

A Pilot Study to Assess Nutrition Knowledge and Behaviors of Low-Income,
Pregnant Adolescents and Adult Women

by

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ABSTRACT

Low income, pregnant adolescents have an increased risk of adverse pregnancy outcomes, such as preterm birth, delivery of low birth weight babies and excessive gestational weight gain that increases the risk of postpartum overweight and obesity. Inadequate dietary intake is a modifiable risk factor that may differentially impact maternal health and fetal outcomes for pregnant adults and adolescents. To evaluate the effectiveness of a social media intervention on improving prenatal health knowledge and dietary intake, 22 racially diverse pregnant women (59% Black and 36% White) were recruited and adolescent (n=10) outcomes compared to those of adults (n=12) across the intervention. Pre- and post-intervention nutrition knowledge questionnaires and diet recalls were completed to assess nutrition knowledge and dietary intake. When assessing dietary change across the intervention, significant decreases in fat (pre vs. post, 97.9 ± 0.2 g vs. 90.2 ± 0.2 g, $P=0.047$) and folate intake (pre vs. post, 537.6 ± 0.3 μ g vs. 531.2 ± 0.2 μ g, $P=0.041$) were observed while significant increases in carbohydrate (pre vs. post, 318.9 ± 0.2 g vs. 335.9 ± 0.2 g, $P<0.001$), calcium (pre vs. post, 851.3 ± 0.3 mg vs. 893.5 ± 0.2 mg, $P<0.001$) and magnesium intakes (pre vs. post, 212.9 ± 0.2 mg vs. 227.8 ± 0.2 mg, $P<0.001$) occurred. These time effects occurred independent of group (adolescents vs. adults) as time*group interactions were not significant ($p>0.05$) with the exception of sugar intake. Increases in sugar intake across the intervention were greater among the adolescent group (adolescent vs. adult, 7.9 ± 0.2 g vs. 6.0 ± 0.2 g, $P=0.023$). Overall nutrition knowledge was limited and confusion regarding MyPlate recommendations persisted. The inadequate dietary behaviors observed suggest that future interventions should focus education on specific dietary nutrients such as added sugars and fiber to improve dietary intakes. The best way to actively engage pregnant adolescents is unknown: however, social media has the potential to reach teens and low-income women

with education that may be key in allowing interventions to change dietary habits and behaviors.

DEDICATION

I would like to dedicate this thesis to my supportive and always positive fiancé, Kyle. I am very fortunate to have his unconditional support and love and I would not have been able to complete this process without it. He forced me to take breaks during the writing process and get out and enjoy life. He listened endlessly while I talked about my thesis. I am forever grateful. I would also like to dedicate this thesis to my family: my twin sister, Katie, my younger sister Anne, and my parents. Thank you for reading drafts of my thesis and giving me constant support and invaluable guidance throughout the process. I would like to thank my dogs, Charlotte and Duke, for staying by my side and comforting me as I wrote and researched. Lastly, I would like to dedicate this thesis to my unofficial family: my friends, for always being encouraging, kind, and supportive of my goal to return to school to become a registered dietitian and to embark on a Masters degree. Without these people in my life, I would not be where I am today. They have been constant cheerleaders for my success and have allowed me to chase my dreams.

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CHAPTER 1

INTRODUCTION

Overview

Low-income, pregnant adolescents are a high-risk, underserved population with an increased risk of obstetric complications.¹ The Centers for Disease Control and Prevention (CDC) report that 305, 388 babies were born in 2012 to adolescents aged 15-19 years of age.² Non-Hispanic black, Latino, and low-income adolescents have the highest rates of teenage pregnancy in the United States.² Adverse outcomes such as higher gestational weight gain, excess weight postpartum,³ low birth weight babies, and inefficient emotional support contribute to poorer health outcomes in this high risk pediatric population.¹

Continued growth occurs into adolescence and entering pregnancy during this time may complicate the growth process for both the mother and child. Furthermore, excessive weight gain is more prevalent among pregnant adolescents than pregnant adults,¹ contributing to negative outcomes such as preterm birth, gestational diabetes, low birth weight, cesarean section, macrosomia, and postpartum weight retention in adolescent and adult women.⁴ Motivating adolescents to maintain healthful lifestyle habits is a challenge, especially among low-income teens who often lack access to high-quality prenatal care and healthful foods.⁵

Inadequate dietary intake may contribute to the risk for complications during pregnancy for both pregnant adolescents and pregnant adults. Previous evidence suggests that pregnant adult women with higher incomes are more likely to strive to improve diet during pregnancy with higher intakes of vegetables, micronutrients, and fiber, when compared to low-income women.³ Adolescent diets are particularly high in

sugar and fat and low in micronutrients.⁶ Greater sugar consumption during pregnancy has been shown to contribute to both maternal and neonatal risks, which may influence adult and teen pregnancies differently. High glucose levels in pregnant adult women have been correlated with higher infant birth weights.⁷ High-sugar diets among adults have been associated with preeclampsia⁸ and gestational diabetes⁹ and have been associated with an increased risk of lower birth weight and small for gestational age (SGA) infants in adolescents.⁶ In addition, a high-sugar diet can displace other, more important, nutrients within the diet.⁶

Additional risk factors for pregnancy complications, including excessive gestational weight gain, are affected by a combination of factors such as poor dietary intake, low socioeconomic status and higher age-related risk. Low-income, African-American, pregnant adolescents have a higher risk for gaining excessive pregnancy weight and consuming a low-quality diet.¹ A study conducted in 2012 concluded that low-income pregnant women were more likely to gain excessive weight than women of higher economic status.³ Furthermore, it has been shown that growing adolescents gain more gestational weight compared to non-growing adolescents and adults.¹⁰ The World Health Organization (WHO) conducted a multi-country study in 2013 concluding that adolescent pregnancy was associated with a higher risk of delivering a low-birth weight baby, preterm delivery and adverse neonatal conditions.¹¹ This complex web of factors that affects overall pregnancy outcomes for both the mother and child requires population specific interventions in order to successfully improve diet and health.

The majority of studies focusing on improving dietary intake have been in adult women. Previous studies of low-income, pregnant women have used intervention methods such as in-home counseling sessions and websites to improve gestational weight gain and postpartum weight loss.^{12,13} A randomized controlled trial conducted by

Phelan, et al.,¹² used one face-to-face interview in conjunction with mailed education material in order to promote healthy behaviors among pregnant women. Other studies have used intervention methods such as educational newsletters to encourage appropriate weight gain and have shown that women who participate more actively in these interventions gain a more appropriate amount of gestational weight.¹⁴ Additionally, Hui, et al.,^{15,16} conducted studies that successfully used exercise-based interventions to help prevent excessive gestational weight gain among pregnant women.

Research among low-income, pregnant adolescents has utilized in-person counseling and website-based education.^{17,18} However, interventions remain sparse and results are not consistent.¹⁷ While a few studies have focused on preventing excessive weight gain or identifying risk factors for this population group,^{3,14} other studies have used peer counseling to educate low-income adolescents on pregnancy prevention, with some success.¹⁸ Using new technologies such as text messaging and internet sites have proven helpful for promoting healthy behaviors among non-pregnant teens,¹⁹ but these methods have not been widely used to improve the dietary intake and gestational weight gain of adolescent, pregnant populations.

Low-income pregnant adolescents remain an underserved population and therefore will benefit greatly from receiving prenatal health and nutrition education. Most adolescents, including those from lower socioeconomic groups,⁵ have greater access to social media and text messaging programs^{20,21} that could be used to target this hard to reach population. However, most interventions to date that aim to improve weight gain and dietary intake have not utilized social media to impact the prenatal outcomes of pregnant adolescents.

The Purpose of Study

The purpose of this study was to examine the nutrition knowledge and behaviors of low-income, pregnant, adolescents in comparison to adult women, residing in Rochester, New York after receiving prenatal nutrition and fitness information via a social media intervention. Data collected from medical records, dietary surveys and 24-hour diet recalls were used to assess relationships between sugar and fiber intake and gestational weight gain. Knowledge about key nutrients and foods (such as sugar, fruits, vegetables, fiber, soda, etc.) were extracted from participant surveys and used to evaluate associations between nutritional knowledge/behaviors and maternal health outcomes including weight gain.

Research Aims and Hypotheses

The overall aim of this study was to compare the nutrition knowledge and behaviors of low-income, pregnant adolescents and adult women. Dietary intake data from both groups of women were assessed to determine whether receiving prenatal health information across gestation improved dietary intake in regards to sugar and fiber intake and decreased the risk of excessive gestational weight gain.

Research question 1: Will the social media intervention contribute to enhanced dietary intake and increased knowledge about nutrition and health post-intervention?

H₁: Nutritional intake will be improved (lower fat and greater micronutrient intakes) after receiving the social media intervention for pregnant adolescents and adults.

H₂: Pregnant adults and pregnant adolescents will have improved knowledge and prenatal health after receiving the social media intervention.

Research question 2: Does diet differ among low-income, pregnant adolescents and low-income, pregnant adults?

H₃: Pregnant adults will have better overall dietary intake compared to pregnant adolescents pre and post-intervention.

Research question 3: Does sugar intake change after receiving digital health messages?

H₄: A reduction in sugar intake will occur in adolescent and adult women during the proposed intervention.

Research question 4: Does fiber intake change after receiving digital health messages?

H₅: An increase in fiber intake will occur in adolescent and adult women during the proposed intervention.

Research question 5: Will higher intakes of sugar during pregnancy correlate with excessive gestational weight gain among adolescents and adults?

H₆: Sugar intake by pregnant adolescents and adult women will positively correlate with excessive gestational weight gain.

H₇: Sugar intake by pregnant adolescents and adult women will differ by gestational weight gain categories and pre-pregnancy BMI classifications.

CHAPTER 2
REVIEW OF LITERATURE

Teen Pregnancy

Low-income, pregnant adolescents are a high-risk, underserved population, with an increased risk of gestational and post-gestational complications.¹ Within the United States, the Centers for Disease Control and Prevention (CDC) reported that 305, 388 babies were born to adolescents aged 15-19 years in 2012.² The prevalence of teenage pregnancy is not specific to the United States; 15 million babies are born to adolescents less than 19 years of age worldwide every year,²³ and the World Health Organization estimates that 11% of all births worldwide are to women 15-19 years of age, of which, 90%, are from low and middle income countries.¹¹

The United States has the highest rate of adolescent pregnancy among developed countries,²³ and although pregnancy rates have declined by 9% over the past two decades, the economic cost of pregnancy has increased.²⁴ Additionally, unintended pregnancy rates have not declined within the past couple decades, and it is estimated that 50% of live births in the United States are unplanned.²⁴ Among adolescents aged 19 and younger, more than four out of five pregnancies are unplanned.² Most unplanned pregnancies occur among adolescents, unmarried women, Black women, and uneducated women.²

Adolescent pregnancies, planned or unplanned, contribute to high health care costs within the United States, indicating a need for cost-effective, helpful intervention methods.¹⁹ In 2011, an average of \$8,680 was spent per person in the United States on health care.² Of these health care costs, pregnancy-related costs exceeded \$24.5 billion annually in the United States in 2007.²⁴ Adolescent pregnancy and childbirth cost United

States taxpayers \$9.4 billion in 2010, mostly covering costs such as increased health care costs, foster care, and lost tax revenue.²⁵ Within the United States, Arkansas ranks number 50 as the state with the highest teen birth rate, with 43.5 births per 1,000 adolescents. Conversely, Massachusetts ranks number 1 with only 12.1 teen births per 1,000 girls.²⁵ In New York alone, 11,129 teen births (17.7 per 1000) occurred in 2013.²⁵ The cost of births to teens aged 15 to 19 years of age in New York, ranked 8th in the nation, was \$337 million in 2010.²⁵ These costs also include the public health care costs such as child welfare and consequences such as lost tax revenue and decreased earnings by the teenage parents.²⁵

The Nationwide Inpatient Sample by AHRQ reported that the mean hospital stay per pregnancy cost \$8,680 to \$22,400 in 2007.²⁴ Pregnancy complications such as cesarean section, increased diagnostic testing and fertility treatments all increase the overall cost of pregnancy.²⁴ The prevalence of cesarean section has risen in the U.S. over the past two decades by 53%, and this contributes greatly to the overall cost of pregnancy.²⁴ Low-birth weight and pre-term birth, complications associated with adolescent pregnancy specifically, also contribute to the high financial cost of pregnancy.²⁴ Pre-term births accounted for 19% (50 million) of all hospital charges related to pregnancy in the year 2007.²⁴ It has been estimated that a pre-term birth costs about \$7,550 per infant whereas the cost of a full-term birth is only \$1,015.²⁴

Women who do not have health insurance are less likely to initiate prenatal care, contributing to pregnancy complications that further add to the economic burden of pregnancy for the United States.²⁴ Age and socioeconomic factors also play a role in the receipt of prenatal care. The Human Resources and Services Administration in the United States reported that among the youngest pregnant adolescents, under 15 years of age, only 32% received any prenatal care during their first trimester in 2008.²⁶ Receipt of

prenatal care went up to 54% for adolescents aged 15-19 years, and as age increased, levels of care dramatically increased.²⁶ Racial disparities affect receipt of prenatal care as well, and within the United States in 2008, white and Asian women had the highest rates of prenatal care during their first trimester at 76% and 77%, respectively. Only 64% of Hispanic women, 60% of Black women, and 53% of American Indian women received prenatal care during their first trimester.²⁶

The combination of high rates of adolescent pregnancy, high health care costs in the United States, and increased risk factors among adolescents contribute to a problem that would benefit from specific interventions to increase incidence of affordable, prenatal care among adolescents and healthy pregnancies. Finding cost-effective solutions to target this problem is important, especially since the United States has the highest rates of teenage pregnancy within the developed world.²³ In addition, adolescents have an increased risk of complications during pregnancy, which can increase the overall health care costs for these pregnancies. Increasing rates of adequate prenatal care and healthy behaviors during pregnancy may decrease the financial burden within the United States.

Gestational Weight Gain

Definition of Problem

The Institute of Medicine (IOM) defines excessive gestational weight gain (EGWG) as weight gain greater than the recommended upper bound based on pre-pregnancy BMI.²⁷ These BMI classes were originally established by using height/weight tables from the Metropolitan Life Insurance Company in 1959.²⁸ In 1990, the IOM gestational weight gain recommendations were established to promote healthy weight gain that would increase fetal growth but also minimize the risk of adverse maternal and

fetal outcomes.²⁹ The 1990 IOM recommendations cited appropriate weight gain as 28-40 lbs. for underweight women (BMI below 19.8), 28-40 lbs. for normal weight women (BMI 19.8-26.0), 15-25 lbs. for overweight women (BMI >26.0-29.0), and at least 15 lbs. for obese women (BMI 29.0 and above).³⁰

In 1995, the World Health Organization (WHO), defined cutoff points for BMI classes to assess obesity that were also adopted by organizations such as the National Heart, Lung and Blood Institute (NHLBI).³¹ It was found that the BMI classifications used in the 1990 IOM recommendations differed from the new WHO cutoff points for BMI.³¹ Subsequently, the IOM guidelines were revised in 2009 to include more clear weight gain recommendations due to the growing amount of obesity in the United States.³² The current, 2009 IOM recommendations cite appropriate weight gain of 28-40 lbs. for underweight women (BMI below 18.5), 25-35 lbs. for normal weight women (BMI 18.5-24.9), 15-25 lbs. for overweight women (BMI 25.0-29.9), and 11-20 lbs. for obese women (BMI 30 and above), as categorized by WHO BMI classes.²⁷ The 2009 revision added a range of appropriate weight gain (11-20 lbs.) for obese women (BMI 30 and above), as opposed to the vague, 15 lbs. or more, that was previously recommended.³³ The revised recommendations have been shown to be accurate weight gain recommendations for pregnant adolescents as well as adults.³³ By gaining weight outside of these recommended ranges, women are at increased risk for complications and adverse outcomes including postpartum weight retention and an increased risk of macrosomia and cesarean section.^{4,34}

Table 1

IOM Pregnancy Weight Gain Guidelines^{27,30}

<u>1990 BMI Range</u>	<u>1990 Pregnancy Weight Gain Recommendations (lbs.)</u>	<u>2009 BMI Range</u>	<u>2009 Pregnancy Weight Gain Recommendations (lbs.)</u>
Underweight (<19.8)	28-40 lb. ~1 lb a week for 2 nd and 3 rd trimester	Underweight (<18.5)	28-40 lb. 1 lb a week for 2 nd and 3 rd trimester
Normal Weight (19.8-26.0)	28-40 lb. 1 lb a week for 2 nd and 3 rd trimester	Normal Weight (18.5-24.9)	25-35 lb. 1 lb a week for 2 nd and 3 rd trimester
Overweight (>26.0 – 29.0)	15-25 lb. 0.66 lb a week for 2 nd and 3 rd trimester	Overweight (25.0 – 29.9)	15–25 lb. 0.6 lb a week for 2 nd and 3 rd trimester
Obese (>29.0)	At least 15 lb. Not specified	Obese (>30)	11-20 lb. 0.5 lb a week for 2 nd and 3 rd trimester

Prevalence of Gestational Weight Gain

Within the United States, excessive gestational weight gain (EGWG) is a problem, with 38.4% of normal weight, 63% of overweight, and 46.3% of obese, adult women gaining more than the recommended amount of gestational weight.¹⁴ The prevalence of EGWG is even higher among pregnant adolescents than pregnant adults, likely due to inadequate nutritional intake.¹ More adolescents gain over 40 pounds during pregnancy when compared to women who are 20 years of age or older.¹⁷

In addition, studies have shown that women retain twice as much of their pregnancy weight if they gain above the IOM recommended amount compared to those who gain within the recommended range.³² Adolescents especially have been shown to have difficulty losing the pregnancy weight, and some continue to gain weight postpartum, which can contribute to an increased risk of overweight or obesity later in life.¹⁷ Weight gain during the first 20 weeks of pregnancy has been identified as an indicator of overall pregnancy weight gain,³² which suggests that it may be possible to target women early in pregnancy with interventions to prevent excessive weight gain. However, catching teens this early in pregnancy may prove to be challenging due to the fact that many teens do not seek out prenatal care until later in pregnancy.

Implications of Gestational Weight Gain

Gestational weight gain recommendations were established in order to enhance the health of the mother and baby and to help reduce the risk factors associated with excessive or inadequate pregnancy weight gain. Women who gain outside of the recommended ranges increase their risk of post-pregnancy weight retention which can lead to further complications for the mother during future pregnancies.^{14,35}

Age plays an important role in determining the risk factors associated with pregnancy, with adolescents and adults being at risk for different adverse outcomes during pregnancy. It has been shown that lower levels of prenatal care and socioeconomic status are attributed to adverse outcomes among pregnant adolescents. Teens are usually dependent upon family members for shelter, health insurance, and food, which can contribute to pregnancy complications if support and prenatal care is not adequate. Despite adult pregnant women having higher levels of education and more consistent prenatal care, risks associated with EGWG remain among this population.

