings of Delgado.[92] For example, Delgado found that less than half of that population was aware of early exposure risks, and less than one third of students understood that body systems develop very early during pregnancy.[92] Students from our study also appeared to not understand the appropriate weight gain for a woman with a normal BMI (18.9-14.8kg/m^2) during pregnancy, with only 39% correctly answering 25-35 pounds, Delgado reported similar results, finding only 43% of students answered correctly.[92] More than 70% of this population indicated that it was important to receive PCC prior to becoming pregnant, which is in keeping with Delgado's findings.[92] However, while the majority of this population perceive themselves to be moderately to extremely aware of behaviors or factors occurring prior to conception that may influence pregnancy, and have been exposed to prenatal course content, this was not reflected in responses to specific knowledge questions. Moreover, very few students in this sample could correctly identify the optimal amount of time that should elapse between pregnancies. It is evident that there are several knowledge gaps in this population of undergraduate students.

How the decision is made to increase knowledge or awareness of health behaviors is important to consider, as this process may provide clues to points of

intervention.[127] The social cognition models that may best explain and predict family planning behaviors include the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), and the Social Cognitive Theory (SCT).[100] The HBM suggests the probability of a person performing a certain health behavior is dependent upon personal beliefs or perceptions about diseases and the ability to decrease their occurrences, and includes 5 subscales (*Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, and Cues to Action*).[100-102] Results of the *Perceived Susceptibility* subscale indicated a belief by this sample of students that their future offspring would not be particularly susceptible to health threats. Responses to the *Perceived Severity* subscale indicated that, on average, these students were ambivalent to potential risks to future offspring. Next, responses to the *Perceived Benefits* subscale indicated that, on average, this sample of students believed that taking action would likely be of some benefit. The mean score of 2.1 (SD 1.1) on the *Perceived Barriers* subscale indicated this sample of students perceived they did not experience significant barriers to taking action to protect the health of future offspring. The mean response of 1.6 (SD 0.5), for *Cues to Action*, indicated this sample has been somewhat informed by either a health professional or peer (parent, boyfriend, friend, etc.) of preconceptive health issues.

Strategies based on the HBM have been shown to increase self-efficacy and cues to action related to pregnancy among diabetic female adolescents, but the HBM fails to incorporate social cognitive variables such as individual intention or the influence from a significant other. [104-106] The TRA incorporates both of these factors, which have been found to be highly predictive of subsequent behaviors.[104-106] The TRA hypothesizes all behaviors are based on one's intentions and that intentions are driven

by attitude toward taking the action and the perceived social expectations regarding that behavior.[107] The mean score of 5.8 (SD 1.5) on the *Personal Attitudes* subscale indicated that this sample is somewhat positive about participating in these behaviors. However, the mean score of 3.4 (SD 1.4) on the *Subjective Norms* subscale indicated that this sample was somewhat ambivalent to ideas expressed by important individuals in their lives. The positive relationship detected between responses to the *Perceived Benefits* and the *Personal Attitudes* subscales indicated that students who were more likely to report the belief that PCC would lead to having a healthy pregnancy/infant were also more likely to report the belief that obtaining and using birth control is or would be easy, necessary, and safe.

This internal belief to act is further explained by the SCT. The SCT is best described by a causal model that suggests behavior, cognitive function, personal factors, and environmental events interact to determine a behavior.[109] Responses to self-efficacy questions indicated that this sample felt relatively confident in their ability to take action to protect the health of future offspring (mean=7.1; SD 2.6), and the relationship detected between *Personal Attitudes* and *Self-Efficacy* indicated that students who were more likely to report that they are confident about obtaining and using birth control, were also more likely to report finding birth control use to be easy, safe, and necessary.

The negative relationship detected between *Cues to Action* and *Personal Attitudes*, *Self-Efficacy*, and *Subjective Norms* indicated that students were confident in their ability to achieve a desirable preconceptive health status, as long as this health status was considered by the individual to be socially normal among family, peers, or

health providers. Students reported family, peers, or health providers provided their knowledge of preconceptive behavior. Additionally, attitudes toward participating in positive preconceptive behaviors were considered desirable for the individual if this health status was perceived to be socially normal among family, peers, or health providers. This is important, as studies have shown family, peers, or health care providers can serve as motivators to improve overall health, or present barriers to participating in positive health behaviors.[99,108] These cues to act upon health behaviors are also reflective of an individual's confidence that the time and effort spent on the action will result in the desired outcome.[101] Increasing internal motivation in undergraduate students, though challenging, has been somewhat successful in promoting positive health behaviors.[128] Though long-term effects have yet to be established[104], implementing strategies that combine these theories with increased understanding of behavior may help to predict improvements in family planning activities.[100]

This study expands upon previous research of knowledge and awareness levels of undergraduate students, but also explores attitudes of preconception care and pregnancy related health issues, such as prenatal weight status and past, present, and future sexual activity. It is important to highlight that current overweight or obese status was associated with perceived health barriers, and that being currently sexually active was associated with feeling susceptible to health threats. However, neither of these attitudes were associated with knowledge. To the best of the authors' knowledge, this is the first time these concepts have been explored in the same sample. However, given the fact that Delgado's work occurred nearly ten years ago[92], and results from this

sample show similar levels of knowledge, it is evident that research in this area continues to be needed.