Adverse Pregnancy Outcomes

Maternal Outcomes

Among pregnant adolescents, adverse health outcomes and inefficient emotional support contribute to a high-risk pregnancy for the mother.¹ Gynecological immaturity contributes to increased risks for the pregnant adolescent including delivery of a low birth weight baby, preterm delivery, anemia, perinatal death, cephalo-pelvic disproportion, maternal death, excessive weight gain that can lead to macrosomia and child overweight, as well as postpartum weight retention.^{1,3,11,23} Adolescents tend to have higher gestational weight gains than adult women and retain more weight postpartum.³ Specifically, gaining excessive gestational weight can lead to negative outcomes such as preterm birth, gestational diabetes, low birth weight, cesarean section, macrosomia, and postpartum weight retention.⁴

Severe prenatal risk factors are associated more frequently with young adolescents. Rates of pre-term birth under 32 weeks and spontaneous miscarriage are the highest among adolescents aged 13-15 years of age.²³ In addition, the prevalence of maternal death is twice as high for teens than adults and 4 times as high for very young adolescents.²³ A major risk factor among adolescents is the risk of delivering a small-for-gestational-age baby (SGA), which may also contribute to an increased risk for complications in subsequent pregnancies, such as SGA and preterm deliveries.¹⁰ The population with the highest number of SGA deliveries is Hispanic adolescents.⁶

Obstetric risks can also affect the developing fetus. During pregnancy, women gain weight steadily throughout the first and second trimesters, gaining subcutaneous fat and storing extra body weight and nutrients for the growing fetus. In adult women, this weight gain and increase in fat indicates a growth in the fetal size and weight.¹⁰ However, in pregnant adolescents, this is not the case. The pregnant adolescent is still growing

herself, so she tends to gain weight continuously over all three trimesters of the pregnancy.¹⁰ Even among adolescents with weight gain that equals that of adult women, a larger percentage of the weight gained goes towards the growing mother, since the mother's metabolic needs are prioritized over the baby's.¹⁰ In this way, pregnant adolescents have been shown to gain more weight than adults during gestation, but they have a three-fold increased risk of delivering a smaller baby.¹⁰

An additional risk associated with child-bearing at a young age is discontinued or halted education.³⁶ Adverse economic and educational outcomes are associated with both the adolescent and her child.³⁷ Adolescents who become pregnant are 10-12% less likely to complete high school and 14-29% less likely to attend college.³⁷ Furthermore, these young mothers have the additional risk of becoming pregnant again during adolescence.³⁷ Adolescents who do stay in school must overcome social and socioeconomic barriers to academic achievement, making it more challenging to complete high school and attend college.³⁷ Adolescent females who have children are estimated to have 2 years less education than women who wait until age 30 to have children.³⁷ While other factors contribute to the adolescent high school dropout rate, about half of these school dropouts have been attributed to pregnancy.³⁷

In adult women, adverse pregnancy outcomes mainly stem from EGWG or complications relating to obesity. Among adults, higher risk for long-term weight gain, overweight and obesity later in life, gestational diabetes, cesarean birth, macrosomia, and preterm birth are associated with gaining excessive weight during pregnancy.^{4,13,32,35} Other risks associated with excessive weight gain and obesity are reduced initiation or early cessation of breastfeeding, and delayed lactogenesis.³⁸ Additionally, overweight or obese women have a higher risk of delivering a large-for-gestational-age baby,⁷ which increases the risk of cesarean delivery.³⁹

Fetal Outcomes

Children born to overweight and obese adolescent mothers are at a greater risk for pediatric overweight and obesity.¹⁷ Additionally, obesity in the mother can contribute to metabolic syndrome in the child and an increased risk of the child developing type 2 diabetes.^{15,29} Adolescents give birth to low-birth-weight babies twice as often as adult women,⁶ and the risks of preterm delivery and low birth weight are especially high in very young adolescents, under 15 years of age.¹¹ It has been reported that 13.4% of adolescents deliver a low birth weight baby, compared to only 8.3% of all pregnant women.⁴⁰ Prenatal or adult morbidity and mortality has been associated with low birth weight.⁴¹ Conversely, the risk of macrosomia, or a large birth weight, defined as a baby born weighing over >4000 g irrespective of gestational age,⁴² has also been seen in adolescent mothers.¹² Macrosomic babies have an increased risk for complications such as shoulder dystocia, birth canal lacerations, type 2 diabetes during adulthood and some cancers.⁴¹

Children born to adolescent mothers are at an increased risk for becoming pregnant during adolescence.³⁷ Daughters born to adolescent mothers are 66% more likely to become adolescent mothers themselves.³⁷ Many of the adolescents who become pregnant and give birth are also unmarried,³⁷ which can affect the family environment surrounding the child. It has been estimated that 1 in 4 of all non-marital births in 2004 were to adolescents.³⁷ In addition, children born to teen moms were at an increased risk for educational and social disparities.³⁷ As these children age, adverse conditions such as poorer cognitive development, lower educational achievement, higher levels of criminal behavior, a higher risk of abuse or neglect, and behavioral problems have all been reported.²³ The cycle of unmarried teens having children, and then those children

repeating these behaviors perpetuates which further contributes to the poor health and social outcomes within this population.

In adults, gaining excessive weight during pregnancy can affect the size of the baby and the child later in life. Excess maternal weight gain has been positively correlated with fetal size and offspring BMI.³⁹ Researchers have observed significant positive associations between gestational weight gain and childhood obesity by the ages 3-6.^{4,33} Exceeding the recommended guidelines for gestational weight gain can increase the risk of overweight for the child by about 30%, and may contribute to abdominal obesity in the child.⁴³ Cognition problems have also been observed in offspring of adult women who gain excessive weight while pregnant.⁴³ Children born to mothers who gain higher amounts of gestational weight are also more likely to have higher systolic blood pressure, which is concerning due to its correlation with heart disease.³⁹ Therefore, preventing and reducing the complications associated with EGWG, has become a priority in prenatal health care.¹³

Factors that Influence Adverse Pregnancy Outcomes

Both modifiable and non-modifiable factors influence the amount of weight a woman gains while pregnant and subsequent adverse outcomes. Despite the impact of non-modifiable factors such as genetics, the focus of this thesis is on the modifiable factors that exist. Factors such as race/ethnicity, socioeconomic status, pre-pregnancy BMI, diet and physical activity, and attitudes and beliefs about weight gain can all contribute to maternal and child health.

Race/Ethnicity

Minority youth, such as African-American, Latino, and low-income adolescents have the highest rates of teenage pregnancy in the United States.² African-American adolescents have two times the rate of teen pregnancy than white adolescents within the United States, and Hispanic adolescents have three times the number of teen pregnancies compared to white teens.¹⁷ In the year 2000, 81 out of every 1,000 births were to African-American adolescents whereas only 32 per 1,000 births were to white adolescents.⁴⁴

Among African-American women specifically, an increased risk of many adverse factors exists, such as higher pre-term birth and low birth weight babies, when compared to other racial groups.⁴⁴ The chance of delivery before 37 weeks is twice as high for African-American women over other races, and delivery of a baby before 32 weeks is three times as high for African Americans as white women.⁴⁵ Rates of delivery of an SGA baby were 11.9% in 2001 for African American women and only 4.9% among white women.⁴⁵

Socioeconomic factors such as being unmarried, having less education, poorer nutritional intake, higher rates of sexually transmitted diseases, less prenatal care, and higher rates of vaginal infections and pregnancy-induced hypertension are also more prevalent among African American adolescents.⁴⁴ Additionally, African American women have been shown to gain extra weight during pregnancy and to continue gaining weight in the 3-12 months following delivery.³⁸ Obese women and non-white women are less likely to weigh themselves, possibly contributing to excess weight gain.¹³ These racial disparities that occur within the United States make targeting African American and Hispanic teens specifically important when designing interventions for this population.

Socioeconomic Status

Women and adolescents with lower incomes and socioeconomic status are at a greater risk for becoming pregnant at a young age, and many of these pregnancies are unplanned. The CDC estimates that between 2006 and 2010, 77% of births to adolescents were unplanned.⁴⁶ Many factors that have been associated with adolescent pregnancy are also linked with socio-economic status. Such factors include ethnicity, early sexual activity, poor knowledge of reproductive health, lower levels of education and educational attainment, age of partner, parental illiteracy, substance abuse, a poor family structure, a family history of adolescent pregnancy, and sexual or domestic abuse.²³

Socioeconomic status has been correlated with poorer health outcomes. One such adverse health outcome is the birth weight of the baby.^{3,47} It is recognized that the lower a woman's income and socioeconomic status, the higher the risk of delivering a low-birth-weight baby.⁴⁷ Additionally, low-income adolescents face challenges such as smoking, alcohol and substance abuse, and reduced access to prenatal care during pregnancy.¹⁰ As previously stated, 50-70% of pregnant adolescents do not see a doctor or receive any prenatal care during their first trimester. The youngest adolescents were less likely to receive prenatal care early in pregnancy, sometimes due to factors such as cost or confidentiality.⁴⁸ Other barriers to receiving adequate prenatal care include factors such as language barriers, low education level, denial, fear, or a negative view towards the pregnancy.⁴⁹ Inadequate prenatal care has been associated with adverse outcomes such that women who receive no prenatal care have a higher risk of delivering a SGA baby.⁴⁸ In a population of very young pregnant girls aged 12-14 years old in Nigeria, it was observed that increased complications like preeclampsia, premature delivery,

urinary tract infections, and premature rupture of fetal membranes occurred among the lower socioeconomic status girls as opposed to the girls from higher economic classes.⁵⁰

Socioeconomic status and age have an impact on overall diet of the mother and her child. Diet is a modifiable factor that can be manipulated in order to improve health and pregnancy outcomes. Women of higher socio-economic status show signs of enhanced nutritional dietary intake after becoming pregnant in order to provide proper nutrients for their growing child.³ Higher income women increase consumption of fiber and protein and may switch to organic foods in preparation for childbirth.³ Adolescents from lower income and minority groups, especially African American women, who become pregnant may enter pregnancy with reduced nutritional stores and a higher risk for problems and complications such as gaining excessive gestational weight throughout pregnancy.^{10,13,38,48} Low-income women are more likely to continue eating energy-dense foods and fewer fruits and vegetables throughout pregnancy.³ Nutritional deficiencies such as iron-deficiency anemia during early pregnancy, diets poor in important micronutrients such as zinc and folic acid, and inadequate gestational weight gain are also seen among pregnant adolescents.¹⁰

Pre-Pregnancy BMI

Pre-pregnancy BMI and EGWG during pregnancy are two modifiable factors that can contribute to obesity during pregnancy.²⁹ Obesity during pregnancy is one of the factors that may contribute to a high-risk pregnancy for the mother.²⁹ Beginning pregnancy as overweight or obese contributes to a larger risk for gestational diabetes, preeclampsia and hypertension during pregnancy, and cesarean section.^{12,16}

In addition, pre-pregnancy BMI has been associated with higher rates of EGWG; more women who begin pregnancy as either overweight or obese gain more than the

recommended amount of gestational weight than women who begin pregnancy at a normal weight.¹² Almost 60% of women in the United States begin pregnancy as overweight or obese.⁴ In 2013, it was reported that 38.4% of normal weight women, 63% of overweight women, and 46.3% of obese women gained more than the recommended amount of gestational weight.¹⁴ This shows that women who begin pregnancy as overweight or obese have a higher gestational weight gain than normal weight women do.

Dietary Intake and “Eating for Two”

Adolescent diets are largely determined by socio-economic factors, poor dietary choices, and emotional considerations. Pregnant adolescents are at greater risk for dietary inadequacies due to consumption of foods high in total sugar, fat and sodium, and low in calcium, iron, folate, and zinc, all of which are important nutrients during pregnancy and for adolescent and fetal growth.^{1,6} In addition, adolescents have an increased need for certain micronutrients.¹ African-American, low-income teens are at increased risk for poor diet and low multi-vitamin use during pregnancy.¹ Additionally, dietary intake during pregnancy among adolescents may be affected by emotional status.⁴⁷ Pregnant adolescents frequently experience stress and depression early in pregnancy and these negative emotions may contribute to poor dietary intake, emotional eating, and overeating.⁴⁷ Typical foods eaten during times of stress and emotional eating include fast-food items and foods high in sugar and fat.⁴⁷ Typical low-quality food preferences and emotional stress both contribute to an increased risk for poor dietary habits during adolescent pregnancy.

Dietary intake during the first trimester is extremely important for optimal health of the fetus.⁴⁷ Receiving the proper nutrients during the first trimester is vital for

development of the placenta and the embryo.⁴⁷ Low maternal weight and low weight gain during the first trimester have been associated with reduced placental growth and fetal size in adolescents.²³ In addition, consuming a nutritionally poor diet during the first trimester of pregnancy has been linked to adverse fetal development and “reprogramming” the fetus to be predisposed to coronary heart disease, obesity, hypertension, and altered insulin metabolism during adulthood.⁴⁷ Even if diet improves during the second and third trimesters, eating a nutritionally poor diet during the first trimester can lead to adversities such as preeclampsia in the pregnant mother and can affect the overall birth weight of the baby.⁴⁷

It has been known since 1981 that fetuses grow more slowly in adolescents, specifically in females aged 10-16 years.⁴⁸ Research suggests that this is most likely due to the competition for nutrients between the growing mother and her fetus.^{23,51} The Camden Study, conducted in Camden, New Jersey in 1994, evaluated factors such as sugar intake, maternal and fetal growth and maternal glucose concentrations in low-income, mostly minority, pregnant adolescents.^{6,7,10} Findings from this study suggested that 50% of pregnant adolescents were still experiencing growth during pregnancy.^{23,48} The continued growth of the mother was associated with higher pregnancy weight gain and greater post-partum weight retention.²³ In addition, the mothers who were still growing during pregnancy delivered babies that were smaller than the adolescents who were no longer growing.^{23,48}

Growing adolescents may require greater intakes of specific nutrients in order to allow for concurrent growth of the mother and fetus.¹⁰ When dietary intake of calories and nutrients is low, the mother’s growing body takes what it needs for growth, and the growing fetus suffers the loss of nutrients and energy essential for growth.¹⁰ It has been shown that a pregnant adolescent who consumes less than 2/3 of the recommended

dietary allowance for pregnancy puts her fetus at significant risk for low birth weight.¹⁰ These findings show that adequate nutrition and a diet rich in micronutrients and adequate calories is vital for optimal growth of both the mother and the growing fetus.

Sugar

Sugar is a nutrient of particular concern among pregnant adolescents, whose diets tend to be high in total sugar.⁶ Total sugar is defined by the U.S. Sugar Task Force as all simple carbohydrates, including monosaccharides, disaccharides, and polysaccharides without any complex carbohydrate, fiber or starch included.⁶ The World Health Organization recommends that no more than 10% of daily calories come from added sugar, defined as sugars or syrups that are added to foods during preparation or processing to add sweetness.^{22,52} The American Heart Association has a similar recommendation of no more than half of daily discretionary calories from added sugar.⁵³ This equates to approximately 100 and 150 calories per day from added sugar for women and men, respectively.⁵³

Studies have suggested that pregnant adolescents who consume large amounts of sugar also often have higher caloric intakes, contributing to EGWG.⁶ Diets that contain high amounts of sugar are thought to be unhealthy because they disrupt the energy balance ratio and displace important micronutrients.⁵² Furthermore, high-sugar diets have been associated with adverse effects including preeclampsia, gestational diabetes, and excessive weight gain.⁵²

The Camden study showed a correlation between high-sugar diets, increased maternal glucose concentrations, and the delivery of larger babies.⁷ Elevated maternal glucose concentrations contribute to increased birth size and are associated with prenatal complications if mothers develop gestational diabetes.⁷ Some factors that were

found to contribute to increased maternal glucose concentrations were greater pre-pregnancy BMI and skin-fold measurements throughout pregnancy.⁷ Conversely, studies have also been conducted that correlate high sugar diets with a higher risk of delivering a small-for-gestational age baby (SGA) among adolescents.⁶

Fiber

Fiber is an important aspect of the diet that provides many health benefits such as reduced risk of heart disease and some cancers, improved glucose control, improved satiety, and improved gastrointestinal health.⁵⁴ The recommendation for fiber intake for both pregnant women and adolescents is 28 g/d.⁵⁵ Within the United States, most Americans do not consume enough fiber. Recent data from the NHANES survey concluded that children and adolescents aged 2 to 19 years of age consume a mean fiber intake of only 14 g/d.⁵⁴ Adults consume an average of 17 g of fiber a day which is far less than the fiber recommendation.⁵⁴ In addition, it was concluded that low-income populations and African-Americans tend to consume less fiber than people of other ethnic and socioeconomic groups.⁵⁴

Fiber is an important nutrient for pregnant women, however research looking at fiber intake among pregnant women, and especially pregnant adolescents is lacking. This is an area that needs further exploration to help to maximize dietary intake and health benefits among this population.

Physical Activity

Physical activity contributes to an overall healthy lifestyle and can be utilized during pregnancy to improve maternal and fetal health and to encourage appropriate gestational weight gain. The Academy of Nutrition and Dietetics recommends pregnant

women get 150 minutes of moderate-intensity aerobic activity per week, or 30 minutes of moderately intense aerobic activity most days.⁵⁶ The American College of Obstetrics and Gynecology also promotes exercise during pregnancy with recommendations for sedentary women to begin exercising during pregnancy and active women to continue with their exercise routine.⁵⁷ Participating in physical activity while pregnant can help to reduce the risk for EGWG and complications such as gestational diabetes and preeclampsia.⁵⁸ Most women in America do not meet the physical activity recommendations during pregnancy, and women of lower socio-economic status are even less likely to meet physical activity guidelines.⁵⁸ Some studies have reported that only 6-11% of pregnant women participate in moderate to vigorous physical activity while pregnant.⁵⁸ In addition, neighborhood poverty is associated with lower levels of physical activity during pregnancy.⁵⁸

Physical activity levels pre-pregnancy have been associated with varying amounts of weight gain during pregnancy. A low level of pre-pregnancy physical activity has been associated with greater weight gain during pregnancy, and a high pre-pregnancy physical activity level has been associated with lower gestational weight gain during the third trimester of pregnancy.⁵⁹ Engagement in physical activity during pregnancy has also been associated with a lower risk of gestational weight gain.⁶⁰ Therefore, participation in adequate levels of physical activity during pregnancy should be encouraged to enhance the health of mother and baby.

Attitudes and Beliefs

Few studies have assessed maternal views on pregnancy health and weight gain. Low-income, minority populations and adolescents have especially been overlooked.³⁷ However, it has been found that white, adult women with low-risk pregnancies tend to

have negative feelings towards weight gain during pregnancy, even when weight gain is within recommended limits.³⁸ Conversely, adult African American women tend to be more accepting of pregnancy weight gain, mainly due to the African American cultural acceptance of “thicker” women and curvier body types.³⁸

A couple studies have been conducted among African-American women focusing on pregnancy weight gain attitudes using focus groups.^{38,45} A major attitude expressed by the women in the focus groups was a desire to have a healthy baby and that weight gain during pregnancy correlated with a healthy baby.³⁸ A knowledge deficit was discovered when women lacked concern about gaining excessive pregnancy weight and associated maternal and fetal risks.³⁸ Interestingly, all of the women attributed greater gestational weight gain with a healthy baby.³⁸ Conversely, the Healthy African American Family I Project (HAAF I), conducted among low-income, adolescents, found that gaining excessive weight was a concern among teens with a lot of weight gain, and some reported depression and body image issues due to the pregnancy weight gain.⁴⁵ In addition, not gaining enough weight caused concern for some because other’s then did not know they were pregnant.⁴⁵ Postpartum weight retention was expected and viewed with acceptance among participants.³⁸ The women falsely attributed pregnancy weight gain to age and genetics and did not consider weight gain, even if over recommended amounts, to be a problem unless it became too excessive and began to hinder appearance, ability to function and enjoyment of activities.³⁸

Other themes that have emerged related to healthy eating during pregnancy were mindless eating or emotional eating, a heavy influence of cultural norms and familial influences, and some dietary adjustments to try to eat healthier for the sake of the growing baby.^{3,45,61,62} Paul, et al. found that low-income women believed that diet contributed greatly to overall weight gain; however, the low-income women in the study

reported overeating during times of stress or depression.³ Devine, et al. reported that the major determinant of pregnancy and postpartum weight gain/loss was pre-pregnancy ideas about body weight.⁶² In a subsequent study among Hispanic women, it was found that husbands and female relatives were the main sources of emotional support for women regarding pregnancy weight gain, diet and behaviors.⁶³ Reliance on parents or grandparents to provide food is common,³ and the opinions of family members is very influential on the behaviors of these pregnant women.⁶³ Low-income participants also believed that simply walking up and down the stairs in their house was enough physical activity during pregnancy.³ It has been noted that the transition to pregnancy, especially for first time mothers and lower-income women, tends to increase consumption of fruits and vegetables and increase the frequency of breakfast consumption at two years postpartum.⁶⁴ In addition, budget and distance to grocery stores are barriers to healthy eating habits during pregnancy faced by many low-income women.⁴⁵

Based on knowledge of the health risks associated with EGWG and dietary intake, future educational interventions are needed to target low-income women and teens regarding prenatal health. In addition, using the information learned about the pregnancy attitudes of these women, studies could be developed that target and modify specific attitudes that exist among pregnant women. Additionally, providing education regarding how pregnancy weight gain affects the fetus could be helpful for motivating young mothers to engage in healthy prenatal behaviors.

Interventions to Improve Prenatal Health

Specific interventions targeting prenatal health and gestational weight gain have been conducted within adolescent and adult populations; however, the number of studies conducted with adolescents is small. Further research is needed in order to

adequately reach and change prenatal health behaviors within this high-risk pediatric population.

Classical Interventions

Diet Interventions. Dietary interventions focusing on gaining healthy amounts of weight and promoting a healthy diet during pregnancy have been conducted with some success in adult, pregnant women.⁶⁴⁻⁶⁷ A few studies have shown that women receiving health-related interventions gained weight within the IOM guidelines more often than control women.^{64,66,67} Dietary interventions have also been shown to contribute to greater postpartum weight loss 1-3 months postpartum in adult women.^{65,66} Other dietary interventions have focused on gestational weight gain and glucose metabolism. Low-glycemic diets have been shown to contribute to lower gestational weight gain.⁶⁴ Individualized, in-home, nutrition-focused, counseling visits have also been used to target pregnant, adult women with some success, contributing to higher newborn birth weights and increased maternal micronutrient consumption.⁶⁷ These studies showed that dietary interventions could be beneficial for pregnant women if specific guidelines were given.

Among adolescent populations, studies remain sparse. One study conducted by Bechtel-Blackwell in 2002 that provided nutrition education to a sample of African-American girls aged 13-18 years had mixed results.⁶⁸ The experimental group gained less weight overall than the control group in the first trimester. However, in the second trimester no difference was seen and by the third trimester, the experimental group gained more weight than the control.⁶⁸ The experimental group did retain less weight postpartum and diet seemed to improve for the experimental group, with lower calorie

and fat consumption.⁶⁸ A correlation was seen between higher gestational weight gain and greater postpartum weight retention among these adolescents.⁶⁸

Additionally, other studies targeting pregnant adolescents with dietary interventions have found some positive results.^{17,69-71} While improvements in nutrition knowledge and cognitive function have been shown based on nutrition interventions, little change in actual dietary intake has been reported.^{70,71} The Higgins Nutrition Intervention Program, conducted among pregnant adolescents in Montreal, reported larger birth weights for the participants involved in the nutrition program and lower rates of low-birth-weight babies.⁶⁹ Davis, et al. conducted an in-home intervention that used dietary counseling within a mainly African-American, postpartum, adolescent population.¹⁷ Maternal BMI decreased and child intake of fruits and vegetables increased throughout the intervention.¹⁷ Dietary interventions have proven helpful regarding outcomes such as nutrition knowledge and birth weight; however, more work is needed to actually change dietary behaviors and intakes of pregnant adolescents.

Physical Activity Interventions. Little is known about how physical activity affects fetal development. Moderately intense aerobic exercise has been shown to lower the incidence of gestational diabetes and macrosomia, but not intrauterine growth restriction.⁷² Conversely, Barakat, et al. reported no significant difference in mean birth weight or length of the baby between experimental and control groups after providing a light intensity resistance exercise program to pregnant adult women.⁴¹ An aerobic exercise program consisting of dancing 2 days a week found no difference between groups for birth weight of the newborn, incidence of LBW or macrosomia.⁵⁷ Other studies have shown that women who participate in moderate to high intensity exercise during pregnancy have an increased risk of intrauterine growth restriction; however,

these results are not consistent.⁷² It has been suggested that pre-pregnancy physical activity levels may impact results such that women who were active prior to pregnancy were more likely to benefit than inactive women.⁵⁷

Physical activity interventions have also explored gestational weight gain as an outcome measure for improving maternal health. Barakat, et al. and Haakstad, et al. reported no significant differences in gestational weight gain between the intervention and control groups when providing aerobic exercise interventions.^{41,57} Nascimento, et al. provided overweight and obese women with supervised group exercise and at-home exercise counseling and discovered that a lower percentage of the women in the intervention group gained over the recommended limits compared to the control group, at 47% and 57%, respectively.⁷³ Increased program adherence by obese participants may be helpful in seeing better results regarding gestational weight gain. Overall, exercise interventions have provided some beneficial effects for pregnant adult women: however, work with pregnant adolescents has not been explored in detail.

Studies that focus on EGWG. Many studies focusing on pregnancy have focused on EGWG as an outcome measure for overall prenatal health. Groth, et al. reported that among low-income, African American women who had their first child during adolescence, all of the women had a significantly increased BMI at 12 and 18 years post-delivery.³³ Additionally, women who gained an excessive amount of weight during pregnancy had a greater BMI increase than the women who gained an appropriate amount of weight.³³

Therefore, interventions using dietary and exercise components have been used to target EGWG in pregnant women. Interventions have proven beneficial in reducing EGWG in pregnant adults who began pregnancy at a normal weight.^{12,16,32} An association

between exercise and greater weight loss during the first 6 months postpartum has been observed,¹² along with increased physical activity levels and lower fat consumption by participants who participate in exercise during these interventions.^{15,16} Lower birth weights among the babies delivered have also been reported.^{15,16} Although these interventions have produced some positive results, these studies reported no effect of the intervention on EGWG in overweight or obese participants.^{12,16,32}

Interventions specifically targeting obese pregnant women with lifestyle interventions have focused on dietary, exercise, and behavioral counseling.^{74,75} The LIMIT randomized controlled trial emphasized limiting saturated fats and refined carbohydrates, and increasing fiber, fruit, and vegetable intakes among women with a pre-pregnancy BMI of 25 or greater.⁷⁴ The Lifestyle in Pregnancy (LiP) Study reported some success with 85% of the intervention group reporting healthier eating habits and greater rates of weight gain within recommended guidelines by the intervention group (65%) compared to the control group (53%).⁷⁵ However, no significant differences were found for obstetric and neonatal outcomes.⁷⁵

Other studies have used methods such as in-home counseling programs, educational newsletters containing information regarding weight gain, diet, and physical activity, and personalized weight management cards in order to prevent EGWG and to promote healthy post-partum weight loss.^{14,17,76} Findings have been mixed. The in-home counseling intervention found significant improvement in health and physical activity knowledge among post-partum women; however, participants in the intervention group became less active over the course of the study.¹⁷ When newsletters with prompts to set weight gain goals were mailed to pregnant women, it was reported that the women who had higher levels of participation with setting goals actually gained more gestational weight.¹⁴ Overall, no differences between intervention and control groups were seen with

weight management cards but among overweight women, the experimental group gained significantly less weight than overweight women in the control group.⁷⁶

Furthermore, racial disparities exist within this population. In a subsequent study that utilized an ethnic-specific intervention to improve weight loss postpartum, no significant improvement was seen between the intervention and control groups; however, some racial differences were observed.⁷⁷ White women lost an average of 5.7 lbs post-intervention, while Hispanic women lost an average of 2.2 lbs and African-American women gained an average of 3.3 lbs over the 13-week intervention.⁷⁷

Technological Interventions

As technological advances occur, social media websites, cell phones, and the Internet have taken over as a primary means of searching for information and communicating with others. Social media, as defined by Merriam-Webster is: “forms of electronic communication (as Web sites for social networking and micro blogging) through which users create online communities to share information, ideas, personal messages, and other content (as videos).”⁷⁸ Adolescents are especially drawn to these applications as social media websites are used by 86% of young adults aged 18-29 and social media is now the third most popular Internet activity in the United States.⁷⁹ It has been reported that certain populations of Americans have higher rates of Internet use: whites, younger generations, people with higher education levels, and people with higher incomes.⁸⁰ No difference in access to cell phone use has been reported among different racial groups; however, lower-income adolescents are less likely to have a cell phone than teens of higher socioeconomic status.⁸¹ To date, interventions using the Internet, text messaging, and social media as a means to target pregnant women/teens are scarce and further research into the feasibility of these resources is needed.

Internet Interventions. Roughly 80% of Internet users aged 18-46 go online to look for and obtain health information,⁷⁹ while an estimated 31%-42% of adolescents look for health information online.^{81,82} Among lower-income populations, access to the Internet and cell phones is widespread as well. A study conducted in Pennsylvania reported that 80% of a low-income sample of participants said that the Internet was the easiest way for them to obtain health information.⁷⁹ Additionally, a survey of 8,144 WIC participants with a mean age of 29 years, revealed that 92% of survey respondents owned a cell phone, with 58% of them using smart phones.⁸⁰ The three most widely used technologies among participants were email (92%), text messaging (86%) and Facebook (80%).⁸⁰ Of the people surveyed, 60% reported that receiving health information from WIC via text message and email would be helpful.⁸⁰ However, it was observed that the older respondents were less interested in receiving information via the Internet, indicating that internet-based interventions could be more useful for younger populations such as adolescents.⁸⁰

Sensitive health topics are especially researched online including topics such as sexual health, nutrition, drug use, and mental health problems.⁸² The Internet serves as a less threatening way to obtain this sensitive information than in-person contact.^{83,84} In addition, some websites provide suggestions for ways to approach a doctor or medical practitioner about health concerns a person may have.⁸³ Individuals with limited income, education, or lack of transportation can always go online to obtain this information.⁷⁹ Women of all ages are more likely than men to search for health information online, and topics such as diet/nutrition and women's health are among top health searches at 36% and 31% of users, respectively.⁸³

Although digital interventions that target pregnant women are sparse, online interventions focusing on smoking cessation, managing depression, or diabetes have

been conducted with some success.⁸⁵⁻⁸⁷ One pregnancy-specific online intervention targeting EGWG during pregnancy was conducted by Demment, et al in 2014.¹³ Racially and socioeconomically diverse women were given access to a website with a weight-gain tracker, health information, physical activity recommendations, diet recommendations, and local resources.¹³ The weight tracker was the feature most widely used; of the 1,014 women in the study, 25% consistently (tracked weight every day for a 45 day period) used this feature, 28% almost consistently (tracked weight at least half of the days during the 45 day period) used, and only 19% inconsistently (tracked weight at least one time, but not more than half of the time) used the weight tracker.¹³ Over half of the participants looked at the health-related information and blogs on the website as well. The results suggested that racial groups had different patterns of use on the website; white women were more likely to be “super-users”, and minority groups were more likely to be “non-users”.¹³ Overall, it was concluded that white women with higher incomes used the website more consistently, but access by low-income, minority groups was still reported, demonstrating feasibility of websites as a way to provide nutrition and health information to pregnant women.¹³ Further supporting the finding that white women access internet sites more frequently was a study by Kim et al.⁸⁸ Researchers found that African American women or women with less positive beliefs regarding gestational weight gain were less likely to utilize online intervention materials that promoted dietary and physical activity monitoring.⁸⁸

An additional study that provided an internet intervention for pregnant women was conducted in 2011 by Graham et al.⁸⁹ The website, titled e-Moms of Rochester, included articles, a weight gain tracker, physical activity and diet goal setting tools, blogs, a prenatal vitamin reminder and health tips to participants.⁸⁹ The intervention group received access to the weight gain tracker, diet goal-setting tool, and physical-activity

goal-setting tool, whereas the control group only had access to basic nutrition information via the website.⁸⁹ The weight gain tracker was one of the most popular aspects of the web intervention, with 70% of the intervention group participating.⁸⁹ Women could track weight online or enter and update weight changes through text message. Overall, 85% of the 1,689 participants logged onto the website during their pregnancy, and overall ratings of the website were high.⁸⁹

Social Media. Social media has recently been explored as a way to provide health education and reach certain target populations due to the low-cost and usability of social media sites.²⁰ Social media is widely accessible and provides immediate results which both contribute to its increasing use nationwide.²⁰ Social media is a form of silent communication thereby allowing discrete use, which may contribute positively to sensitive health interventions.²⁰ A recent study of social media use reported that receiving information via social media was personalized and therefore more powerful than traditional methods of advertising to promote health behaviors.²⁰ Studies have shown that online nutrition information provided via social media is equally or more effective than traditional, in-person, means of education for some populations, including low-income teens and young mothers.⁷⁹ Participants in WIC have been found to respond well to receiving health education via social media.⁷⁹

Many government agencies, including the CDC, have begun to provide health information via social media channels such as blogs, Facebook, podcasts, and Twitter.²⁰ The Get Yourself Tested campaign was launched by the CDC, Planned Parenthood, MTV Networks, and the Henry Kaiser Family Foundation in 2008 to educate youth about sexual health.⁸¹ The campaign used Facebook to target its audience with videos and information and has over 13,000 Facebook fans.⁸¹ The twitter account connected to the

campaign had over 2,000 followers, indicating that these social media sites can be used to educate adolescents.⁸¹ In addition, the CDC had 12 Facebook pages with over 200,000 fans, 31 twitter accounts with over 1.6 million followers, a YouTube channel with more than 4 million views, and 7,569 women in the United States receiving text messages through the e-Health program.⁸¹ Another governmental agency that has utilized social media to distribute information is the San Francisco Department of Health, which launched a campaign to text message youth about sexually transmitted disease awareness. The campaign text messages were shown to have a positive effect on at-risk populations such as African-Americans, adolescents aged 12-18 years, people without a college degree, and people residing in lower income neighborhoods.⁸¹ The positive benefits shown from these programs provide further evidence that use of social media to provide health information may be an effective and affordable way to target adolescents.

Online support groups and blogs have been shown to be good outlets for women to deal with pregnancy-related struggles.⁸⁴ Blogs have also shown to provide social support to pregnant women.⁸⁴ Blogging is a newer form of social media that has gained popularity in recent years.⁸¹ There are currently more people who read blogs than write blogs; however, only 14% of adolescent girls aged 12-17 report blogging.⁸¹ “Mommy blogging” is a form of blogging that allows women to chronicle their experiences as mothers and have gained tremendous popularity, with the most popular mommy blogs generating over 50,000 hits a day and hundreds of comments.⁹⁰ Therefore, blogging may be a way to reach adult women during pregnancy, additionally shown by the e-Moms of Rochester study.⁸⁹ The study provided a pregnancy website to participants and the blogs were the most popular feature on the website. The 1,689 study participants posted almost 700 blog entries and over 3,000 blog comments were generated. Additionally, it was found that women who were married or in a committed relationship and women

with higher education levels were more likely to view blogs and articles than single women and women with lower levels of education.⁸⁴ It was shown that women with a larger support network looked online for health information more often than women with less of a social network, and women who felt loved and supported were more likely to access the website as well.⁸⁴

Text Messaging. Beginning with the emergence of the smart phone in 2007, use of cell phones and features such as text-messaging have become widely used.¹⁹ Within all forms of social media, text messaging has been the means of communication most widely studied and has been shown to promote behavior change. Studies have shown that low-income adolescents and minority groups have access to and use technologies such as mobile phones and the internet with a high level of skill and comfort.^{19,83} The Pew Internet and American Life Project concluded that 9 out of 10 young adults, aged 18-29 years of age, owned a cell phone, and that 78% of teens in 2013 owned a cell phone.^{20,91} A study conducted in 2010 found that adolescents, aged 13-17, in the United States, sent and received 1,707 messages per month.⁸¹ Younger generations use text messaging systems more frequently, with 95% of 18-29 year olds and 82% of 30-49 year olds sending and receiving text messages.¹⁹ Additionally, the study reported that out of teens aged 13-17 years of age, 33% stated that it was “absolutely essential” to have the newest, most advanced cell phone.¹⁹

The use of text messages is a quick, easy, cost-effective way to reach large audiences.¹⁹ A review of previous text-message intervention studies among adolescents showed that most research to date has been conducted regarding diabetes self-monitoring.¹⁹ One study, conducted by Shapiro, et al. looked at text messaging as a way to self-monitor healthful behaviors such as activity level and consumption of sugar-

sweetened beverages.⁹² The study concluded that the use of text messaging resulted in higher participant retention and higher self-monitoring of behaviors than a paper version.⁹² Additionally, adolescents in text-message interventions have reported that they prefer text messages that are short, relevant, easy to read, and that send a positive message.¹⁹ Overall, the review concluded that text messaging is an accessible, culturally acceptable and fast way to provide health information to adolescents who are at greater risk for health disparities.¹⁹

To date, most research with pregnant women has been conducted in adult populations with one specific text messaging intervention utilizing the text4baby app, a free mobile health information service for pregnant women and mothers that was provided by the non-profit National Healthy Mothers, Healthy Babies Coalition (HMHB). The app was tested in San Diego County, California among over 2,200 pregnant, minority women. Participants were interviewed and when asked how they would rate the text message app, the mean rating was an 8.5 on a 1 to 10 scale, with 1 being the lowest and 10 being the highest rating.⁹³ In addition, due to the app, 63.1% of participants remembered an appointment or immunization, 75.4% were informed of medical warnings they didn't know, 71.3% talked to a doctor about a text they received, and 38.5% of participants without health insurance called a service number.⁹³ When the text4baby app was tested in Fairfax County, Virginia, similar results were found. Mostly Hispanic women (79.7%) were interviewed and the women who used the app showed significant improvements in attitudes about maternal health. Many felt more prepared to become a mother, and overall attitudes against alcohol consumption during pregnancy were improved among app-users.⁹⁴ Other improvements in attitudes included increased understandings of the importance of fruit and vegetable intake, prenatal vitamin adherence, prenatal care, and smoking cessation.⁹⁴ Although the app was not specifically

nutrition-based, these results demonstrate feasibility of social media as a way to contact and educate women on pregnancy-related health. In addition, these data suggest that use of a text-messaging program is feasible and well received among low-income, minority women.^{93,94}

Summary

Adolescent pregnancy is a complex problem that is impacted by many age-related, socioeconomic, emotional and behavioral factors. With the exception of pregnancy prevention, this population has been largely neglected resulting in few interventions that are geared towards improving prenatal health among pregnant adolescents. Any nutritional knowledge and education would be beneficial for this high-risk population, and interventions utilizing the Internet, text messaging and social media websites may prove to be an economic and feasible way to reach this group. Further research into how these social media interventions can impact pregnancy health outcomes in adolescents compared to adults is a logical next step in providing optimal prenatal care for this hard to reach, underserved population.

CHAPTER 3

METHODS

Study Design

This study was a longitudinal, pilot social media intervention addressing nutrition knowledge and behaviors of low-income, pregnant adolescents and adult women (**Figure 1**). The intervention included health information (pregnancy fitness, healthy recipes, nutrition, and stress management) sent out via Facebook and/or text message. Messaging methods were determined through previous studies available in the literature that were conducted in adult women and through initial polling of adolescents to see if they had the resources to participate in a social media intervention.⁹⁶ In addition to receiving daily messages through social media, a weekly paper mailing option was also offered to all participants. Participants began receiving messages at ≤ 28 weeks of gestation. All pregnant adolescent and adult participants completed pre- and post-nutrition knowledge questionnaires, one electronic data usage survey and pre- and post-intervention 24-h dietary recalls across pregnancy. Data were collected at approximately two time points, upon entry into the study (at ≤ 28 weeks of gestation) and again at or near delivery of their baby.

Subject Recruitment

Low income, pregnant adolescents aged 14-18 years of age and low-to-medium income pregnant adults aged 19+ years were recruited from the Rochester Adolescent Maternity Program at the University of Rochester Midwifery Clinic (URMC) in Rochester, NY. All adolescent participants were recruited from a larger pool of adolescents who were already participating in a study designed to assess the dose-

response effects of vitamin D supplementation on inflammation and infection during pregnancy. The adult women were not participating in the vitamin D study but were recruited from the URMC to maintain relatively equal demographic profiles between the adolescent and adult participants. Adult women were recruited by flyers posted at the URMC clinic.

Inclusion criteria comprised pregnant women carrying a single fetus who were within 12-30 weeks of gestation (as specified in parent vitamin D study). In order to create homogeneity between the two groups and to eliminate confounding variables such as disease complications, exclusion criteria for the study included having a history of malabsorptive diseases, eating disorders, HIV infection, and diabetes. Also, adults and adolescents with high blood pressure or reported cigarette use were excluded.

Participants provided informed written consent prior to enrolling in the study (see Appendix A). The Cornell University and Arizona State University Institutional Review Boards approved this study (see Appendix B).