Limitations

While this study provides information about undergraduate students' knowledge, awareness, and attitudes of preconception care, there are some limitations of the study. First the generalizability of the findings to the greater undergraduate population is unknown. The results of this study reflect responses from students enrolled in an introductory nutrition course in a large university in the southeastern U.S. While these students may be somewhat health-focused, as they self-selected into the nutrition course, this is also not known. In addition, the questionnaire was completed in an online format and unauthorized collaboration from other people potentially may have occurred. Repeating this survey in a non-health related class, such as Accounting, and doing so via both paper and online may increase generalizability of results. Finally, the survey was conducted at the beginning of the course, and it is unknown how much knowledge increased as a result of exposure to the course content. Repeating this study, and adding a post-assessment, may show increased knowledge in this population.

Conclusion

Results from this study indicate that, aside from dangers related to alcohol consumption during pregnancy, this undergraduate population has a general lack of knowledge regarding health behaviors that can positively or negatively affect maternal, fetal, and/or infant outcomes. More research is needed to better understand the motivations of undergraduates to participate in, or avoid, these healthy behaviors. Increasing knowledge, awareness, and promoting beneficial attitudes towards

preconceptive care has the potential to reduce risk of exposures and behaviors for the infant and improve the health of mothers, infants, and families. Therefore, these are important targets for future intervention. The findings from this current study can contribute to the development of those future interventions.

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APPENDIX: EXPANDED METHODS

Participants and Recruitment

This was an exploratory, cross-sectional study conducted among undergraduate students enrolled in an online, introductory nutrition course during the first summer session of 2015, and who were at least 18 years of age, were eligible to participate. Recruitment occurred within the first week of class, via an email from the course instructor informing students of the opportunity to receive 3 extra credit points for completing a survey about undergraduates' thoughts about preconception care. Those choosing not to complete the survey had the option of completing an equivalent alternative extra credit opportunity.

A link to the survey, hosted by the *Qualtrics 2015* online platform, was embedded in the email, and was active for the subsequent Friday, Saturday, and Sunday. Clicking the link delivered potential participants to a screen displaying the Student Information Sheet (**Appendix a**), which also served as the informed consent document and confirmed the student was 18 year of age or older. Potential participants then had the choice to proceed to the survey itself or to exit. By proceeding to the survey students were considered to have provided consent to be enrolled in the study. *Qualtrics* allows researchers to select 'hide IP address', making this information unavailable to researchers. As no identifiers were collected on the survey, responses were considered to be anonymous. At survey completion, students were reminded of the opportunity to receive extra credit and were prompted to take a screen shot of the 'Survey Complete' page. This screen shot was then provided to the course instructor to receive the extra credit. To limit the amount of missing data, responses to survey questions were set up as 'forced'. However, students were able to select 'choose not to respond', or a similar response, if relevant. Questions were designed to elicit close-ended or scaled Likert-like

answers focusing on facts and scenarios surrounding preconception care. The complete survey consisted of 77 questions, and the estimated completion time was 10-25 minutes. The University of Tennessee Institutional Review Board approved all study procedures prior to implementation.

Measures

In addition to demographic questions the survey included questions selected from two previously published surveys: the Reproductive Health Attitudes and Behavior (RHAB) questionnaire[101] (**Appendix b**) and the Pregnancy Issues Questionnaire[92] (PIQ) (**Appendix c**). Permission to use both instruments was obtained.

The RHAB instrument measures perceptions about health beliefs regarding preconceptive care, using three constructs: the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), and Social Cognitive Theory (SCT).[101] The RHAB originally targeted adolescent females and was thus modified to include males/partners, and healthy individuals. For example, 'How much do you worry that you could become pregnant?' was replaced with 'How much do you worry that you/your partner could become pregnant?'. In the revised survey, 19 of the 39 questions targeted the HBM, and were distributed across four sub-constructs: 'susceptibility' (4 questions), 'severity' (3 questions), 'benefit' (3 questions), 'barrier' (5 questions), and 'cues to action' (4 questions). Sixteen of the 40 questions targeted the TRA, and were distributed across four sub-constructs: 'personal attitude' (3 questions), 'subjective norm' (12 questions), and 'intention' (1 question). Finally, 4 of the 39 questions assessed 'self-efficacy', a sub-construct of the SCT.

The PIQ, originally developed for undergraduates in an introductory psychology course, contains items on knowledge, self-perception of awareness, and awareness of content related to healthy preconception status. Twenty-six of the 32 original questions were retained, as these were considered most directly relevant to the current research question and the method of implementation.

Data Analysis

Once the survey period closed, data were imported into IBM SPSS 20.0, where they were cleaned and analyzed. The dataset was evaluated for missing data and subjects responding to less than 80% of questions were dropped from analysis. Variables were tested for normality and those that were not normal were analyzed using nonparametric statistical methods. Responses to knowledge/awareness questions were calculated and scored on a scale from 1 to 100%, with 100% representative of correct answers on all knowledge/awareness questions. The response option, 'choose not to respond' was considered as incorrect, because if it were treated as missing the student's score would have been inflated, thus appearing the student did better overall. Responses to attitudes questions were summed and this summation was treated as a continuous variable. Descriptive statistics were used to describe demographics of the sample. Cronbach's alpha was used to assess the internal reliability consistency of responses to the RHAB sub-constructs. Chi-square analysis was used to examine relationships between two categorical variables. Nonparametric testing, such as Spearman's correlation was used to assess the relationship between continuous variables, such as preconception care knowledge and attitudes about preconception care, as preconception care knowledge was not normally distributed. Mann-Whitney U

tests were used to examine differences between dichotomous categorical variables, such as gender (when dichotomous), and continuous, non-normal variables such as RHAB subscales. ANOVA testing was not used to test for differences in continuous variables by more than one group as the sample size was too small and the data was not normally distributed. **Tables 7** and **8** reflect the types of variables and the individual tests utilized.

To determine if differences existed between various characteristics the following research questions were used:

Research Questions:

1. Are there differences, by various characteristics such as gender, age, and BMI, in the level of preconception care knowledge of undergraduates?
2. Are there differences, by various characteristics such as gender, age, and BMI, in the level of awareness of concepts of preconception care among?
3. Are there differences by, various characteristics such as gender, age, and BMI, in preconception care attitudes of undergraduates?

Table 7. Variables analyzed: Type and classification

Variable	Type (categorical, continuous)
Dependent Variables (DVs)	
Knowledge	Continuous
Awareness	Continuous
Attitude	Continuous
Independent Variables	
BMI	Continuous; Categorical
Sexual activity	Categorical
Gender	Categorical
Prior exposure	Categorical
Class	Categorical
Race	Categorical
Ethnicity	Categorical
Age	Continuous; Categorical

Table 8. Description of statistical tests utilized: By variable type and classification

Independent Variable	Dependent Variable	Statistical Test
BMI*	Attitude (cont)	Mann-Whitney U
Sexual activity		
Gender		
Prior exposure		
Class		
Race		
Ethnicity		
Sexual activity, prior exposure	Attitude (cont)	Chi-square
BMI (cont)**	Knowledge, awareness, attitude	Spearman's correlation
Age (cont)	Knowledge, awareness, attitude	Spearman's correlation
Attitude subscales	Knowledge	Spearman's correlation

*Cat=Categorical
**Cont=Continuous

Appendix a: Study Information Sheet

If you have any questions, please contact the Office of Research Compliance Officer at (865) 974-7697.

Online survey of undergraduates' knowledge, awareness, and attitudes about preconception care

INTRODUCTION

You are invited to participate in a research study. The purpose of this study is to better understand the current knowledge, awareness, and attitudes undergraduates have about preconception care.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY

You will be asked to answer the questions on the online survey to the best of your ability. The survey will take approximately 15 minutes to complete and we ask that you answer to the best of your knowledge and without looking elsewhere for the answers (i.e., textbooks, online, etc). The survey link will only be active for 72 hours. After that time, you will no longer have access to the survey. Your participation is entirely voluntary, though you may receive a small amount of extra credit for participating.

RISKS

There is no more than minimal risk for your participation in completing the survey. The completion of this survey is not a class requirement, but is voluntary. The instructor is offering 3 points of extra credit for completing this survey. However, in order to receive this extra credit, you must provide a screenshot of the completion page to the instructor, which will identify you as a participant in the study.

BENEFITS

Responses from this survey will allow us to better understand what undergraduate students know and believe about preconception care.

CONFIDENTIALITY

Information from this study will be kept confidential. We will not collect names, email addresses, or I.P addresses. Responses will be anonymous. Data will be stored securely and will be made available only to persons conducting the study unless participants specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link participants to the study.

COMPENSATION

Upon providing the instructor with a screenshot of the survey completion page, students participating in this study will receive 3 extra credit points. Those who do not wish to participate in the study may complete the alternative activity, outlined in the instructor's email, but must do so within the same time frame (72 hours) in order to receive the same number of extra credit points.

CONTACT

If you have questions at any time about the study or the procedures, you may contact the researcher, Katie Kavanagh, at 213 Jessie Harris Building, or 865-974-6250. If you have questions about your rights as a participant, contact the Office of Research Compliance Officer at (865) 974-7697.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the online survey at any time (by exiting out) without penalty. If you exit the survey before completing it your responses will not be kept or analyzed. However, you will not receive extra credit if you exit the survey before reaching the survey completion page.

By proceeding to the survey, you agree that you are 18 years of age or older.

[The following options will be presented at the bottom of the computer screen:]

'Proceed to survey'

'Exit. Do not proceed to survey'

Appendix b: Reproductive Health Attitudes and Behavior Instrument[100]

1. How much do you worry that you could become pregnant?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

2. How much do you worry that you could catch a sexually transmitted disease (eg AIDS, venereal disease, etc?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

3. How much do you worry that you could develop health problems during pregnancy?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

4. How much do you worry that your baby could develop health problems during your/your partner's pregnancy?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

5. If you developed problems during pregnancy, do you think that those problems would be:
    1. Not serious at all
    2. A little serious
    3. Somewhat serious
    4. Moderately serious
    5. Very serious

6. If your baby developed problems during pregnancy, do you think that the problems would be:
    1. Not serious at all
    2. A little serious
    3. Somewhat serious

4. Moderately serious
5. Very serious

7. If you had an unplanned pregnancy, do you think that this problem would be:
    1. Not serious at all
    2. A little serious
    3. Somewhat serious
    4. Moderately serious
    5. Very serious