Anthropometric data including race, ethnicity, height, weight, and neonatal length and weight data were extracted from medical charts by the study coordinator. Gestational weight gain (GWG) was calculated by subtracting the self-reported pre-pregnancy weight collected at entry into the study from the clinic weight at delivery. The 2009 Institute of Medicine (IOM) gestational weight gain guidelines that categorize pregnancy weight gain by pre-pregnancy BMI were used to assess participant weight gain. The BMI cutoffs used by the IOM have been recognized as appropriate for use with adolescent pregnancy.⁹⁷

Measures

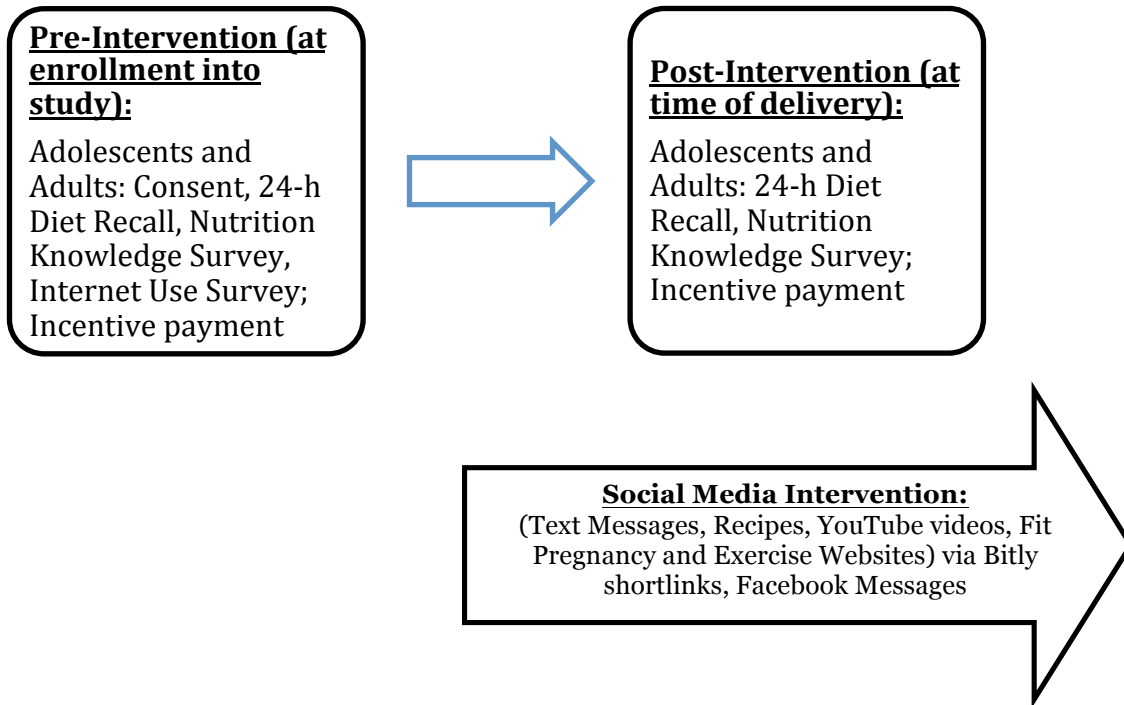


Figure 1. Study design flow chart

Dietary Intake

Dietary intake of all participants was assessed and dietary intake of the pregnant adolescents and the pregnant adults was compared. Pre- and post-intervention 24-hour diet recalls (one per study time point) were administered to participants by the study recruiter and/or study staff during gestation (see Appendix D). The 24-hour diet recalls contained the identifying code of each participant, and required the researcher to record gestational weight. Each participant described their dietary intake during the previous day and study staff probed for easily forgotten foods such as beverages and condiments. Questions regarding typical dietary intakes and pica were also included at the end of the diet recall. The program Food Processor (ESHA Research. Food Pro Version 10.14.0.

Salem, OR)¹⁰⁰ was used to enter and assess the dietary intake (macronutrients and micronutrients, including sugar and fiber intakes) of each participant.

Nutrition Knowledge

The knowledge and behaviors survey was used to evaluate and assess participant knowledge of basic nutrition concepts as described by the MyPlate guidelines⁵⁵ and Dietary Guidelines for Americans 2010 (see Appendix C).⁹⁸ The survey consisted of 15 questions and was given to participants upon acceptance into the study and post-intervention, near the time of delivery. This survey was developed specifically for this pilot intervention and was modeled after previous knowledge surveys;⁹⁹ however, it was not validated. The survey asked questions to assess nutritional behaviors, nutritional knowledge, and general health knowledge. Specifically, questions designed to assess knowledge of dietary fiber, sugar-containing foods and added sugars were also asked.

Technology Use

Passive and active participation on the private Facebook group page was measured by tracking the number of messages viewed and “liked” by participants. Additionally, participation was tracked by sharing periodic poll questions via Facebook or text message and recording individual responses. Bitly shortlinks to health websites and videos were included in Facebook and text messages and sent to all participants. Study-wide shortlink use was tracked by viewing the number of clicks on each link within the Bitly built-in analytics system.

Statistical Analysis

Descriptive statistics were computed for all variables (maternal weight gain, WIC status, beginning gestational age, pre-pregnancy height and weight, BMI, age, race, ethnicity, baby birth weight and height, ending gestational age, delivery height and weight, delivery BMI, dietary intake from the beginning of the study (B) and the end of the study (E), responses to the nutrition questionnaire, and Bitly analytics data from internet site visits) after checking for outliers (± 3 SD's from the mean) and missing values. Mean neonatal birth weight (kg) and birth length (cm) was determined for both the adolescent and adult groups. Macro- and micronutrient intakes were adjusted to the mean calorie intake according to the residual method.¹⁰¹ This was done in order to adjust for variations in individual diets and reduce the chance of bias. Adjusted nutrient intakes were used in all subsequent analyses. Dietary change for all variables was computed by subtracting the post-intervention dietary variables from the pre-intervention dietary variables. Data were tested for normality using the Shapiro-Wilk test of normality (sample size under 50) and data that were not normally distributed were assessed using non-parametric tests. Data are presented as mean \pm SD or median (IQR) depending on the normality of each variable.

A general linear model was used to assess differences in dietary intake between the adolescents and the adults where group was always a fixed variable and race, pre-pregnancy BMI, WIC, and age were controlled for as covariates. Dietary change over time was looked at to assess whether the intervention played a role in changing dietary habits for the adolescents and adults. A two-way repeated measures general linear model was used to assess dietary change over time. Group (adolescents, adults) was a fixed variable and race, pre-pregnancy BMI, WIC, and age, were controlled for. Mean and standard error were reported for all variables.

Correlations between the change in sugar/fiber intakes and gestational weight gain (kg) were assessed for both adolescents and adults using a partial Pearson correlation after controlling for race, pre-pregnancy BMI, WIC, and age. A general linear model was also run to assess whether the change in sugar intake differed by pre-pregnancy BMI groups. Only one adolescent (RDS029) was classified as “underweight” pre-pregnancy, so her data were combined with the normal weight category. Additionally, a general linear model was run to compare the change in sugar intake by gestational weight gain categories (within recommended limits or excessive gestational weight gain). Race, pre-pregnancy BMI, and WIC status were controlled for.

Statistical significance was fixed at $P < 0.05$. The system used for the analyses was SPSS statistical software (IBM Corp. Released 2013. IBM SPSS Statistics for Mac, Version 22.0. Armonk, NY: IBM Corp.).¹⁰² The sample size for this study was based on recruiting until information/message redundancy was achieved. The primary goal of the study was to assess changes in attitudes and beliefs about prenatal nutrition/health and in-depth interviews were used to assess these changes. As described previously,⁹⁷ redundancy was expected to be reached before the enrollment of 40 participants. In order to allow for dropouts and variation in data quality, a maximum of 20 pregnant adolescents and 20 pregnant adults were recruited.

CHAPTER 4
DATA AND RESULTS

Descriptive Characteristics

Twenty-four women were recruited into this study (12 adolescents and 12 adults). All 12 adults finished the study; however, two adolescents were lost to follow up due to delivering at a hospital not affiliated with the University of Rochester Midwifery Clinic. Of the 22 participants included in the final analysis, 7 adolescents and 3 adults were enrolled in WIC. The study cohort was racially and ethnically diverse. Seven of the adolescents were black, 2 were white, and 1 did not identify with a race. Two of the adolescents were of Hispanic ethnicity, including the one adolescent who did not specify a race. Of the adult participants, 4 were black and 6 were white. One adult did not specify a race but self-identified as Hispanic. This participant was the only adult who reported a Hispanic ethnicity.

Maternal and neonatal characteristics are found in **Table 2**. Upon comparison of maternal and delivery characteristics, no statistically significant differences were observed between the adults and adolescents. Based on the IOM weight gain guidelines, three out of the four obese adolescents gained excessive gestational weight, and one of the two overweight adolescents gained excessive weight. None of the pre-pregnancy normal weight adolescents gained excessive weight. One teen self-reported a pre-pregnancy BMI in the underweight category and gained less than recommended during her pregnancy. Of the obese adults, all three gained excessive gestational weight, and two of the four overweight adults gained excessive weight. Three out of the five normal weight adults gained excessive gestational weight.

Table 2

Subject Characteristics

Mean	Adolescents (n=10)	Adults (n=12)	P-value
Pre-Intervention Age (y)*	16.97 (16.40, 17.73)	29.20 (23.71, 33.75)	<0.001
Pre-Preg BMI (kg/m ²)	26.97 ± 6.53	26.71 ± 4.84	0.108
Delivery BMI (kg/m ²)	31.33 ± 6.17	31.53 ± 4.49	0.089
GWG (kg)*	11.14 (7.84, 15.11)	12.50 (11.14, 17.16)	0.197
GA Delivery (wks)	40.24 ± 0.88	39.89 ± 1.04	0.843
Baby Birth Weight (kg)	3.42 ± 0.44	3.37 ± 0.39	0.292
Baby Birth Length (cm)	51.23 ± 2.61	50.86 ± 2.51	0.337

Ind. T-Test: Mean ± Standard Deviation; *Mann-Whitney: Median (25%, 75%)

N=22 (10 adolescents and 12 adults)

GWG, gestational weight gain; GA, gestational age

Dietary Intake

For both adolescents and adults, reported intakes for protein and carbohydrate were within the AMDR at both pre- and post-time points (**Table 3**). For both adolescents and adults, the pre-intervention fat intake was higher than the AMDR, and among the adolescents, post-intervention fat intake dropped to within the AMDR, at 30.7% of total calories, accounting for a mean decrease of 7.46 ± 1.21 g in fat consumption pre- to post-intervention. Mean fat intake decreased for adults as well; however it was still above the AMDR post-intervention.

Table 3

Acceptable Macronutrient Distribution Ranges (AMDR)

Macronutrient	Adolescent AMDR (Pre)	Adolescent AMDR (Post)	Adult AMDR (Pre)	Adult AMDR (Post)	AMDR Range
Calories (kcal)	2218.09 ± 906.36	2595.25 ± 1128.74	2336.79 ± 641.56	2323.80 ± 567.04	2000 kcal/d
Protein (%)	17.5%	13.6%	14.9%	16.4%	10-35%
Fat (%)	45.5%	30.7%	38.8%	36.8%	20-35%
Carbohydrate (%)	65.7%	50.9%	56.3%	60.5%	45-65%

Calories reported in Mean ± Standard Deviation

*All variables were energy-adjusted based on the mean caloric intake.

Changes in dietary intake between the two groups (adolescents and adults) are shown in **Table 4**. After adjusting for covariates (race, pre-pregnancy BMI, WIC participation, and maternal age), a linear analysis suggested that the increase in sugar consumption during the intervention was significantly greater among the adolescents when compared to adults (7.9 ± 0.4 vs. 6.0 ± 0.4 g, respectively; $P=0.023$). No other significant differences in dietary intake changes across the intervention were observed. Adolescents had a larger decrease in fat consumption across gestation than adults but the difference did not reach significance (-8.6 ± 0.5 vs. -6.8 ± 0.5 for teens and adults, respectively; $P=0.064$).

Table 4

Diet Change between Adolescents and Adults

Diet Variable	Adolescent Diet Change	Adult Diet Change	P-Value
Calories (kcal)	129 ± 552	300 ± 469	0.854
Protein (g)	5.4 ± 0.8	6.0 ± 0.7	0.676
Fat (g)	-8.6 ± 0.5	-6.8 ± 0.5	0.064
Carbohydrate (g)	17.6 ± 0.5	16.3 ± 0.5	0.169
Sugar (g)	7.9 ± 0.4	6.0 ± 0.4	0.023*
Fiber (g)	-0.5 ± 0.5	-0.6 ± 0.4	0.899
Folate (μ g)	-5.6 ± 0.8	-7.2 ± 0.7	0.242
Iron (mg)	2.0 ± 0.6	1.2 ± 0.5	0.407
Calcium (mg)	42.6 ± 0.9	41.8 ± 0.7	0.547
Vitamin D (μ g)	-1.1 ± 0.7	-1.7 ± 0.6	0.642
Magnesium (mg)	14.7 ± 0.7	15.0 ± 0.6	0.815

General Linear Model: Mean \pm Standard Error

N=22 (10 adolescents and 12 adults)

Analyses were adjusted for the following covariates: race, pre-pregnancy BMI, participation in WIC, and maternal age at study enrollment.

*All variables were energy-adjusted based on the mean caloric intake.

Table 5 depicts the effect of intervention time on dietary intake of both adolescent and adult participants. Group (adolescents, adults) was a fixed variable and race, pre-pregnancy BMI, WIC, and age, were included as covariates. Fat intake significantly decreased over time ($P=0.047$), whereas carbohydrate intake significantly

increased over time ($P < 0.001$). Micronutrients that increased over time were calcium ($P < 0.001$) and magnesium ($P < 0.001$), while folate intake significantly ($P = 0.041$) decreased over time. A significant interaction was observed between time and age group (adolescents vs. adults) for sugar consumption ($R = 0.110$, $P = 0.023$). Mean sugar intake accounted for $26.3\% \pm 11.8\%$ of the teens' total energy consumption pre-intervention, and $25.2\% \pm 13.7\%$ post-intervention, in comparison to $22.9\% \pm 6.3\%$ and $23.8\% \pm 5.5\%$ for adult women before and after the intervention, respectively.

Table 5

Time receiving the intervention had a mild positive effect on macro and micronutrient consumption during pregnancy among adolescents and adult women

Diet Variable	Pre- Adol. Mean	Post- Adol. Mean	Pre-Adult Mean	Post-Adult Mean	Time P-Value	Time* Group P-Value
Calories (kcal)	1940 (1662, 3233)	2638 (1471, 3287)	2265 (1752, 2681)	2218 (1832, 2811)	0.281	0.854
Protein (g)	84.7 ± 1.1	90.0 ± 1.1	84.3 ± 0.9	90.7 ± 0.8	0.157	0.676
Fat (g)	98.2 ± 1.2	90.0 ± 1.1	97.7 ± 1.0	90.7 ± 0.8	0.047*	0.064
Carbohydrate (g)	318.6 (318.0, 319.3)	335.9 (335.5, 336.5)	318.9 (318.4, 320.3)	335.5 (335.2, 336.1)	<0.001*	0.169
Sugar (g)	124.6 ± 0.9	132.0 ± 1.1	125.2 ± 1.0	131.5 ± 0.9	0.101	0.023*
Fiber (g)	21.3 (21.0, 22.3)	21.0 (20.8, 21.1)	21.9 (21.3, 23.0)	21.2 (20.9, 21.8)	0.480	0.899
Folate (µg)	537.6 (537.3, 537.8)	531.4 (530.3, 532.4)	537.4 (537.0, 537.7)	530.7 (530.2, 531.3)	0.041*	0.242
Iron (mg)	19.5 (19.4, 20.9)	21.2 (20.9, 21.6)	19.5 (19.3, 20.5)	21.2 (21.0, 21.3)	0.627	0.407
Calcium (mg)	850.8 (850.3, 851.8)	893.6 (892.9, 894.1)	851.2 (850.6, 851.6)	892.9 (892.1, 894.2)	<0.001*	0.547
Vitamin D (µg)	2.1 (2.0, 2.5)	1.2 (0.6, 2.3)	2.2 (1.8, 2.6)	0.3 (0.1, 1.6)	0.570	0.642
Magnesium (mg)	212.4 (212.0, 213.9)	227.5 (226.9, 227.9)	212.6 (212.2, 214.2)	227.7 (226.7, 228.7)	<0.001*	0.815

General Linear Model, Two-Way Repeated Measures: Mean ± Standard Deviation, Median (25%, 75%)

Group (adolescents, adults) was a fixed variable and analyses were adjusted for the following covariates: race, pre-pregnancy BMI, participation in WIC, and maternal age at study enrollment. N=22 (10 adolescents and 12 adult women)

*All variables were energy-adjusted based on the mean caloric intake.

**The following are the AMDR for protein, fat, and carbohydrate respectively: 10-35%, 20-35%, 45-65%. The following are the Dietary Reference Intakes (DRI) for folate (µg), iron (mg), calcium (mg), vitamin D (µg), and magnesium (mg), respectively: 600 µg/d, 27 mg/d, 1300 mg/d, 15 µg/d, 400 mg/d.

Correlation analysis was used to assess the changes in sugar and fiber intake in relation to gestational weight gain (kg). After controlling for race, pre-pregnancy BMI, WIC participation and maternal age, partial correlations revealed that sugar was not correlated with maternal gestational weight gain of both the adolescents and adults (R=-

0.082, $P=0.762$). Similarly, change in fiber intake was not correlated with gestational weight gain ($R=0.154$, $P=0.568$).

Change in sugar intake and gestational weight gain among pre-pregnancy BMI classes was compared using a general linear model. Pre-pregnancy BMI classes (normal weight (9 participants), overweight (6 participants), obese (7 participants)) were used to categorize participants. No association was found between change in sugar intake and pre-pregnancy BMI categories ($P=0.143$). The mean change \pm SE in sugar intake was 7.2 ± 0.6 , 7.0 ± 0.4 , and 6.6 ± 0.7 g for normal, overweight, and obese BMI groups, respectively.

Additionally, a general linear model was used to look at the change in sugar intake and categories of GWG (normal GWG and excessive GWG) after holding constant variables for race, WIC, and pre-pregnancy BMI. No association between change in sugar intake and GWG was observed ($P=0.331$) with mean \pm SE changes of 6.7 ± 0.3 , and 7.2 ± 0.3 g for the normal and excessive GWG groups, respectively.

Nutrition Knowledge

Results from pre- and post-intervention nutrition knowledge surveys suggested that both adults and adolescents lacked knowledge of the MyPlate.gov recommendations. When asked to identify foods from a short list, adolescents struggled to identify foods high in fiber with many reporting that yogurt was high in fiber. **Figure 2** shows the responses given regarding fiber-containing foods. The adult women more frequently identified oatmeal and broccoli as good sources of fiber; however, many still listed yogurt as a fiber-containing food.