8. Would having blood sugar levels in the normal range before becoming pregnant improve your chances of having a healthy baby?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

9. Would using birth control prevent an unplanned pregnancy?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

10. Would seeking preconception counseling (special medical care and advice) when planning a pregnancy improve your chances of having a health baby?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot

11. Would getting preconception counseling (special medical care and advice) improve your/your partner's chances of having a healthy pregnancy?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot

12. How much of a problem for you is the cost of birth control?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount

5. A lot

13. How much of a problem for you is getting birth control?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

14. How much of a problem for you is using birth control on a regular basis?
    1. Not at all
    2. A little
    3. Somewhat
    4. A moderate amount
    5. A lot

15. How difficult would it be to seek preconception counseling (special medical care and advice) when planning a pregnancy?
    1. Does not apply at all
    2. No problem at all
    3. A little problem
    4. Somewhat of a problem
    5. A moderate problem
    6. A big problem
16. How difficult would it be, to follow the preconception counseling advice given by health professional (eg keeping blood sugar levels in normal range, taking more insulin injections, etc)?
    1. Does not apply at all
    2. No problem at all
    3. A little problem
    4. Somewhat of a problem
    5. A moderate problem
    6. A big problem

17. Have you ever discussed how diabetes affects your pregnancy with your regular diabetes health care provider?
    1. No
    2. Yes

18. Has a health care professional (doctor, nurse, etc) ever told you that you should get special medical care and advice before you become pregnant or plan for a pregnancy?
    1. No
    2. Yes

19. Has anyone (boyfriend, parent, friend, etc) told you that you should get preconception counseling (special medical care and advice) before you become pregnant or plan for a pregnancy?
    1. No
    2. Yes

20. Has a healthcare professional (doctor, nurse, etc) told you that you should use some type of birth control when preventing a pregnancy?
    1. No
    2. Yes

21. Has anyone else (boyfriend, parent, friend, etc) told you that you should use some type of birth control when preventing pregnancy?
    1. No
    2. Yes

22. My getting preconception counseling (special medical care and advice) when planning pregnancy is (will be): □□
    □ Unnecessary □ Necessary

    1. □ Extremely dangerous
    2. □ Quite dangerous
    3. □ Slightly dangerous
    4. □ Neither
    5. □ Slightly safe
    6. □ Quite safe
    7. □ Extremely safe

23. My using birth control is (will be):

    □ Difficult □ Easy
    1. □ Extremely difficult
    2. □ Quite difficult
    3. □ Slightly difficult
    4. □ Neither
    5. □ Slightly easy
    6. □ Quite easy
    7. □ Extremely easy

24. My using birth control is (will be):

□ Dangerous ? Safe

1. □ Extremely dangerous
2. □ Quite dangerous
3. □ Slightly dangerous
4. □ Neither
5. □ Slightly safe
6. □ Quite safe
7. □ Extremely safe

25. Would you say that your husband/partner/boyfriend think you should use birth control when preventing a pregnancy?

0. Does not apply
1. Not at all
2. A little of the time
3. A moderate amount of the time
4. A lot of the time
5. All of the time

26. When it comes to using birth control, do you want to do what your husband/partner/boyfriend thinks you should do?

0. Does not apply
1. Not at all
2. A little of the time
3. A moderate amount of the time
4. A lot of the time
5. All of the time

27. Would you say that your husband/partner/boyfriend thinks you should seek preconception counseling (special medical care and advice) when planning a pregnancy?

0. Does not apply
1. Not at all
2. A little of the time
3. A moderate amount of the time
4. A lot of the time
5. All of the time

28. When it comes to preconception counseling do you want to do what your husband/partner/boyfriend thinks you should do?

0. Does not apply
1. Not at all
2. A little of the time
3. A moderate amount of the time
4. A lot of the time
5. All of the time

29. Would you say that your parents think you should use birth control when preventing a pregnancy?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

30. When it comes to using birth control, do you want to do what your parents think you should do?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

31. Would you say that your parents think that you should seek preconception counseling (special medical care and advice) when planning pregnancy?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

32. When it comes to preconception counseling, do you want to do what your parents think you should do?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

33. Would you say that most of your friends think that you should use birth control when preventing a pregnancy?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

34. When it comes to using birth control, do you want to do what most of your friends think that you should do?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

35. Would you say that most of your friends think that you should seek preconception counseling (special medical care and advice) when planning pregnancy?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

36. When it comes to preconception counseling, do you want to do what most of your friends think that you should do?
    0. Does not apply
    1. Not at all
    2. A little of the time
    3. A moderate amount of the time
    4. A lot of the time
    5. All of the time

37. When I have sex, I intend to always use some type of birth control to prevent an unplanned pregnancy.

Unlikely 1□ 2□ 3□ 4□ 5□ 6□ 7 □ Likely

38. When I have sex, I intend to use a birth control method that gives me full protection against unplanned pregnancy.
    Unlikely 1□ 2□ 3□ 4□ 5□ 6□ 7 □ Likely

On a scale of 0 to 10, rate how confident you are, that you could regularly do each activity for at least 6 months. Choose the number from 0 to 10 that best describes your level of confidence, where 0 is not at all confident and 10 is absolutely confident.

How confident am I that I could:

39. Get preconception counseling before I get pregnant.
40. Convince my husband/partner/boyfriend that it is necessary for me to use birth control, even if he does not want me to use it.
41. Change my insulin and diet to keep my blood sugar levels in normal range, even if I am not yet pregnant, but planning a pregnancy.

42. Delay sex with my husband/partner/boyfriend if birth control is not available.
43. Wait on becoming pregnant until my blood sugar levels are within the normal range.
44. Use birth control each time I have sex when preventing a pregnancy.

1 □ not at all 2 □ a little 3□ some 4 □ a moderate amount 5□ a lot

45. Would you get normal blood sugars:
46. Would you help understand how diabetes affects pregnancy:
47. Would you help you decided what birth control method to use:
48. Would you say that using birth control would help you prevent an unplanned pregnancy:

Appendix c: Pregnancy Issue Questionnaire

Your responses to the following questions will be used for research as well as to develop an upper-level course on prenatal development. To best develop this course, it is important to understand the types of information that most students do and do not know prior to taking the course. Please answer the following questions to the best of your ability and as honestly as possible. This questionnaire should only be completed by students who are 18 years of age or older.

Mark all of your answers directly on this questionnaire. Select ONE answer unless otherwise indicated.

1. Sally and her husband have decided to start trying to get pregnant. When should Sally schedule her first visit to the obstetrician?

a. Right now, before she becomes pregnant
b. As soon as she discovers she is pregnant
c. After she's been pregnant for at least 3 months
d. The timing of the first visit is not important

2. During which of the following periods of pregnancy is the developing baby at the greatest risk from exposure to harmful substances (such as prescription or illegal drugs) or environmental toxins (such as arsenic or mercury)?

a. First three months
b. Second three months
c. Third three months
d. The risk is equal throughout pregnancy
e.

3. The likelihood of a child being born with a chromosomal abnormality

a. Increases as the mother's age increases
b. Increases as the father's age increases
c. Both a and b
d. Is not related to the age of either parent

4. Which of the following has been proven effective in reducing the risk of neural tube defects such as spina bifida?

a. Vitamin A
b. Folic Acid
c. Calcium
d. Iron

5. Herbal supplements and herbal teas are typically considered safe to consume during pregnancy?

a. True
b. False

6. Mother with which of the following diseases/disorders is most likely to have a baby that is born heavier than normal at birth?

a. Diabetes
b. Anemia
c. Thyroid disease
d. High blood pressure

7. Women who will deliver a baby at age _____ years or older are considered to have a high risk pregnancy?

a. 25
b. 35
c. 40
d. 45

8. Women of normal weight prior to becoming pregnant are advised to gain a total of _____ during pregnancy.

a. 15-25 pounds
b. 25-35 pounds
c. 35-45 pounds
d. 45-55 pounds

9. Compared to pregnant women of normal weight, obese pregnant women are at increased risk for all of the following EXCEPT

a. Low blood pressure during pregnancy
b. Gestational diabetes
c. Miscarriage
d. Having a baby with a birth defect

10. Exposure to large amounts of alcohol during pregnancy is associated with which of the following

a. Facial deformities
b. Mental retardation
c. Heart defects
d. All of the above

11. Serious birth defects can be caused by a pregnant woman binge drinking (5 or more drinks) on one occasion even prior to the time that she realizes she is pregnant.

a. True

b. False

12. If a pregnant woman has an active case of a sexually transmitted disease such as genital herpes or syphilis the baby can be born with the disease?

a. True
b. False

13. By ____ weeks from conception all of the baby's organs and body systems have formed.

a. 8
b. 15
c. 22
d. 38

14. Which of the following senses function prior to birth? *Circle all that apply.*

a. Touch
b. hearing
c. taste
d. smell
e. vision

15. For women who want more than one child, it is recommended that at least _____ elapse between the birth of one child and becoming pregnant with the next to allow the mother's body time to physically recover.

a. 6 months
b. 1 year
c. 2 years
d. 3 years

16. Which of the following are considered dangerous during pregnancy and have been associated with birth defects or negative pregnancy outcomes (such as miscarriage, prematurity, or low birth weight)? *Check all that apply.*

□ Alcohol
□ Aspirin
□ Bleach
□ Cigarettes
□ Cocaine
□ Computer
□ Dental X-rays
□ Folic acid
□ Hot dogs
□ Lead
□ Marijuana
□ Microwave oven
□ Orange juice
□ Seafood
□ Tylenol
□ Vitamin A

17. Pregnant women should avoid which of the following activities? *Check all that apply.*

□ Aerobic exercise
□ Airplane travel
□ Cleaning the house
□ Dying their hair
□ Getting a manicure or a pedicure
□ Getting dental X-rays
□ Pumping gas
□ Scuba diving
□ Sexual intercourse
□ Swimming
□ Using hot tubs and saunas
□ Wearing a seatbelt

18. **Prior to becoming pregnant**, what should a woman do to improve her chances of having a healthy pregnancy and a healthy baby?

19. **Once a woman finds out she is pregnant**, what should she do to improve her chances of having a healthy pregnancy and a healthy baby?