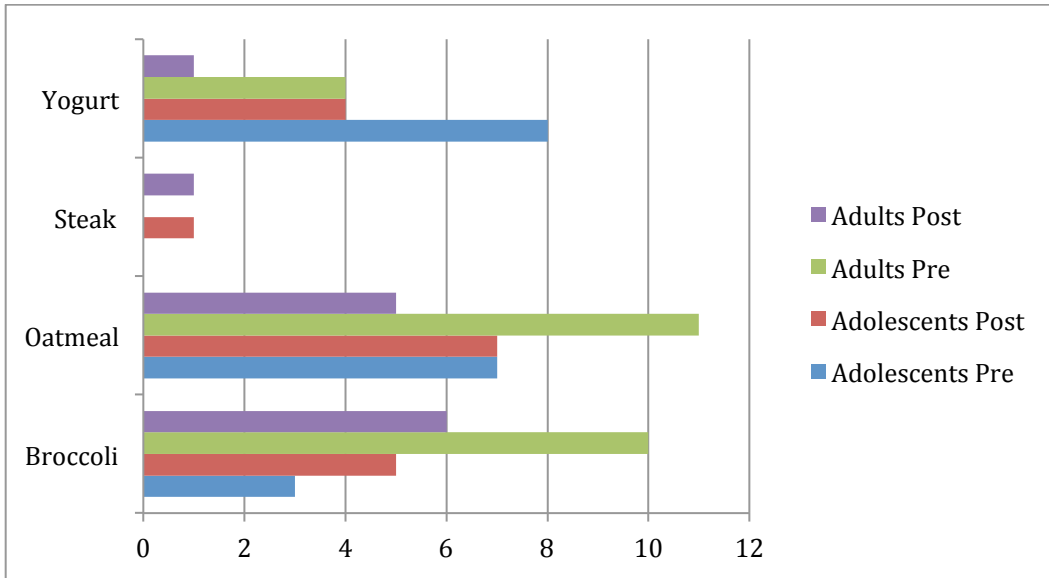


Figure 2. Yogurt was frequently incorrectly identified as containing fiber when asked “Which of the following foods do you think contain fiber?”
**Participants were able to select more than one choice.*

Despite receiving digital messages about whole grains, the majority of both the adolescents and adults responded to a question regarding whole grains that all grains consumed should be whole (**Figure 3**). Only three of the adult participants selected $\frac{1}{2}$ of grains as whole prior to the intervention and no improvement was seen across the study. A slight improvement was seen for the adolescents such that zero and one participants selected $\frac{1}{2}$ at pre- and post-intervention time points, respectively.

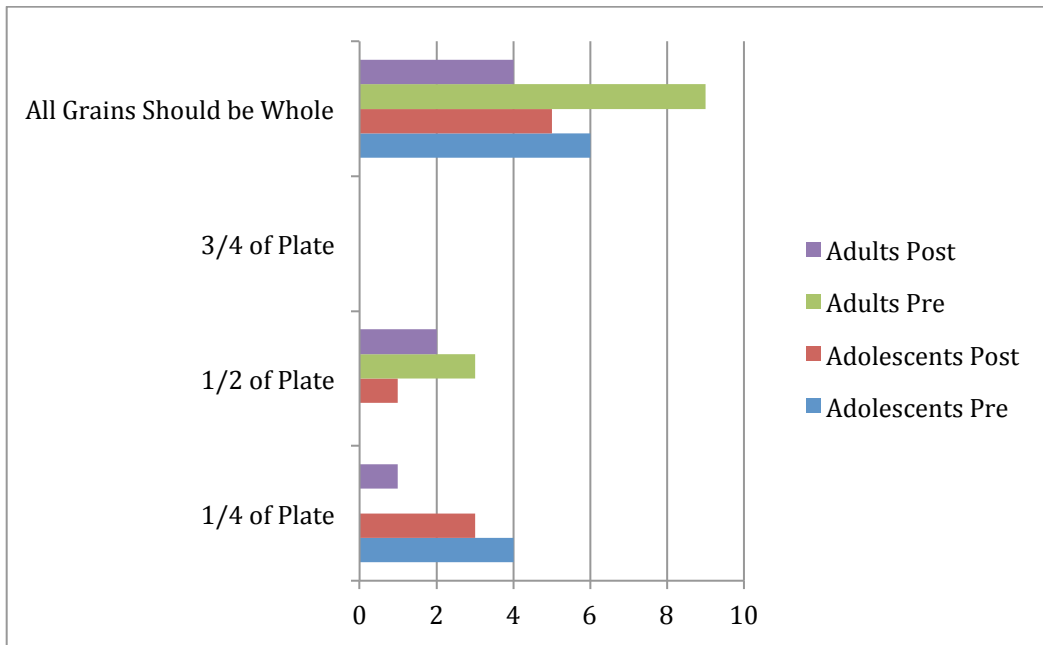
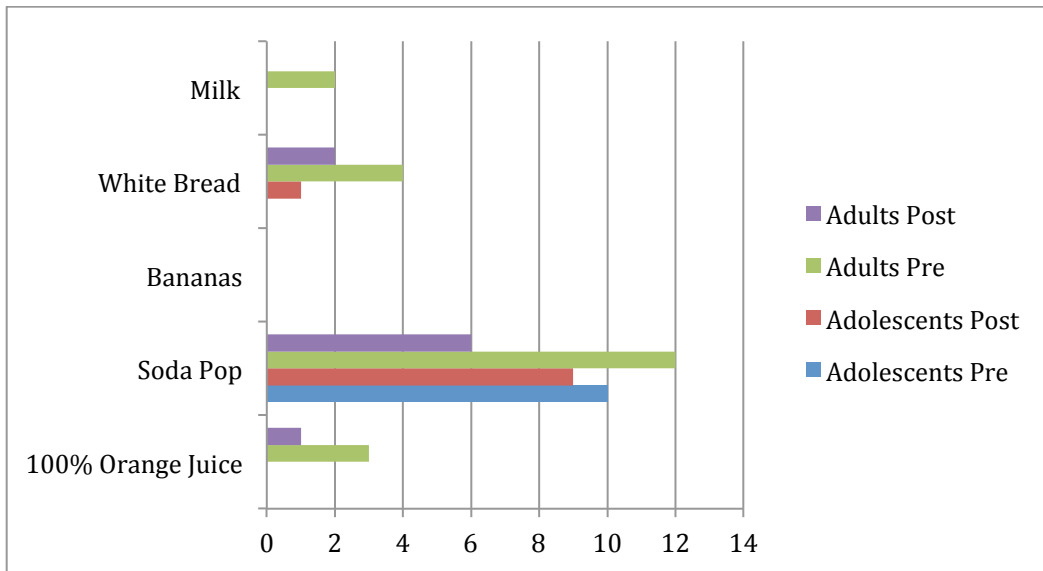


Figure 3. A good understanding of the positive benefits of whole grains was demonstrated with survey responses to “How much of the grains you eat should be whole grains?”

When asked to identify foods high in added sugar, most participants correctly identified that soda had added sugar; however, many of the adults also reported that milk, orange juice, and white bread contained added sugars. Participant responses to this question are shown in **Figure 4**.



*Figure 4. White bread and milk were incorrectly identified as foods containing added sugar when asked, “Which of the following foods have added sugar?”
Participants were able to select more than one choice.

Participants were also asked how much of a dinner plate should be filled with fruits and vegetables; results are shown in **Figure 5**. Most of the adolescents responded with the answer “1/4” of the plate, while only 2 teens on the first survey and one teen on the second survey correctly answered “1/2” of the plate. The adults scored much better on this question with more than half of the participants responding “1/2” before the intervention. After the intervention, all but 2 of the adults answered correctly with half of a plate, however fewer adults answered the question.

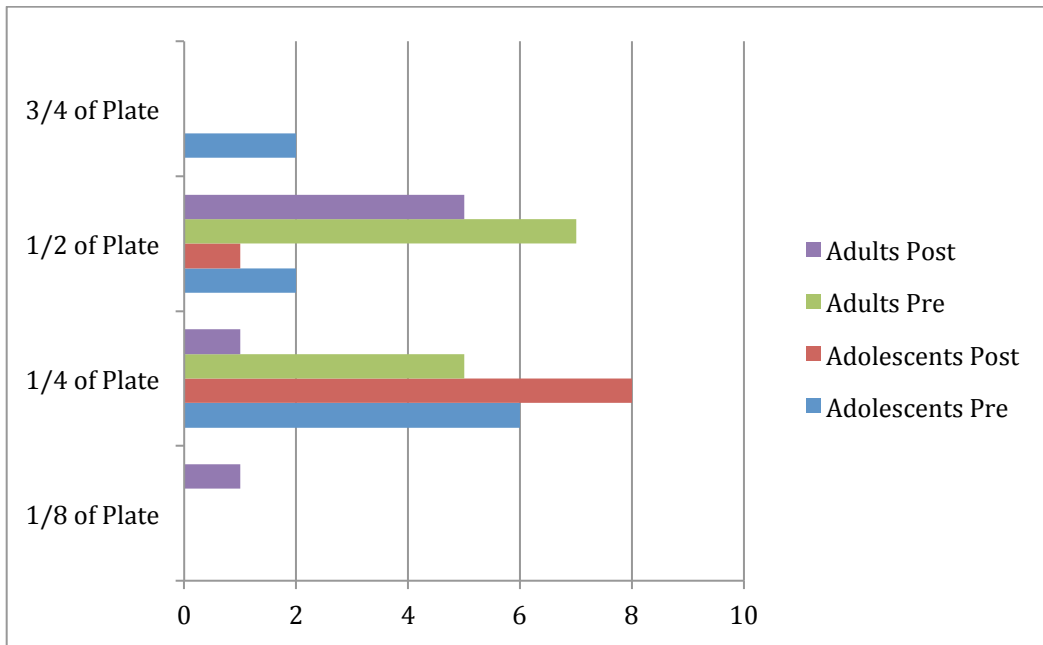


Figure 5. Confusion regarding correct portion sizes for fruits and vegetables occurred, as shown by varying responses to the survey question: “How much of a dinner plate should someone fill with fruits and vegetables?”

Technology Use

High levels of access to social media were reported for all participants. The majority (90.9%) of both the adolescents and adults had a cell phone that could receive text messages. Of the adolescents, nine of the ten had a cell phone that could receive text messages and only one had to pay for this service. Of the adult participants, eleven of the twelve had a cell phone with text messaging, and only one had to pay a fee for this service. Overall, a total of 48 messages were sent to adolescents and 52 messages were sent to adults via text message over the course of the intervention. High levels of access to Facebook were also reported; all participants except one adolescent had a Facebook account. Forty-seven Facebook messages were sent to adolescent participants and they were viewed 235 times (mean=34/person). Fifty Facebook messages were sent to adult participants and they were viewed 356 times (mean=45/person). Messages sent out through Facebook and text message were categorized into ten themes; exercise, recipes,

healthy diet, weight gain, pregnancy cravings, relaxation, hydration, fruits and vegetables, fun, and science.

Study-wide shortlink use during the study was tracked by viewing the number of clicks on each link within the Bitly built-in analytics system. **Figures 6 and 7** show the shortlink participation by adolescents and adults, respectively. Total clicks were low for adolescents with only 11 overall clicks by participants. Messages pertaining to recipes and weight gain were the most popular, with 7 of the 11 clicks falling under these categories. Links relating to healthy snacks, fun, and science did not receive any clicks by the adolescent participants. Numerous messages regarding exercise were sent out but only one click was recorded. Participation by adults was much higher with regards to the Bitly shortlinks. A total of 49 clicks were recorded across all 10 message categories. The majority of the messages that were sent to the adults pertained to exercise and recipes; however, links with the most click action were about exercise and weight gain. Other categories of interest were healthy snacks, recipes, and relaxation/music. As observed with adolescents, messages relating to fun, science, and hydration were not popular, with only two clicks total for all three categories among the adult group.

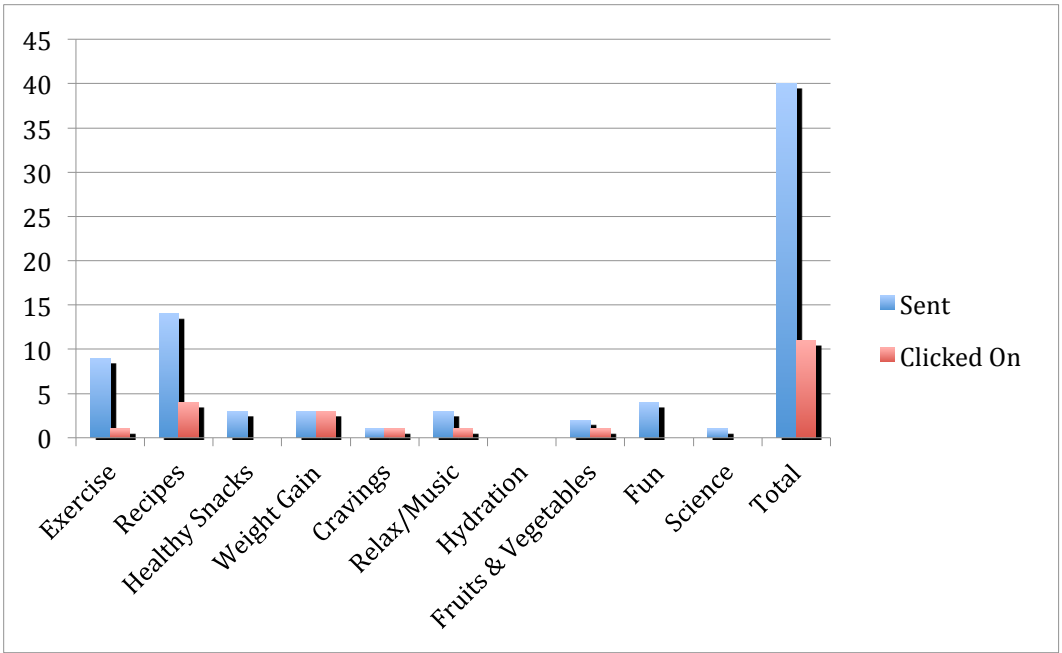


Figure 6. Poor Bitly shortlink participation by adolescents with few clicks recorded
 *The category “Sent” represents the total number of links sent out for each category and “Clicked On” represents the total number of times that participants clicked on a link in that category.

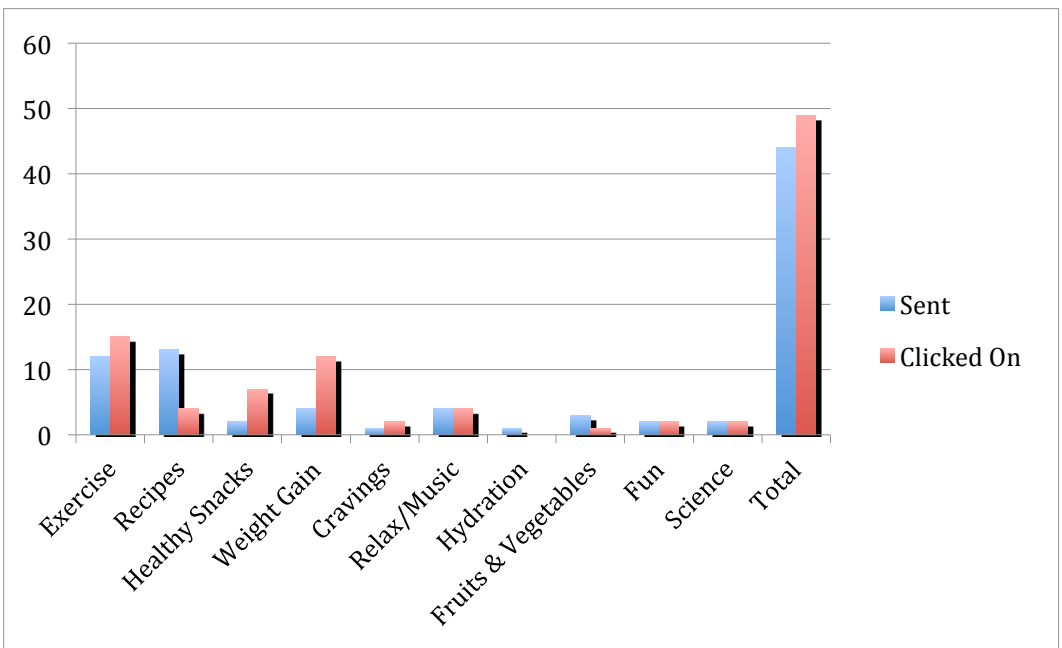


Figure 7. Bitly shortlink participation was much higher among adults
 *The category “Sent” represents the total number of links sent out for each category and “Clicked On” represents the total number of times that participants clicked on a link in that category.

CHAPTER 5

DISCUSSION

Currently, most prenatal nutrition research focuses on adult women, with few studies examining dietary intake and nutrition knowledge of low-income, pregnant, adolescents.¹⁷ Additionally, research using social media to target dietary intake and nutrition knowledge within low-income, pregnant, adolescents has not been explored, despite data suggesting that teens have access to and respond well to social media.^{5,19-21} To our knowledge, this is the first study to assess the effects of a social media-delivered intervention on dietary intake and nutritional attitudes during teen pregnancy.

Over the course of the intervention, sugar was the only dietary variable with a significant change between the two groups. Adolescent sugar consumption increased more than adult consumption. Adolescents consumed, on average, an additional 8 g/d of sugar by the end of the intervention, whereas adults had an average dietary sugar increase of 6 g/d. Although this difference was significant, the difference of only 2 grams of sugar between the adolescent and adult groups is small, and contains only 8 calories and therefore, may not be a clinically relevant amount. A significant interaction between time and group (adolescents, adults) occurred for sugar intake. Overall sugar intake was high, with roughly 25% of total calories coming from total sugar, pre- and post-intervention. This is much higher than the national average (16.6%) of added sugars consumed by adolescent girls aged 12-19 years old in the U.S.¹⁰⁶ However, the sugar intake within this population was lower than participants within the high-sugar intake group in the Camden Study who consumed an average of 44% of total calories from sugar, compared with only 19% within the low-sugar intake group.¹⁰⁷ Although the high-sugar intake within this cohort included total sugar consumed, including foods such as

fruit, much of the sugar came from foods such as cakes, cookies, and high-sugar cereals. Many participants also reported sugary fruits and desserts as pregnancy cravings, so it is likely that they increased their consumption of these foods during pregnancy given the observed longitudinal increase in reported sugar consumption.

High sugar consumption during pregnancy has been shown to have negative effects on health at all ages, and is therefore a cause for concern.⁵² The WHO recommends that no more than 10% of daily calories come from added sugar in order to prevent adverse health outcomes in all populations.⁵² The Camden Study concluded that the teens consuming above ≥ 206 g/d of sugar had a two-fold greater risk for delivering a SGA baby, and an increased risk for delivering a LBW baby.¹⁰⁷ Additionally, high sugar intakes among pregnant teens have been positively correlated with maternal glucose concentrations and subsequent delivery of large-for-gestational age fetuses with higher birth weights.⁷ Maternal complications have also been shown to increase with high glucose levels including gestational diabetes.⁷ Additionally, Whisner, et al. found that maternal sugar intake during pregnancy was positively associated with fetal abdominal fat.¹⁰⁸ Furthermore, high-sugar diets have been associated with adverse effects including preeclampsia and excessive weight gain.⁵²

When comparing the dietary intake of the adolescents to the adults, some minor changes were observed. This study found that adolescents had a larger decrease in fat consumption than the adults over the course of the intervention, however not significantly different. The decrease in fat intake may be important, due to the fact that current literature suggests that teens especially have diets high in fat.⁶ Although no studies have supported a low-fat diet for pregnant women, high-fat diets during pregnancy have been negatively associated with cardiovascular status among offspring during childhood.¹⁰³ Blumfield, et al. also reported that a higher fat consumption (> 40%

of energy intake) during pregnancy has been associated with increased fetal growth, specifically mid-thigh fat area growth.¹⁰⁴ Excessive maternal fat intake has been associated with obesity, insulin resistance, and high risk for cardiovascular disease (CVD) among offspring in animal models.¹⁰³ One study reported that pregnant rats consuming a high fat diet of 59.5% had increased body weight and triglycerides compared with rats on a diet of only 10.9% fat.¹⁰⁵ In addition, the fetuses of the high fat diet rats had plasma insulin levels almost twice as high as the fetuses in the control group,¹⁰⁵ indicating that very high fat diets could contribute to adverse clinical outcomes. Adolescents and adults in this study consumed a fat intake higher than the AMDR pre-intervention; while intake decreased slightly among the adolescents, adult consumption of fat remained above the AMDR post-intervention. Among this population, the replacement of high-fat foods such as cakes and fast food, with healthier alternatives such as avocados, nuts, and eggs, or lower-fat, nutrient-dense foods may be a positive dietary strategy that merits investigation in relation to maternal and fetal health outcomes.