20. Below is a list of terms related to pregnancy. Check the terms that you are aware of or have ever heard before. *Check all that apply.*

□ Amniocentesis
□ Blastocyst
□ Chorionic villus sampling
□ Chromosome
□ Differentiation
□ Doula
□ Ectopic pregnancy
□ Embryo
□ Epidural block
□ Episiotomy
□ Estrogen
□ Fallopian tubes
□ Fetal alcohol syndrome
□ Fetus
□ Folic acid
□ Lanugo
□ Meconium
□ Meiosis
□ Miscarriage
□ Neural tube defects
□ Ovaries
□ Oxytocin
□ Peritoneum
□ Placenta
□ Placenta previa
□ Preeclampsia

□ Progesterone
□ Sperm
□ Stillbirth
□ Teratogen
□ Testes
□ Testosterone
□ Toxemia
□ Toxoplasmosis
□ Trophoblast
□ Ultrasound
□ Uterus
□ Vernix caseosa
□ Zona pellucida
□ Zygo

21. Have you ever taken a course that contained information on pregnancy and/or child development?

a. No
b. Yes

22. If yes, where was the class offered? (circle all that apply)

a. High school
b. College or University
c. Hospital
d. Other (Please specify:_____)

23. To what extent do you feel that you are aware of the behaviors and other factors that are potentially dangerous to a developing baby during pregnancy?

a. Extremely aware
b. Moderately aware
c. Slightly aware
d. Not aware at all

24. To what extent do you feel you are aware of the positive behaviors and other actions pregnant women can take to increase their odds of having a healthy pregnancy and a healthy baby?

a. Extremely aware
b. Moderately aware
c. Slightly aware
d. Not aware at all

25. How interested would you be in taking a course that covered pregnancy and fetal development as well as pre-pregnancy issues that can influence the developing baby?

a. Extremely interested
b. Moderately interested
c. Slightly interested
d. Not at all interested

26. What is your main source of medical information?

a. Medical professionals (doctors or nurses)
b. Internet or medical websites
c. Books or magazines
d. Family
e. Friends

f. Other (please specify:_____)

27. How likely would you be to visit an interactive, informational website targeted to college students containing information on risk factors for poor pregnancy outcomes, fetal development, and other pre-pregnancy and pregnancy issues?

a. Definitely would visit website
b. Probably would visit website.
c. May or may not visit website
d. Probably would NOT visit website
e. Definitely would NOT visit website

28. What is your age?

a. less than 18
b. 18-24 years
c. 25-30 years
d. 30-35 years
e. over 35 years

29. What is your gender?

a. Female
b. Male

30. What is your class?

a. Freshman
b. Sophomore
c. Junior
d. Senior
e. Other (employee, part-time student, etc.)

31. What is your race/ethnicity?

a. White, Non-Hispanic
b. Black, Non-Hispanic
c. c. Hispanic
d. Asian
e. Other
f. Multiracial

32. Do you have any children?

a. No
b. Yes (How many? _____ What ages? _____)

Appendix d: Knowledge, Attitudes, and Awareness of Preconception Care Survey

1. How old are you?

2. What is your gender?
    a. Female
    b. Male
    c. Other
    d. Choose not to respond

3. How tall are you? (in feet and inches)

4. How much do you weigh? (in pounds)

5. What is your class?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Other (employee, part-time student, etc.)
    f. Choose not to respond

6. What is your race?
    a. American Indian/ Alaska Native
    b. Asian
    c. Black/African American
    d. Hawaiian/Pacific Islander
    e. White
    f. Other
    g. Choose not to respond

7. What is your ethnicity?
    a. Hispanic/Latino(a)
    b. Not Hispanic/Latino(a)
    c. Choose not to respond

8. Are you currently sexually active?
    a. Yes
    b. No
    c. Choose not to respond

9. Have you been sexually active in the last 6 months?
    a. Yes
    b. No
    c. Choose not to respond

10. Do you plan to be sexually active in the next 6 months?
    a. Yes
    b. No
    c. Choose not to respond

11. What is your sexual orientation?
    a. Heterosexual (straight)
    b. Gay or Lesbian
    c. Bisexual
    d. Transgender
    e. Don't know/not sure
    f. Choose not to respond

12. Sally and her husband have decided to start trying to get pregnant. When should Sally schedule her first visit to the obstetrician?
    a. Right now, before she becomes pregnant
    b. As soon as she discovers she is pregnant
    c. After she's been pregnant for at least 3 months
    d. The timing of the first visit is not important
    e. Choose not to respond

13. During which of the following periods of pregnancy is the developing baby at the greatest risk from exposure to harmful substances (such as prescription or illegal drugs) or environmental toxins (such as arsenic or mercury)?
    a. First three months
    b. Second three months
    c. Third three months
    d. The risk is equal throughout pregnancy
    e. Choose not to respond

14. The likelihood of a child being born with a chromosomal abnormality
    a. Increases as the mother's age increases
    b. Increases as the father's age increases
    c. Both a and b
    d. Is not related to the age of either parent
    e. Choose not to respond

15. Which of the following has been proven effective in reducing the risk of neural tube defects such as spina bifida?
    a. Vitamin A
    b. Folic Acid
    c. Calcium
    d. Iron
    e. Choose not to respond

16. Herbal supplements and herbal teas are typically considered safe to consume during pregnancy?
    a. True
    b. False
    c. Choose not to respond

17. Mother with which of the following diseases/disorders is most likely to have a baby that is born heavier than normal at birth?
    a. Diabetes
    b. Anemia
    c. Thyroid disease
    d. High blood pressure
    e. Choose not to respond

18. Women who will deliver a baby at age ____ years or older are considered to have a high risk pregnancy?
    a. 25
    b. 35
    c. 40
    d. 45
    e. Choose not to respond

19. Women of normal weight prior to becoming pregnant are advised to gain a total of ____ during pregnancy.
    a. 15-25 pounds
    b. 25-35 pounds
    c. 35-45 pounds
    d. 45-55 pounds
    e. Choose not to respond

20. Compared to pregnant women of normal weight, obese pregnant women are at increased risk for all of the following EXCEPT
    a. Low blood pressure during pregnancy
    b. Gestational diabetes
    c. Miscarriage
    d. Having a baby with a birth defect
    e. Choose not to respond

21. Exposure to large amounts of alcohol during pregnancy is associated with which of the following
    a. Facial deformities
    b. Mental retardation
    c. Heart defects
    d. All of the above
    e. None of the above
    f. Choose not to respond

22. Serious birth defects can be caused by a pregnant woman binge drinking (5 or more drinks) on one occasion even prior to the time that she realizes she is pregnant.
    a. True
    b. False
    c. Choose not to respond

23. By ____ weeks from conception all of the baby's organs and body systems have formed.
    a. 8
    b. 15
    c. 22
    d. 38
    e. Choose not to respond

24. For women who want more than one child, it is recommended that at least ____ elapse between the birth of one child and becoming pregnant with the next to allow the mother's body time to physically recover.
    a. 6 months
    b. 1 year
    c. 2 years
    d. 3 years
    e. Choose not to respond

25. Which of the following are considered dangerous during pregnancy and have been associated with birth defects or negative pregnancy outcomes (such as miscarriage, prematurity, or low birth weight)? *Check all that apply.*

□ Alcohol
□ Aspirin
□ Bleach
□ Cigarettes
□ Cocaine
□ Computer
□ Dental X-rays
□ Folic acid
□ Choose not to respond
□ Hot dogs
□ Lead
□ Marijuana
□ Microwave oven
□ Orange juice
□ Seafood
□ Tylenol
□ Vitamin A

26. Pregnant women should avoid which of the following activities? *Check all that apply*.

□ Aerobic exercise
□ Airplane travel
□ Cleaning the house
□ Dying their hair
□ Getting a manicure or a pedicure
□ Getting dental X-rays
□ Pumping gas
□ Scuba diving
□ Sexual intercourse

□ Swimming
□ Using hot tubs and saunas
□ Wearing a seatbelt
□ Choose not to respond

27. Have you ever taken a course that contained information on pregnancy and/or child development?
    a. No
    b. Yes
    c. Choose not to respond

28. If yes, where was the class offered? (check all that apply)
    a. High school
    b. College or University
    c. Hospital
    d. Other (Please specify:_____)
    e. Choose not to respond

29. To what extent do you feel you are aware of the behaviors and other factors that are potentially dangerous to a developing baby during pregnancy?
    a. Extremely aware
    b. Moderately aware
    c. Slightly aware
    d. Not aware at all
    e. Choose not to respond

30. To what extent do you feel you are aware of the positive behaviors and other actions pregnant women can take to increase their odds of having a healthy pregnancy and a healthy baby?
    a. Extremely aware
    b. Moderately aware
    c. Slightly aware
    d. Not aware at all
    e. Choose not to respond

31. How interested would you be in taking a course that covered pregnancy and fetal development as well as pre-pregnancy issues that can influence the developing baby?
    a. Extremely interested
    b. Moderately interested
    c. Slightly interested
    d. Not at all interested
    e. Choose not to respond

32. What is your main source of medical information?
    a. Medical professionals (doctors or nurses)
    b. Internet or medical websites

c. Books or magazines
d. Family
e. Friends
f. Other (please specify:_____)
g. Choose not to respond

33. How much do you worry that you/your partner could become pregnant?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

34. How much do you worry that you could catch a sexually transmitted disease (eg AIDS, venereal disease, etc)?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

34. How much do you worry that you/your partner could develop health problems during pregnancy?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

35. How much do you worry that your baby could develop health problems during you/your partner's pregnancy?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

36. If you/your partner developed problems during pregnancy, do you think that those problems would be:
    a. Not serious at all
    b. A little serious
    c. Somewhat serious

d. Moderately serious
e. Very serious
f. Choose not to respond

37. If your baby developed problems during pregnancy, do you think that the problems would be:
    a. Not serious at all
    b. A little serious
    c. Somewhat serious
    d. Moderately serious
    e. Very serious
    f. Choose not to respond

38. If you/your partner had an unplanned pregnancy, do you think that this problem would be:
    a. Not serious at all
    b. A little serious
    c. Somewhat serious
    d. Moderately serious
    e. Very serious
    f. Choose not to respond

39. Would using birth control prevent an unplanned pregnancy?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

40. Would seeking preconception counseling (special medical care and advice) when planning a pregnancy improve your chances of having a healthy baby?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

41. Would getting preconception counseling (special medical care and advice) improve you/your partner's chances of having a healthy pregnancy?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot

f. Choose not to respond

42. How much of a problem for you is the cost of birth control?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

43. How much of a problem for you is getting birth control?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

44. How much of a problem for you is using birth control on a regular basis?
    a. Not at all
    b. A little
    c. Somewhat
    d. A moderate amount
    e. A lot
    f. Choose not to respond