When assessing dietary changes across the intervention among all participants, many significant differences were found including decreases in fat and folate intakes and increases in carbohydrate, calcium and magnesium consumption. These results show some significant improvements in dietary intake; however, it is difficult to elucidate whether these changes were due to the intervention or other factors such as pregnancy-related hyperphasia.¹⁰⁹ In addition, the adolescents and adults were still not reaching adequate levels of important micronutrients such as fiber, folate, iron, calcium, and vitamin D, which is consistent with current literature that adolescents and low-income women tend to consume diets low in micronutrients.^{1,3,6,13,38} Lenders, et al. reported that inadequate intakes of calcium and zinc may contribute to insulin resistance among

pregnant women, thereby contributing to negative outcomes.⁶ Other studies have associated zinc deficiency with growth retardation, congenital abnormalities, neurobehavioral and immunological complications in the offspring.¹¹⁰ Folate is important for congenital formation in the fetus, whereas iron deficiency during pregnancy can result in anemia and can contribute to risk of death from hemorrhage during childbirth.¹⁰⁶ Additionally, low intakes of vitamin D during pregnancy may lead to high bone turnover and osteomalacia in the mother.¹¹¹ Due to these negative complications associated with micronutrient deficiency, and the major deficits in micronutrient intake observed among this population, it is important to monitor and encourage adequate intakes among pregnant women.

One way to increase micronutrient intake among pregnant adolescents and adults is through the use of prenatal vitamins, which can help to ensure that women receive adequate nutrition of these critical micronutrients during pregnancy. Many recommendations currently exist; the CDC and the IOM recommend iron supplementation for all pregnant women, and consumption of 400 µg of folic acid are recommended for all women of childbearing age.¹¹² In addition, for women with poor diets, anemia, or who smoke cigarettes, a multivitamin containing iron, zinc, calcium, copper, folic acid, and vitamins D, C, B6, and B12 is recommended.¹¹² Due to these recommendations, pregnant teens should be encouraged to consume prenatal vitamins during pregnancy and additionally consume foods naturally high in or fortified with folate, vitamin D, and iron in order to increase consumption of micronutrients of concern.

No change in fiber intake was observed over the course of the intervention. The USDA guidelines recommend pregnant adolescents and adults consume 28 g/d of fiber.¹¹³ Participant intakes of fiber did not meet these recommendations, with average

intakes of 21-22 g/d. Recent NHANES data concluded that children and adolescents aged 2 to 19 years of age consumed a mean fiber intake of only 14 g/d, whereas adults consumed an average of 17 g/d of fiber.⁵⁴ This shows that although participants were not meeting recommendations, consumption of fiber was higher than the national average. Participants consumed foods such as sugary cereals and beans both pre- and post-intervention, which likely were high in or fortified with fiber, which could have increased their fiber intake over the national average. However, consumption of fruits and vegetables remained low and few major dietary changes were observed throughout the intervention resulting in similar fiber intakes both pre- and post-intervention for both groups of participants. Furthermore, reported foods that increased across pregnancy tended to be sugar-sweetened beverages and dessert items, which are high in sugar but low in fiber, both contributing to the increase in sugar intake and relatively equal fiber consumption of the participants during pregnancy.

Total carbohydrate intake is of importance due to a correlation between fetal abdominal fat and the mother's protein-to-carbohydrate ratio during pregnancy that was observed by Blumfield et al.¹⁰⁴ Specifically, an increase in the protein-to-carbohydrate ratio correlated with an increase in fetal abdominal visceral fat area.¹⁰⁴ In addition, maternal glucose concentrations are important for fetal growth such that decreased maternal insulin sensitivity has been associated with fetal birth weight.¹¹⁴ These studies indicate that a high carbohydrate or total starch intake by the mother may have negative repercussions for the fetus. Childhood obesity may stem from fetal adiposity and in-utero programming;¹¹⁵ therefore, the need for interventions that improve dietary behaviors beginning with pregnancy are important for promoting optimal maternal and fetal health.

Some diet-focused interventions targeting pregnant adolescents have shown improvements in cognitive function and nutrition knowledge among participants.^{70,71} The studies by Long and Perkin saw increased nutrition knowledge but no actual change in dietary intake,^{70,71} indicating a disconnect between knowledge and behaviors. Contrary to those studies, participants in this cohort did not show an improvement in nutrition knowledge. However, albeit small, some positive dietary changes were seen, such as a decrease in fat intake and increases in protein, carbohydrate, iron, calcium, and magnesium. Additionally, studies have shown that nutrition-focused, counseling sessions have proven beneficial for pregnant women with higher birth weights and increased consumption of some micronutrients by the mother.⁶⁷ Providing interventions that target small dietary changes along with basic nutrition education may be beneficial in helping to target both knowledge and behaviors among this population.

Congruent with current literature, the adults and adolescents in this study had high levels of access to social media such as Facebook and text message,^{5,20,21,79} and this could potentially be a way to target and close the gap between increasing nutrition knowledge and promoting healthful dietary intake. Studies have shown that online nutrition information provided via social media or text message is an effective means of education for low-income teens and young mothers.⁷⁹ The Text-4-Baby app proved that use of a text-messaging program is feasible and well received among low-income, minority women.^{93,94} Additionally, participants in WIC have been found to respond well to receiving health education via social media.⁷⁹ When internet-based interventions have been used with pregnant women, features such as weight trackers and online blogs have been reported as the most popular among participants,^{13,89} indicating that this could be a feature to utilize in future interventions. Although one study concluded that white women with higher incomes used a website more consistently, access by low-income,

minority groups was still reported, thereby demonstrating the feasibility of websites as a way to provide nutrition and health information to pregnant women.¹³

Contrary to other studies conducted, no correlation between change in sugar intake and gestational weight gain was observed in this study.⁶ In addition, no association between change in dietary sugar intake and pre-pregnancy BMI or GWG groups (normal GWG or EGWG) were observed. Despite the lack of an association, both teens and adults still experienced EGWG in this study, which is problematic. EGWG has been associated with negative health outcomes in adolescents such as increased risk of delivery of a low birth weight baby, preterm delivery, anemia, perinatal death, maternal death, macrosomia, child overweight, and postpartum weight retention.^{1,3,11,23} Adults face such adverse outcomes such as higher risk for long-term weight gain, overweight and obesity later in life, gestational diabetes, cesarean birth, macrosomia, and preterm birth.^{4,13,32,35} The IOM weight gain guidelines have been established for teens and adults in order to promote healthy levels of weight gain and minimize the risk for negative birth outcomes.^{14,35}

Previous studies have found that teens tend to gain more gestational weight than adults.¹ However, we did not see a significant difference when compared to the adult group. The comparable weight gain between the adolescents and adults could have been influenced by the intervention or the high quality of care the participants received at the University of Rochester Midwifery Clinic. Women who begin pregnancy as overweight or obese tend to gain greater amounts of gestational weight than women who begin pregnancy at a normal BMI.^{12,14,29} This study showed similar results with 85.7%, 50% and 37.5% of obese, overweight and normal weight participants gaining weight excessively, respectively. This is comparable with 2003 rates of EGWG among American women where 38.4% of normal weight, 63% of overweight, and 46.3% of obese women gained

excessive gestational weight during pregnancy.¹⁴ Although rates of weight gain were similar among all pre-pregnancy BMI groups for the adults in this study, the overweight and obese adolescents had greater rates of excessive gestational weight gain than the teens who began pregnancy at a normal BMI. Therefore, adolescents may need to be monitored more closely than adult women for appropriate gestational weight gain.

Since overall dietary intake was poor among participants, further education and research is needed in order to enhance dietary intake among low-income, pregnant adolescents and adult women. Future interventions to determine why intakes of certain micronutrients remain low are warranted. This study had a small impact on dietary intakes: however, future research may need to use simple, whole foods to increase these micronutrients of concern. Research is needed to determine what types of sugars are being consumed in order to target adolescents with healthier food choices. Additionally, future interventions are needed to explore whether increases in sugar intake are common among other teen populations and to what extent increases in sugar consumption across gestation affects the mother and fetus. Other dietary components like fat intake or physical activity and familial support may need to be included in this research to fully explore this topic in the future.

First time pregnancy has been noted as a time when women want to establish positive nutritional behaviors such as increasing fruit and vegetable consumption.⁶¹ This should be considered as a factor when targeting the adolescent population with education as most of these teens are carrying their first baby. Future interventions are needed to assess what types of education are most effective within this population, as education is important for improving daily dietary choices. Finding ways to help adolescents especially actively engage and retain the information are also necessary, as information retention proved to be a challenge for some participants. Further research

into what specific dietary and healthy behavior topics interest diverse teens and low-income women is necessary in order to promote interest and adherence to interventions.

Strengths and Limitations

This study targeted low-income, pregnant adolescents and adults with a social media intervention, which is an area of research with little prior exploration. Strengths include that the adult comparison group was recruited from the University of Rochester Midwifery Clinic in order to obtain relatively equal demographics between the two groups of women. Additionally, the study was cost-effective and provided health and nutrition information to participants via fast, accessible, and timely media sources.

Limitations of this study included the use of 24-hour diet recalls to evaluate macro- and micronutrient intakes. Relying on participant memory and knowledge of portion sizes is challenging and can contribute to reporting bias and inaccuracies. The program Food Processor was used to enter and evaluate food intake and not all of the foods recorded were found in the database, requiring educated guesses for some items. In addition, only total sugar intake was provided by Food Processor which resulted in the inability to accurately calculate added sugar intakes. The high sugar intakes in adolescents may have been confounded by increased fruit consumption as many of the teens received fruit and vegetable supplements from the WIC program. Another limitation was the small sample size used in the study. This may have limited the ability to see significant results and limits generalizability of the findings. Many participants in the study were already 25-28 weeks pregnant when they enrolled in the social media study, thereby limiting the time to motivate participants with messages regarding prenatal health. Lastly, findings from this intervention may not apply to other populations who do not live in Rochester, New York where the study was conducted.

CHAPTER 6

CONCLUSION

This pilot study indicated that sugar is a nutrient of concern among pregnant, low-income adult women and adolescents, with adolescents having a greater increase in dietary sugar intake than adults across the intervention. Sugar and fiber consumption were not associated with GWG among participants, and no associations between change in sugar intake and pre-pregnancy BMI or GWG groups (normal GWG or EGWG) were observed. A significant decrease in dietary fat was observed across gestation for both adolescents and adults, although this change was greater for adolescents. Overall, dietary quality was poor, with low fiber and micronutrient intakes. Nutrients important for maternal and fetal growth, most notably iron, calcium, and vitamin D, were especially low throughout gestation. Knowledge of the MyPlate guidelines was also lacking among adult and adolescent participants. Although teens have increased access to social media, the adults had higher levels of participation during this study. Although this may speak more to personal motivation and interest rather than the feasibility of the intervention, future studies should aim to understand the motivations behind pregnancy health choices when comparing teens and adults.

The overall poor quality of participant diets suggests that further education and research are needed to examine factors that affect diet and gestational weight gain. Since dietary sugar consumption increased across gestation for all participants, looking into why this occurred, what types of sugar were consumed, and how this contributes to pregnancy health is necessary. This is especially true for adolescents as they are at greater risk of EGWG. Future interventions to determine why consumption of important micronutrients remains low are also important. Different aspects of behavior such as

physical activity levels and familial support may be necessary in researching gestational weight gain, since sugar was not found to have an effect. The best way to actively engage pregnant adolescents in comparison to adult women is still not known; however, these data suggest that social media may be an effective way to reach this high-risk pediatric population. Finding areas of interest among pregnant women at different ages, along with the best ways to reach them with educational material will be key in promoting information retention and allowing interventions to change dietary habits.

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APPENDIX A
CONSENT FORMS (3)

ADULT STUDY CONSENT FORM

Study Title: Text for Prenatal Health Study

Principal Investigators: Corrie Whisner, PhD, Kimberly O'Brien, PhD, Eva Pressman, MD, Elizabeth Cooper, CNM, EdD, FACNM

This consent form describes a research study, what you may expect if you decide to take part and important information to help you make your decision. Please read this form carefully.

The study staff will explain this study to you. Please ask questions about anything that is not clear before you agree to participate or at any time. You may take this consent form home to think about and discuss with family or friends.

- Being in this study is voluntary – it is your choice.
- If you join this study, you can change your mind and stop at any time.
- If you choose not to take part, your routine medical care will not be changed in any way.
- There are risks from participating and you should understand what these mean to you.

Introduction

You are being asked to take part in this study because you are an adult female receiving prenatal care at the University of Rochester Midwifery Clinic in Rochester, NY.

This study is being conducted by Kimberly O'Brien, PhD, Rebecca Seguin, PhD, and Corrie Whisner, PhD, of Cornell University and Eva Pressman MD, Beth Cooper, CNM, EdD and Ruth Anne Queenan, MD, of the University of Rochester's Department of Obstetrics and Gynecology and Highland Hospital's Department of Obstetrics and Gynecology. Kimberly O'Brien is also on the faculty at University of Rochester.

You are eligible to participate in this study because you:

- Are 20 years of age or older
- Are at least 12 weeks pregnant, but less than 30 weeks pregnant
- Do not have high blood sugar (diabetes)
- Do not have HIV infection
- Do not have problems eating and digesting your food
- Do not have an eating disorder (such as anorexia)
- Do not have high blood pressure or regularly take steroids for another condition
- Do not use illegal drugs

Purpose of Study

The purpose of this study is to find out if receiving electronic health information (e.g. text messages and Facebook posts) changes how you think about your pregnancy. Your healthcare provider shares important information about nutrition and medical care during

your prenatal visits but receiving additional information between these visits may help improve the health of your baby.

Description of Study Procedures

If you decide to take part in this study, you will be asked to take two short surveys so that we can see what you know about nutrition and how you use the internet. We will also ask you to participate in a one-on-one interview with study staff. *One-on-one interviews can be completed in-person, through Skype on a clinic computer, or over the phone depending on your schedule. **The first interview must be completed before you reach 28 weeks of gestation.*** During this interview, we will ask you some questions about your feelings about weight gain, diet and physical activity during pregnancy and to see where you look for health information. After talking to you, we will ask you to enroll in a PRIVATE group on Facebook and to receive text messages from study staff. The information received on Facebook or through text messages will be about general nutrition and health during pregnancy. If you do not have access to Facebook or text messages but want to be in this study, we will provide the information to you on paper. **You will begin receiving text, Facebook or paper messages after your first interview or at 28 weeks of gestation, depending on which comes first.** We will have you complete the nutrition survey again at the end of your pregnancy and ask you to complete an additional interview (Skype, phone or in-person). This interview will let us see what you thought about the Facebook group and text messages we sent you. We will also see if your diet and exercise habits changed during the study.

You will also be asked to complete three 24-h dietary recalls. These will be completed at three times across gestation with the goal of collecting records during early, mid- and late gestation.

Additionally, you will have the option to participate in a group discussion (focus group) sometime during your pregnancy. This discussion will be about the same discussion topics above but will be completed in a group of 8-12 pregnant women from the URM clinic. Focus groups will be completed after you start receiving health messages through Facebook and text messages. You are not required to complete the group discussion but will be presented with the option upon enrolling in the study. The focus group will be completed in the evening on a weekday or on a weekend and food will be provided.

All focus groups and interviews (Skype, phone, in-person) will be recorded with a digital recording device or tape recorder to allow for accurate and complete transcription of results. These recordings will be listened to and transcribed into a written format for analysis. Responses to questions will be categorized into themes. All responses will be de-identified using subject numbers within three weeks of completing each focus group to protect your identity.

We will also look in your medical chart to learn more about how healthy you are and to learn more about your pregnancy. Record information that will be taken from your medical chart will be your weight, height, weight gain, blood pressure and heart rate. We will also record the birth weight and birth length and other health information on your baby from your baby's medical chart.

Number of Subjects

Approximately 30 subjects will take part in this study.

Duration of the Study

Your participation in the study will last up to 9 months and will end when you deliver your baby. Each interview or group discussion will take one to one and a half hours to complete and the nutrition and internet usage surveys will take approximately 10-15 minutes to answer the questions. Each 24-h dietary recall will take approximately 15-20 minutes to complete.

Risks of Participation

There are no risks to your developing baby from participating in this study. Potential risks to you include psychological or social discomfort if someone outside of the study sees your text messages or information posted on the PRIVATE Facebook page. Messages posted by study staff will be about general health and will NOT contain personal information. The Facebook site will be monitored daily to assure that your privacy is maintained and that posts made by study participants have a positive tone. Study staff will screen all posts and remove negative comments during daily monitoring sessions. Additionally, all participants will receive a Facebook and text message information sheet at the beginning of the study that outlines how to act respectfully using these tools.

An additional risk is someone hearing or seeing your interview if you choose to complete your interview on Skype. This is an online video-telephone service which someone could gain access to. The website does do their best to protect the data transferred (encryption) during the call; however, there is a small risk that the call may be intercepted by a third party. This risk is no more than the risk associated with web surfing or shopping online.

In the event that you want to join the Facebook group but do not want to use your actual profile, the study staff will allow you to create an alias account so your identity is protected. Similarly, if you would like to enroll in the Facebook group but do not have an account; study staff will assist you in creating an account on a computer within the health clinic or by downloading a Facebook app on your cell phone.

Information obtained will be kept confidential and will only be accessible to study personnel and those study subjects who choose to join the Facebook group. As soon as the study is complete and data analyzed, the Facebook group will be closed and removed from Facebook. The study cell phone used to send text messages will also be cancelled.

Benefits of Participation

You might not benefit from being in this research study. The potential benefit to you from being in this study might be learning new information about nutrition and health during pregnancy.

Alternatives to Participation

You do not have to participate in this study if you do not want to. Your decision not to join this study will not affect the health care you receive at Highland or Strong Hospitals or elsewhere.

Sponsor Support

The University of Rochester and Cornell University are receiving payment from the United States Department of Agriculture for conducting this research study.

Costs

There will be no cost to you to participate in this study.

Payments

You will be paid \$160 for completing this study according to the schedule below:

For enrolling in the study and for completing baseline surveys and the first interview you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group before 28 weeks gestation - \$30 gift card to Walmart
- Internet use survey - \$10 to Walmart

When it is time to begin receiving text and Facebook messages (email or paper copy of messages if you do not have internet / text messaging) you will be given;

- A \$10 gift card to Walmart

For completing the final study visit near delivery you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group - \$30 gift card to Walmart

For completing the three 24-h dietary recalls you will be given;

- Early gestation 24-h Diet Recall - \$5 gift card to Walmart
- Mid-gestation 24-h Diet Recall - \$5 gift card to Walmart
- Late gestation 24-h Diet Recall - \$10 gift card to Walmart

For completing the optional focus group discussion, you will be given;

- Focus group - \$40 gift card to Walmart

In addition to earning the above gift cards, you will be eligible to participate in weekly wellness challenges which will be awarded with small prizes ranging \$5 - \$20. Challenges will be described (i.e. post 3 photos of your dinner plate this week following the MyPlate.gov guide) in detail through text messages or on the Facebook page. The specific prize will be listed for each challenge. Prizes will include items such as lotion, lip gloss, nail polish and books.

Confidentiality of Records

The study staff working on this study will be able to see the information collected. In the event that you share information that shows that your health or the health of your baby is at risk, the study staff may need to tell your doctor or healthcare provider.

Additionally, undergraduate researchers may be able to use the information collected for Honors Thesis projects. If a student is interested in doing such a project, they will only have access to data after your name has been removed in order to protect your identity.

While we will make every effort to keep information we learn about you private, this cannot be guaranteed. Other people may need to see the information.

While they normally protect the privacy of the information, they may not be required to do so by law. Results of the research may be presented at meetings or in publications, but your name will not be used. The federal Health Insurance Portability and Accountability Act (HIPAA) requires us to get your permission to use health information about you that we either create or use as part of the research. This permission is called an Authorization. We will use;

- Demographic information (where you live, your phone number, etc.)
- Information on your height, weight and previous pregnancies
- Dietary information and information on supplement use over pregnancy
- Self-reported drug and alcohol use and use of cigarettes
- Current use of medications and prescription drugs
- Diagnosis of any pregnancy complications or health problems
- Test results on hemoglobin and routine tests drawn across pregnancy
- Information from your medical chart on all infections, inflammatory conditions and birth complications that you experience across pregnancy and at delivery
- The place where you were seen
- The name of your physician
- The medical records of your newborn

We will use your health information to conduct the study and to determine how your health beliefs and behaviors during your pregnancy might be influencing your health and the growth of your developing baby. Health information is used to report results of research to sponsors and federal regulators. The health information collected may be audited to make sure we are following regulations, policies and study plans. RMC/Strong Health policies let you see and copy health information we have gathered for this research study after the study ends, but not until the study is completed. If you have never received a copy of the URM/ Strong Health HIPAA Notice of Privacy Practices, please ask the investigator for one.

To meet regulations or for reasons related to this research, the study investigator may share a copy of this consent form and records that identify you with the following people: The University of Rochester; the Department of Health and Human Services; the United States Department of Agriculture, Cornell University, University of Rochester, Highland Hospital, Food and Drug Administration, and your primary care provider.

If you decide to take part, your Authorization for this study will not expire unless you cancel (revoke) it. The information collected during your participation will be kept indefinitely. You can always cancel this Authorization by writing to or calling the study investigator. If you cancel your Authorization, you will also be removed from the study. However, standard medical care and any other benefits to which you are otherwise entitled will not be affected. Canceling your Authorization only affects uses and sharing of information after the study investigator gets your written request. Information gathered before then may

need to be used and given to others. For example, by Federal law, we must send study information to the FDA for drug studies it regulates. Information that may need to be reported to the FDA cannot be removed from your research records.

A description of this clinical trial will be available on <http://clinicaltrials.gov> as required by U.S. Law. This website will not include information that can identify you. At most, the website will include a summary of the results. You can search this website at any time.

Contact Persons

For more information concerning this research or if you feel that your participation has resulted in any emotional or physical discomfort please contact: Lauren Cowen in the URMIC clinic at (585) 410-0119 or Corrie Whisner at (607) 342-3049.

If you would like to speak to a patient advocate about any issues or concerns you have involving your participation in this study please contact, Jennifer Morse, RN at (585) 224-1716.

If you have any questions about your rights as a research subject, or any concerns or complaints, you may contact the Cornell University Institutional Review Board for Human Participants at email irbhp@cornell.edu, telephone (607) 255-5138 for the following reasons:

- You wish to talk to someone other than the research staff about your rights as a research subject
- To voice concerns about the research
- To provide input concerning the research process
- In the event the study staff could not be reached

Additionally complaints or concerns can be shared anonymously through Ethicspoint (www.hotline.cornell.edu) or by calling toll free at 1-866-293-3077.

Voluntary Participation

Taking part in this study is voluntary. You are free not to take part or to withdraw at any time, for whatever reason. No matter what decision you make, there will be no penalty or loss of benefit to which you are entitled. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner.

SIGNATURE/DATES

After reading and discussing the information in this consent form you should understand:

- Why this study is being done
- What will happen during the study
- Any possible risks and benefits to you
- Other options you may have instead of being in the study
- How your personal information will be protected
- What to do if you have problems or questions about this study

If you choose to participate in this study you can choose to participate in an additional focus group discussion, with 8-12 other patients from the URMC clinic. Please check one option from below:

- YES, I will complete the focus group*
- NO, I will NOT complete the focus group*

Also, please choose the method in which you would like to receive health information below:

- Text messages and Facebook group*

Phone Number: _____

Facebook Name: _____

- Postal mail* **Address:**

Subject Consent

I have read (or have had read to me) the contents of this consent form and have been encouraged to ask questions. I have received answers to my questions. I agree to participate in this study. I understand that my interviews and / or focus group discussions will be audio recorded for data collection in this study. I have received (or will receive) a signed copy of this form for my records and future reference.

Subject Name (Printed by Subject)

Signature of Subject

Date

This consent form will be kept by the researcher for at least three years before the end of the study and was approved by the IRB.

Person Obtaining Consent

I have read this form to the subject and/or the subject has read this form. I will provide the subject with a signed copy of this consent form. An explanation of the research was given and questions from the subject were solicited and answered to the subject's satisfaction. In my judgment, the subject has demonstrated comprehension of the

information. I have given the subject adequate opportunity to read the consent before signing.

Name and Title (Print)

Signature of Person Obtaining Consent

Date

ASSENT FORM
[Adolescents ages 13-14]

Study Title: Text for Prenatal Health Study

Principal Investigator: Corrie Whisner, PhD

Co-Investigators: Kimberly O'Brien, PhD, Elizabeth Cooper, CNM, EdD, FACNM, Eva Pressman, MD

What are some general things you should know about research studies?

You are being asked to take part in a research study. Your parent or guardian needs to give permission for you to be in this study. You do not have to be in this study if you don't want to, even if your parent has already given permission. You are free to choose whether or not to be in this study. You may decide not to join, or, if you join, you may decide to stop being in the study, at any time, for any reason, without penalty.

What is the purpose of this study?

Research is how we learn new things. The purpose of this research study is to learn about the things you do to stay healthy during your pregnancy. You are being asked to be in the study because you are enrolled in the "Vitamin D Status Impacts Inflammation and Risk of Infections During Pregnancy" study and said that you were interested in hearing about other studies.

What will happen if you take part in the study?

If you decide to take part in this study, you will be asked to receive health information through text messages, a PRIVATE Facebook group, or on paper. Before receiving these messages, we will have you fill out two short surveys to see what you think about food and how you use the internet. We will also ask you spend 1 to 1.5 hours telling us how you feel about weight gain, food and physical activity during your pregnancy. This talk can be in a group (focus group) with other teens at the clinic or one-on-one (interview) with a study staff person. One- on-one interviews can be completed in-person, through Skype on a clinic computer, or over the phone depending on your schedule. **The first interview must be completed before you reach 28 weeks of gestation. You will begin receiving text, Facebook or paper messages after your**

first interview or at 28 weeks of gestation, depending on which comes first. We will have you complete one more interview (Skype, phone or in-person) or focus group toward the end of your pregnancy to see what you thought about the health messages we gave you and if they changed your diet and exercise habits. The study staff will record each interview or focus group to make sure that they do not miss anything that you say. These recordings will be used to type your responses so that we can save and read them again later. Your name will not be included in these typed versions. Your study id number will be used instead to protect your identity.

You will be asked to share your preference for an interview method at the end of this assent form. You may choose between an interview and a focus group. If your choice is different from your parent or guardian's choice, the study staff will use the interview method chosen by your parent/guardian.

All focus groups and interviews (Skype, phone, in-person) will be recorded with a digital recording device or tape recorder to allow for accurate and complete transcription of results. These recordings will be listened to at the RAMP clinic after each focus group or interview. Responses to questions will be categorized into themes. All responses will be de-identified using subject numbers within one week of completing each focus group to protect your identity.

Who will be told the things we learn about you in this study?

The doctors and study staff working on this study will be able to see the information collected. If there is something that you tell us that might impact your health or the health of your baby, study staff will share this information with your doctor or health care provider.

Undergraduate researchers may be able to use the information collected for Honors Thesis projects. If a student is interested in doing such a project, they will only have access to data after your name has been removed in order to protect your identity.

How long will your part in this study last?

Your participation in this study will last as long as you are pregnant so about 9 months.

What are the possible risks or discomforts involved from being in this study?

There are no risks to your baby if you participate in this study. The possible risks for you include emotional discomfort if someone outside of the study sees your text messages or posts on the PRIVATE Facebook group page. Messages posted by study staff will be about general health and will NOT contain personal information about you. All participants will receive a form that states behavior expectations when using the Facebook site and text messages. This is to make sure that you are treated with respect and that personal information is not shared.

An additional risk is someone hearing or seeing your interview if you choose to complete your interview on Skype. This is an online video-telephone service which someone could gain access to. The website does do their best to protect the data transferred during the call; however, there is a small risk that the call may be intercepted by a third party. This risk is no more than the risk associated with web surfing or shopping online.

Cornell University makes every effort to keep the information collected from you private. In order to do so, we will monitor the Facebook site daily to make sure that your personal information is safe and that posts to the Facebook group are friendly. At the start of the study, you will get a paper that tells you how to use the Facebook group and text messages. Study staff will read all posts and remove any comments that are negative or share personal information. If you do not want to use your regular Facebook account to join this study group, study staff will help you create a new Facebook account that you can use for the study. If you do not already have Facebook, study staff will help you make an account on a computer in the health clinic or by adding an app to your cell phone. As soon as the study is over, the Facebook group and study cell phone will be cancelled.

Sometimes, however, researchers need to share information that may identify you with people that work for the University, the government or the study sponsor. If this does happen we will take precautions to protect the information you have provided. Results of the research may be presented at meetings or in publications, but your name will not be used.

What are the possible benefits from being in this study?

You might not benefit from being in this research study. The potential benefit to you from being in this study might be learning new information about nutrition and health during pregnancy.

Will you get any money or gifts for being in this study?

You will be paid \$100 for being in this study according to the schedule below:

For enrolling in the study and for completing the food and internet surveys and interview/focus group you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group before 28 weeks gestation - \$30 gift card to Walmart
- Internet use survey - \$10 to Walmart

When it is time to begin receiving text messages or join the Facebook group (paper copy of messages if you do not have internet or text messaging) you will be given;

- A \$10 gift card to Walmart

For completing the final study visit near delivery you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group - \$30 gift card to Walmart

In addition to earning the above gift cards, you may participate in weekly wellness challenges. When you complete a challenge you will receive a small prize ranging in value from \$5 - \$20. Challenges will be described (e.g. post 3 photos of your dinner plate this week following the MyPlate.gov guide) in detail through text messages or on the Facebook page. The specific prize will be listed for each challenge. Prizes will include items such as lotion, lip gloss, nail polish and books.

What if you have questions about this study?

For more information concerning this research or if you feel that being in the study has resulted in any research related injury, emotional or physical discomfort please contact: Lauren Cowen in the RAMP clinic at (585) 410-0119 or Corrie Whisner at (607) 342-3049.

What if you have questions about your rights as a research subject?

If you have any questions about your rights as a research subject, or any concerns or complaints, you may contact the Cornell University Institutional Review Board for Human Participants at email irbhp@cornell.edu, telephone (607) 255-5138 for the following reasons:

- You wish to talk to someone other than the research staff about your rights as a research subject
- To voice concerns about the research
- To provide input concerning the research process
- In the event the study staff could not be reached

Additionally complaints or concerns can be shared anonymously through Ethicspoint (www.hotline.cornell.edu) or by calling toll free at 1-866-293-3077.

Do I have to be in this study?

Taking part in this research study is your choice. You are free not to take part or to withdraw at any time, for whatever reason. No matter what decision you make, there will be no penalty or loss of benefit to which you are otherwise entitled. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner.

SIGNATURE/DATES

If you choose to participate in this study you can choose how you would like to discuss your health beliefs and behaviors with research staff. Please check one option from below:

One-on-One Interview

Focus Group

Also, please choose the method in which you would like to receive health information below:

Text messages and Facebook group

Phone Number: _____

Facebook Name: _____

Postal mail

Mailing Address: _____

Subject Assent

I have read (or have had read to me) the contents of this assent form and have been encouraged to ask questions. I have received answers to my questions. I agree to take part in this study. I understand that my interviews or focus group discussions will be audio recorded for data collection in this study. I have received (or will receive) a copy of this form for my records and future reference.

Print name if you agree to be in the study

Sign name if you agree to be in the study

Date

Person Obtaining Assent

I have read this form to the subject and/or the subject has read this form. I will provide the subject with a copy of this assent form. An explanation of the research was given and questions from the subject were solicited and answered to the subject's satisfaction. In my judgment, the subject has demonstrated comprehension of the information. I have given the subject adequate opportunity to read the assent before signing.

Name and Title (Print)

Signature of Person Obtaining Assent Date

Date

This assent form will be kept by the researcher for at least three years before the end of the study and was approved by the IRB on [date].

STUDY PARENT PERMISSION

Study Title: Text for Prenatal Health Study

Principal Investigators: Corrie Whisner, PhD, Kimberly O'Brien, PhD, Eva Pressman, MD, Elizabeth Cooper, CNM, EdD, FACNM

This parent permission form describes a research study, what you may expect if your child decides to take part and important information to help you and your child make a decision. Please read this form carefully.

The study staff will explain this study to you and your child. Please ask questions about anything that is not clear before you agree to let your child participate or at any time you have a question. You may take this consent form home to think about and discuss with family or friends.

- Being in this study is voluntary – the choice is up to you and your child.
- If your child joins this study, you can change your mind and stop at any time.
- If you choose not to take part, your child's routine medical care will not be changed in any way.
- There are risks from participating and you should understand what these mean for your child.

Introduction

Your child is being asked to take part in this study because she is enrolled in the "Vitamin D Status Impacts Inflammation and Risk of Infections During Pregnancy" study.

This study is being conducted by Corrie Whisner, PhD and Kimberly O'Brien PhD, of Cornell University and Eva Pressman MD, Beth Cooper, CNM, EdD and Ruth Anne Queenan MD, of the University of Rochester's Department of Obstetrics and Gynecology and Highland Hospital's Department of Obstetrics and Gynecology.

Purpose of Study

The purpose of this study is to find out if receiving electronic health information (eg. text messages and Facebook posts) during pregnancy changes how your child thinks about her prenatal health. Your child's healthcare provider shares important information about nutrition and medical care during routine prenatal visits but receiving additional information between these visits may help improve the health of her baby.

Description of Study Procedures

If your child decides to take part in this study, she will be asked to take two short surveys so that we can see what she thinks about nutrition and how she uses the internet. We will also ask her to participate in a one-on-one interview or group discussion (focus group) with study staff. *One-on-one interviews can be completed in-person, through Skype on a clinic computer, or over the phone depending on your schedule. **The first interview must be completed before you reach 28 weeks of gestation.*** During this interview or focus group, we will ask your child some questions about her feelings about weight gain and diet during pregnancy and to see where she looks for health information. After talking to you, we will ask your child to enroll in a PRIVATE group on Facebook and to receive text messages from study staff. The information received on Facebook or through text messages will be about general nutrition and health during pregnancy. If your child does not have access to Facebook or text messages but wants to be in this study, we will provide the information to her on paper or through email. **You will begin receiving text, Facebook or paper messages after your first interview or at 28 weeks of gestation, depending on which comes first.** We will have your child complete the nutrition survey again at the end of her pregnancy and ask her to complete an additional interview (Skype, phone or in-person) or focus group. This interview or focus group will let us see what she thought about the Facebook group and text messages we sent.

All focus groups and interviews (Skype, phone, in-person) will be recorded with a digital recording device or tape recorder to allow for accurate and complete transcription of results. These recordings will be listened to at the RAMP clinic after each focus group or interview. Responses to questions will be categorized into themes. All responses will be de-identified using subject numbers within one week of completing each focus group to protect the identity of your child. The interview will not be recorded without your permission. Please let me know if you do not want the interview to be recorded; you also can change your mind after the interview starts, just let me know.

As your child's parent/guardian, you will be asked to share your preference for the interview method your child engages in. If your preference differs from that of your child, the study staff will use the interview method designated by the parent/guardian.

Number of Subjects

Approximately 40 subjects will take part in this study.

Duration of the Study

Your child's participation in the study will last up to 9 months and will end when she delivers her baby. Each interview or group discussion will take one to 1.5 hours to

complete and it will take approximately 10-15 minutes to answer the questions on the nutrition and internet usage surveys.

Risks of Participation

There are no risks to your child's developing baby from participating in this study. Potential risks to your child include psychological or social discomfort if someone outside of the study sees her text messages or information posted on the PRIVATE Facebook page. Messages posted by study staff will be about general health and will NOT contain personal information. The Facebook site will be monitored daily to assure that your child's privacy is maintained and that posts made by study participants have a positive tone. Study staff will screen all posts and remove negative comments during daily monitoring sessions.

In the event that your child wants to join the Facebook group but doesn't want to use their actual profile, the study staff will allow your child to create an alias account so that their identity is protected. Similarly, if your child would like to enroll in the Facebook group but does not currently have an account; study staff will assist her in creating an account on a computer within the health clinic or by downloading a Facebook app on her cell phone. Study staff will allow participants to use an alias instead of their name on the created account.

An additional risk is someone hearing or seeing your interview if you choose to complete your interview on Skype. This is an online video-telephone service which someone could gain access to. The website does do their best to protect the data transferred (encryption) during the call; however, there is a small risk that the call may be intercepted by a third party. This risk is no more than the risk associated with web surfing or shopping online.

Information obtained will be kept confidential and will only be accessible to study personnel and those study subjects who choose to join the Facebook group. As soon as the study is complete and data analyzed, the Facebook group will be closed and removed from Facebook. The study cell phone used to send text messages will also be cancelled. Additionally, at the time of Facebook and text message enrollment, participants will receive a Facebook and Text Messaging Information Sheet which will outline study guidelines for safe and effective sharing via Facebook and text messages.

Benefits of Participation

Your child might not benefit from being in this research study. The potential benefit to your child from being in this study might be learning new information about nutrition and health during pregnancy.

Alternatives to Participation

Your child does not have to participate in this study if she does not want to. Her decision not to join this study will not affect the health care she receives at Highland Hospital or elsewhere.

Sponsor Support

The University of Rochester and Cornell University are receiving payment from the United States Department of Agriculture for conducting this research study.

Costs

There will be no cost to you or your child to participate in this study.

Payments

Your child will be paid \$100 for taking part in this study according to the schedule below:

For enrolling in the study and for completing the food and internet surveys and interview/focus group you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group before 28 weeks gestation - \$30 gift card to Walmart
- Internet usage survey - \$10 to Walmart

When it is time to begin receiving text messages or join the Facebook group (email or paper copy of messages if you do not have internet or text messaging) you will be given;

- A \$10 gift card to Walmart

For completing the final study visit near delivery you will be given;

- Food survey - \$10 gift card to Walmart
- Interview/Focus group - \$30 gift card to Walmart

In addition to earning the above gift cards, your child may participate in weekly wellness challenges. When she completes a challenge she will receive a small prize ranging in value from \$5 - \$20. Challenges will be described (e.g. post 3 photos of your dinner plate this week following the MyPlate.gov guide) in detail through text messages or on the Facebook page. The specific prize will be listed for each challenge. Prizes will include items such as lotion, lip gloss, nail polish and books.

Confidentiality of Records

The study staff working on this study will be able to see the information collected. In the event that your child shares information that shows that her health or the health of her baby is at risk, the study staff may need to tell her doctor or healthcare provider.

Additionally, undergraduate researchers may be able to use the information collected for Honors Thesis projects. If a student is interested in doing such a project, they will only have access to data after your child's name has been removed in order to protect her identity.

While we will make every effort to keep information we learn about your child private, this cannot be guaranteed. Other people may need to see the information. While they normally protect the privacy of the information, they may not be required to do so by law. Results of the research may be presented at meetings or in publications, but your child's name will not be used. The federal Health Insurance Portability and Accountability Act

(HIPAA) requires us to get your permission to use health information about you that we either create or use as part of the research. This permission is called an Authorization. We will use;

- Demographic information (where you live, your phone number, etc.)
- Information on your child's height, weight and previous pregnancies
- Dietary information and information on supplement use over pregnancy
- Self-reported drug and alcohol use and use of cigarettes
- Current use of medications and prescription drugs
- Diagnosis of any pregnancy complications or health problems
- Test results on hemoglobin and routine tests drawn across pregnancy
- Information from your child's medical chart on all infections, inflammatory conditions and birth complications that you experience across pregnancy and at delivery
- The place where your child was seen
- The name of her physician
- The medical records of her newborn

We will use your child's health information to conduct the study and to determine how her health beliefs and behaviors during pregnancy might be influencing her health and the growth of her developing baby. Health information is used to report results of research to sponsors and federal regulators. The health information collected may be audited to make sure we are following regulations, policies and study plans. RMC/Strong Health policies let you see and copy health information we have gathered for this research study after the study ends, but not until the study is completed. If you have never received a copy of the URM/ Strong Health HIPAA Notice of Privacy Practices, please ask the investigator for one.

To meet regulations or for reasons related to this research, the study investigator may share a copy of this consent form and records that identify your child with the following people: The University of Rochester; the Department of Health and Human Services; the United States Department of Agriculture, Cornell University, University of Rochester, Highland Hospital, Food and Drug Administration, and your child's primary care provider.