45. How difficult would it be to seek preconception counseling (medical care and advice) when planning a pregnancy?
    a. Does not apply at all
    b. No problem at all
    c. A little problem
    d. Somewhat of a problem
    e. A moderate problem
    f. A big problem
    g. Choose not to respond

46. How difficult would it be, to follow the preconception counseling advice given by health professional?
    a. Does not apply at all
    b. No problem at all
    c. A little problem
    d. Somewhat of a problem
    e. A moderate problem
    f. A big problem
    g. Choose not to respond

47. Has a health care professional (doctor, nurse, etc) ever told you that you should get special medical care and advice before you become pregnant or plan for a pregnancy?

This is called preconception counseling or pregnancy planning.

a. Yes
b. No
c. Choose not to respond

48. Has anyone else (boyfriend, parent, friend, etc) told you that you should get preconception counseling (special medical care and advice) before you become pregnant or plan for a pregnancy?
    a. Yes
    b. No
    c. Choose not to respond

49. Has a healthcare professional (doctor, nurse, etc) told you that you should use some type of birth control when preventing a pregnancy?
    a. Yes
    b. No
    c. Choose not to respond

50. Has anyone else (boyfriend, parent, friend, etc) told you that you should use some type of birth control when preventing pregnancy?
    a. Yes
    b. No
    c. Choose not to respond

51. My getting preconception counseling (special medical care and advice) when planning pregnancy is (will be):
    a. Extremely unnecessary
    b. Quite unnecessary
    c. Slightly unnecessary
    d. Neither
    e. Slightly necessary
    f. Quite necessary
    g. Extremely necessary
    h. Choose not to respond

52. My using birth control is (will be):
    a. Extremely difficult
    b. Quite difficult
    c. Slightly difficult
    d. Neither
    e. Slightly easy
    f. Quite easy
    g. Extremely easy

h. Choose not to respond

53. My using birth control is (will be):
    a. Extremely dangerous
    b. Quite dangerous
    c. Slightly dangerous
    d. Neither
    e. Slightly safe
    f. Quite safe
    g. Extremely safe
    h. Choose not to respond

54. Would you say that your husband/partner/boyfriend thinks you should use birth control when preventing a pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

55. When it comes to using birth control, do you want to do what your husband/partner/boyfriend thinks you should do?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

56. Would you say that your husband/partner/boyfriend thinks you should seek preconception counseling (special medical care and advice) when planning a pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

57. When it comes to preconception counseling do you want to do what your husband/partner/boyfriend thinks you should do?
    a. Does not apply

b. Not at all
c. A little of the time
d. A moderate amount of the time
e. A lot of the time
f. All of the time
g. Choose not to respond

58. Would you say that your parents think you should use birth control when preventing a pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

59. When it comes to using birth control, do you want to do what your parents think you should do?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

60. Would you say that your parents think that you should seek preconception counseling (special medical care and advice) when planning pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

61. When it comes to preconception counseling, do you want to do what your parents think you should do?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

62. Would you say that most of your friends think that you should use birth control when preventing a pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

63. When it comes to using birth control, do you want to do what most of your friends think that you should do?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

64. Would you say that most of your friends think that you should seek preconception counseling (special medical care and advice) when planning pregnancy?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

65. When it comes to preconception counseling, do you want to do what most of your friends think that you should do?
    a. Does not apply
    b. Not at all
    c. A little of the time
    d. A moderate amount of the time
    e. A lot of the time
    f. All of the time
    g. Choose not to respond

66. When I have sex, I intend to use a birth control method that gives me full protection against unplanned pregnancy.
    a. Extremely unlikely
    b. Quite unlikely

c. Moderately unlikely
d. Neither
e. Moderately likely
f. Quite likely
g. Extremely likely
h. Choose not to respond

On a scale of 1-10, rate how confident you are, that you could regularly do this activity for at least 6 months. Choose the number from 1-10 that best describes your level of confidence, where 1 is not confident at all and 10 is absolutely confident.

67. Get preconception counseling before I get pregnant. _____

68. Convince my husband/partner/boyfriend that it is necessary for me to use birth control, even if he does not want me to use it.

69. Delay sex with my husband/partner/boyfriend if birth control is not available.

70. Use birth control each time I have sex when preventing a pregnancy.

71. Do you have any children?
    a. No
    b. Yes
    c. Choose not to respond

If Yes

72. How many? What ages?

VITA

Kelly Crusenberry was born in Bristol, Tennessee and has resided in east Tennessee her entire life. She graduated from the University of Tennessee-Knoxville in May 2014 with a Bachelor of Science in Nutrition and began graduate school at the University of Tennessee in August 2014. During graduate school, Kelly served as a member of the Infant Child and Adolescent Nutrition (ICAN) Lab and assisted with research projects. Kelly is pursuing a master's degree: Master of Science (MS) in Public Health Nutrition. Her interests include maternal and child health, chronic disease prevention, and parental feeding styles. Kelly's long-term career goal is to work within a pediatric medical center that will improve the health of children through exceptional, comprehensive family-centered care, wellness, and other nutrition-related needs.