If you decide to let our child take part, your Authorization for this study will not expire unless you cancel (revoke) it. The information collected during your child's participation will be kept indefinitely. You can always cancel this Authorization by writing to the study investigator. If you cancel your Authorization, your child will also be removed from the study. However, standard medical care and any other benefits to which your child is otherwise entitled will not be affected. Canceling your Authorization only affects uses and sharing of information after the study investigator gets your written request. Information gathered before then may need to be used and given to others. For example, by Federal law, we must send study information to the FDA for drug studies it regulates. Information that may need to be reported to the FDA cannot be removed from your research records.

A description of this clinical trial will be available on <http://clinicaltrials.gov> as required by U.S. Law. This website will not include information that can identify you or your child. At most, the website will include a summary of the results. You can search this website at any time.

Contact Persons

For more information concerning this research or if you feel that your child’s participation has resulted in any emotional or physical discomfort please contact: Lauren Cowen in the RAMP clinic at (585) 410-0119 or Corrie Whisner at (607) 342-3049.

If you have any questions about your rights as a parent/guardian, or any concerns or complaints, you may contact the Cornell University Institutional Review Board for Human Participants at email irbhp@cornell.edu, telephone (607) 255-5138 for the following reasons:

- You wish to talk to someone other than the research staff about your child’s rights as a research subject
- To voice concerns about the research
- To provide input concerning the research process
- In the event the study staff could not be reached

Additionally complaints or concerns can be shared anonymously through Ethicspoint (www.hotline.cornell.edu) or by calling toll free at 1-866-293-3077.

Voluntary Participation

Taking part in this study is voluntary. You child is free not to participate or to withdraw at any time, for whatever reason. No matter what decision you make, there will be no penalty or loss of benefit to which your child is entitled. In the event that you do withdraw from this study, the information you and your child have already provided will be kept in a confidential manner.

SIGNATURE/DATES

After reading and discussing the information in this consent form you should understand:

- Why this study is being done
- What will happen during the study
- Any possible risks and benefits to your child
- Other options your child may have instead of being in the study
- How your child’s personal information will be protected
- What to do if you child has problems or questions about this study

If you choose to let your child participate in this study you can choose how you would like your child to discuss their health beliefs and behaviors with research staff. Please check one option from below:

One-on-One Interview

Focus Group

Also, please choose the method in which you would like to receive health information below:

Text messages and Facebook group

Phone Number: _____

Facebook Name: _____

Email or postal mail

Email Address: _____

Mailing Address: _____

Subject Consent

I have read (or have had read to me) the contents of this consent form and have been encouraged to ask questions. I have received answers to my questions. I agree to allow my child to participate in this study. I understand that my child's interviews or focus group discussions will be audio recorded for data collection in this study. I have received (or will receive) a signed copy of this form for my records and future reference.

Subject Name (Printed by Subject)

Signature of Subject

Date

This permission form will be kept by the researcher for at least three years before the end of the study and was approved by the IRB on [date].

Person Obtaining Consent

I have read this form to the guardian or they have read this form. I will provide the guardian with a signed copy of this consent form. An explanation of the research was given and questions from the guardian were solicited and answered to their satisfaction.

In my judgment, the guardian has demonstrated comprehension of the information. I have given the parent adequate opportunity to read the consent before signing.

Name and Title (Print)

Signature of Person Obtaining Consent

Date

APPENDIX B
INSTITUTIONAL REVIEW BOARD APPROVAL

SOCIAL BEHAVIORAL INSTRUCTIONS AND TEMPLATE		
NUMBER	DATE	PAGE
HRP-503a	6/1/2015	1 of 3

Instructions and Notes:

- Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as "NA".
- When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

1 Protocol Title
Include the full protocol title: Text for Prenatal Health Study

2 Background and Objectives
Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.

- Describe the purpose of the study.
- Describe any relevant preliminary data.

The goal of a recently approved and completed study from Cornell University was to investigate the consequences of maternal knowledge and attitudes on adolescent health outcomes across pregnancy in a group of pregnant adolescents receiving health messages via Facebook and cellular text message. Additionally, teen knowledge and attitudes were compared to a demographically similar group of pregnant adult women from the same prenatal clinic, who also received digital health messages.

Data was collected by Dr. Corrie Whisner and colleagues at Cornell University and has now been transcribed and de-identified for data analysis.

Our objective is to analyze the de-identified data collected during this intervention to better understand how receiving digital health messages influences health behaviors of pregnant teens in relation to adult women.

3 Inclusion and Exclusion Criteria
Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.
Indicate specifically whether you will target or exclude each of the following special populations:

- Minors (individuals who are under the age of 18)
- Adults who are unable to consent
- Pregnant women
- Prisoners
- Native Americans
- Undocumented individuals

We are only proposing to complete data analysis, as all enrolled participants have completed all parts of the above-mentioned study.

The dataset we are proposing to use will include data from a social / behavioral intervention that was approved by and carried out at Cornell University. Data will include demographic data (race, ethnicity, age at start of pregnancy, height, weight, body mass index, and participation in food programs such as Women, Infants and Children (WIC)), transcripts from participant interviews regarding dietary habits, attitudes and beliefs, dietary intake, internet and cell phone access, and delivery characteristics (gestational weight gain, infant birth weight, and gestational age at time of delivery)

4 Number of Participant
Indicate the total number of participants to be recruited and enrolled: 24

5 Recruitment Methods

- Describe when, where, and how potential participants will be identified and recruited.
- Describe materials that will be used to recruit participants. (Attach copies of these documents with the application.)

Participants were recruited through the Cornell University study. All participants have completed the intervention and data collection forms.

SOCIAL BEHAVIORAL INSTRUCTIONS AND TEMPLATE		
NUMBER	DATE	PAGE
HRP-503a	6/1/2015	2 of 3

<p>6 Procedures Involved</p> <p>Describe all research procedures being performed and when they are performed. Describe procedures including:</p> <ul style="list-style-type: none"> • Surveys or questionnaires that will be administered. (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants.) • What data will be collected including long-term follow-up? • Lab procedure and tests and related instructions to participants • The period of time for the collection of data. • Describe the amount and timing of any compensation or credit to participants. • If the research involves conducting data analysis only, describe the data that that will be analyzed. <p><u>Qualitative Data Analysis of Interviews and Focus Groups</u> In the case of narrative data, transcribed responses to interview questions that are de-identified will be categorized by the major themes outlined above and used to describe the thoughts and behaviors of this population in qualitative publications.</p> <p><u>Quantitative Data Analysis of Chart Reviews and Surveys</u> All data transformations and analyses will be performed and managed using common statistical software such as SPSS, SAS or JMP. Descriptive statistics will be computed for all variables (maternal weight gain, pre-pregnancy height and weight, socioeconomic status, race, ethnicity, responses to the nutrition survey and internet usage questionnaire, and Bit.ly analytics data for internet site visits) after checking for outliers and missing values. Gestational weight gain (defined as gaining within the recommended amount vs. above the recommended amount) will be compared for differences between racial and ethnic groups, internet access and scores on the nutrition survey using Chi-square tests. The chi-square test will also be used to compare interrelationships among the demographic variables. Any differences will be adjusted for in subsequent analyses examining gestational weight gain categories. Multivariate analyses (logistic, linear or ANOVA) will be used to determine differences in responses to the nutrition knowledge survey and internet use questionnaire between gestational weight gain categories. Additionally, if 2-3 specific attitudes or behaviors are identified for a single theme when reviewing focus group or interview responses, these answers will be coded as categorical variables for inclusion in multivariate analyses to explain differences in gestational weight gain.</p> <p>Sub analyses will include comparing attitudes and beliefs about maternal health between participants who receive digital information via text and Facebook posts vs. paper handouts. This can be done by adding a categorical variable for mode of message delivery to statistical models. Additionally, comparing adolescent health themes to those of healthcare providers and adult women will offer insights into how pregnant adolescents communicate with key healthcare providers during pregnancy.</p>
<p>7 Risks to Participants</p> <p>List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.</p> <p>N/A</p>
<p>8 Potential Benefits to Participants</p> <p>Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do not include benefits to society or others.</p> <p>N/A</p>
<p>9 Prior Approvals</p> <p>Describe any approvals – other than the IRB - that will be obtained prior to commencing the research. (e.g., school, external site, or funding agency approval.)</p> <p>N/A</p>
<p>10 Privacy and Confidentiality</p>

SOCIAL BEHAVIORAL INSTRUCTIONS AND TEMPLATE		
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Describe the steps that will be taken to protect subjects' privacy interests. "Privacy interest" refers to a person's desire to place limits on with whom they interact or to whom they provide personal information.

Describe the following measures to ensure the confidentiality of data:

- Where and how data will be stored?
- How long the data will be stored?
- Who will have access to the data?
- Describe the steps that will be taken to secure the data (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data) during storage, use, and transmission.

The de-identified dataset will be stored on a secure, password protected, ASU drive with regular back-up and only the PI, Dr. Corrie Whisner and her graduate student, Megan Ellis will have access to the data. The data will be stored for no more than 10 years following publication of the study findings, after which, the data will be deleted.

11 Consent Process

Indicate the process you will use to obtain consent. Include a description of:

- Where will the consent process take place
- How will consent be obtained

Non-English Speaking Participants

- Indicate what language(s) other than English are understood by prospective participants or representatives.
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent.

Waiver or Alteration of Consent Process (written consent will not be obtained, required information will not be disclosed, or the research involves deception)

- Review the "CHECKLIST: Waiver or Alteration of Consent Process (HRP-410)" to ensure you have provided sufficient information for the IRB to make these determinations.

Participants who are minors (individuals who are under 18)

- Describe the criteria that will be used to determine whether a prospective participant has not attained the legal age for consent to treatments or procedures involved in the research under the applicable law of the jurisdiction in which the research will be conducted.

N/A

12 Process to Document Consent in Writing

If your research presents no more than minimal risk of harm to participants and involves no procedures for which written documentation of consent is normally required outside of the research context, the IRB will consider a waiver of the requirement to obtain written documentation of consent.

(If you will document consent in writing, attach a consent document. If you will obtain consent, but not document consent in writing, attach the short form consent template or describe the procedure for obtaining and documenting consent orally.)

13 Training

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 3 years. Additional information can be found at: <http://researchintegrity.asu.edu/training/humans>

Dr. Corrie Whisner – 8/4/2014
Megan Ellis – 9/4/2014

APPENDIX C
SURVEY (2)

Text for Prenatal Health Study: Nutrition Knowledge and Behaviors Survey

How many meals do you typically eat during a day?

How many snacks do you eat each day? _____

Do you skip any meals on a regular basis? (Circle the answer that best describes your eating behavior)

- a) Breakfast
- b) Lunch
- c) Dinner
- d) I do not skip meals

Who cooks your meals at home?

- a) Parent or guardian
- b) Grandparent
- c) Brother or sister
- d) You
- e) Other _____

How often do you eat at fast food restaurants during the week?

- a) 1 time or less
- b) 2-3 times
- c) 4-6 times
- d) Daily
- e) More than once a day

Who does the grocery shopping in your home?

- a) Parent or guardian
- b) Grandparent
- c) Brother or sister
- d) You
- e) Other _____

How much of a dinner plate should someone fill with fruits and vegetables?

- a) 1/8
- b) 1/4
- c) 1/2
- d) 3/4

What food group should you consume the least?

- a) Meats and beans
- b) Vegetables
- c) Fruit
- d) Fats, oils, sweets
- e) Dairy
- f) Bread, pasta, cereal, rice

Which of the following foods do you think contain fiber (check all that apply)?

- a) Broccoli
- b) Oatmeal
- c) Steak
- d) Yogurt

Which of the following foods is a low-fat source of dairy?

- a) Whole milk
- b) Ice cream
- c) 2% milk
- d) Regular cheese

What percent of daily calories should come from fat?

- a) 30% or less
- b) 30-50%
- c) More than 50%

Which of the following foods are high in fat?

- a) Soda pop
- b) Fried chicken
- c) Milk
- d) Jelly beans
- e) Baked potato
- f) Bread

How much of the grains you eat should be whole grains?

- a) 1/4
- b) 1/2
- c) 3/4
- d) All grains should be whole

Which of the following foods has added sugar?

- a) 100% orange juice
- b) Soda pop
- c) Bananas
- d) White bread
- e) Milk

Which color of fruits and vegetables is most healthy?

- a) Red
- b) Green
- c) Yellow
- d) Orange
- e) Brown
- f) White
- g) All colors are important

TEKNO ID: _____

Date: _____

Visit Number: 1 ____ 2 ____

Text for Prenatal Health Study: Electronic Data Usage Survey

1. How old are you? _____

2. Where do you access the internet?
 - a. Home computer
 - b. School
 - c. Friend/Boyfriend/Relative's house
 - d. Library
 - e. Other: _____
 - f. I do not have access to the internet

3. How often do you use the internet?
 - a. Less than once per month?
 - b. A few times per month
 - c. Once per week
 - d. A few times per week
 - e. Daily
 - f. I do not use the internet

4. Do you have a Facebook account? ____Yes ____No

5. Do you have an email account that you check weekly? ____Yes ____No

6. Do you own a personal cell phone? ____Yes ____No

7. Do you have a phone that sends and receives text messages? ____Yes ____No

8. Do you pay a fee for each text message received? ____Yes ____No

9. Does your phone have a data plan to access the internet? ____Yes ____No

10. If yes to #9, how do you use the internet on your phone (i.e. Facebook, Google search, Email, etc.)?

11. If yes to # 9, how often do you access the internet on your phone?
 - a. Less than once per month?
 - b. A few times per month
 - c. Once per week
 - d. A few times per week
 - e. Daily
 - f. I do not use / have internet on my phone

TEKNO ID: _____

Date: _____

APPENDIX D
24-HOUR DIET RECALL

APPENDIX E
INTERVIEW QUESTIONS

Text for Prenatal Health Study: Pre-Intervention Interview Questions

I want to thank you for taking the time to meet with me today. My name is _____ and I would like to talk to you about your experiences while pregnant. Specifically, I want to find out what motivates you to make decisions related to nutrition and weight gain and how social media/internet may play a role in your decision-making process while you are pregnant.

The interview should take about an hour and a half. I will be taping the session because I don't want to miss any of your comments. Although, I will be taking some notes during the session I will not be able to write down everything we discuss so we both need to be sure to speak up so that the recorder doesn't miss our comments. All responses will be kept confidential which means that once your responses are typed, they will not be associated with your name. Only our research team will have access to your responses and your name will never be mentioned in any report or publications that come from this research.

Are there any questions about what I have just explained?
Are you willing to participate in this interview?

General Introduction and Media Access Questions

1. I am going to start by asking you questions to describe you and your pregnancy which will be important when we look at your answers later on.
 - a. How old are you?
 - b. How tall are you? About how much do you weigh?
 - c. Is this your first pregnancy?
 - d. Was your pregnancy planned?
 - e. What hopes or goals do you have for your unborn child?
 - f. What challenges do you face as you plan to be a mother?
 - g. What do you think are important things you should be doing to make sure your baby is healthy?
2. Where or who do you ask for advice or information about your pregnancy?
 - a. Do you ever use the internet for information?
 - i. How do you gain access to the internet? Do you have a computer at home?
 - ii. What types of information have you searched for?

Text for Prenatal Health Study: Pre-Intervention Interview Questions

- iii. Are there any sites that you have found helpful for information?
 1. How often do you visit these sites?
- iv. Do you use or have access to a cell phone?
 1. Do you own your own phone?
 2. How do you use your phone?
 3. Do you ever search for health information on your phone? If so, where do you search for information?
3. Have you joined any email, text message, twitter, blog, or facebook groups for additional information?
 - a. What are they?
 - b. What information did you get from these sources?
 - c. How often do you receive information or search these sites for information?
4. Based on your experiences, is there a place or person that provides you with the best information on pregnancy?

Questions related to weight gain

5. Have you been given any advice about weight gain during pregnancy?
 - a. If so, from whom?
 - b. What was the advice?
 - c. How did they tell you?
 - d. Are you following this advice? Why or why not?
6. Do you know how much weight you are supposed to gain during pregnancy?
 - a. How do you know?
 - b. If you don't know, what do you think about these? (show weight gain guidelines)
7. Have you been told how much weight you are supposed to gain during pregnancy?

Text for Prenatal Health Study: Pre-Intervention Interview Questions

- a. Do you think those recommendations are good for you? Why or why not?
8. Do you ever use the internet to learn about weight gain you might be experiencing?
 - a. What information did you find?
 - b. Where did you find this information?
 - c. How helpful did you find the information?
 - d. Do you feel the information was accurate? How do you know?
 - e. Did you change your behaviors after finding this information?

Questions on diet during pregnancy

1. Who prepares the meals you eat?
2. Who goes shopping for the food to make those meals?
3. Do you help in making decisions about what groceries to buy?
4. How much money do you think your household spends on food each week?
5. Can you tell me how you have been eating during your pregnancy?
6. Have you made any modifications from what you did before you became pregnant? What specifically and why?
7. In terms of the quantity of food that you are eating, how does it compare to the amount you ate pre-pregnancy? (quantities per meal and number of times)
8. In terms of what foods you are eating, have you made any changes? What foods have changed and why? Probe about what foods might be eliminated and what specifically might be added.
9. Are you hungrier now that you are pregnant or do you seem to have less of an appetite? Why do you think this is the case?
10. Do you think a pregnant woman should be careful about what she eats? Why?
 - a. If yes, what have you heard that pregnant women should be careful about eating?
 - b. Are there any foods that are good or bad for a growing fetus?

Text for Prenatal Health Study: Pre-Intervention Interview Questions

- c. Is there anything that you are avoiding or adding to your diet now that you are pregnant?
 - d. Does a pregnant woman's diet need to change at different times during pregnancy?
11. Have you changed any of the ways that you prepare food since you have been pregnant?
- f. For example, what about fried foods?
 - g. What about foods with salt or sugar?
 - h. How much dairy food are you consuming?
 - i. Have you been craving any non-food items? (PICA feeler)
 - j. What smells do you like more or less now that you are pregnant?
12. Are there any special foods or preparations or products that you are taking as diet supplements while you are pregnant?
- a. Vitamin pills?
 - b. Foods that are fortified like a cereal product?
13. What advice have you received about what to eat during pregnancy?
- a. Who offered this information / where did you learn about this recommendation?
 - b. Where else have you received information about eating for a healthy pregnancy?
14. What source has provided you with the most helpful information?
- a. Why do you think this source gave the best information about having a healthy pregnancy?
15. Do you ever use the internet to find information about diet and nutrition?
- a. What kind of information have you searched for?
 - b. What websites did you find most helpful?
 - c. How helpful did you find the information?

Text for Prenatal Health Study: Pre-Intervention Interview Questions

- d. Do you feel the information was accurate? How do you know?
- e. Did you change your behaviors after finding this information?

Questions on physical activity during pregnancy

1. Now let's talk about physical activity during pregnancy. Does a woman need to change her physical activity levels during pregnancy?
 - a. Why do you feel the way you do?
2. What do you think the recommendations are for a pregnant woman?
 - a. Have you heard of anything specific that you should or should not do?
 - b. Has anyone tried to give you advice on how to exercise during pregnancy?
 - i. Do you trust this advice?
 - ii. Do you plan to follow this advice?
 - c. If you wanted to know more about exercising during pregnancy, where or who would you go to for information?
3. Are you currently exercising?
 - a. What kind of exercise do you enjoy most?
 - b. How much have you exercised after becoming pregnant?
4. Have you changed your physical activity behaviors since you became pregnant?
 - a. Why do you think your activity level has changed or not changed?
 - b. How much did you exercise before becoming pregnancy?
 - c. How much do you exercise now that you are pregnant?
 - d. For those currently not exercising, what is the reason for not exercising?
 - i. Do you want to exercise?
 - ii. What would motivate you to begin exercising?
5. What effects does your physical activity have on your developing baby?

Text for Prenatal Health Study: Pre-Intervention Interview Questions

- a. How do your current actions affect your baby?
- b. What do you think are the best exercises to do while pregnant?
- c. What activities should pregnant women avoid during pregnancy?

References used to create questions:

Tovar et al. Beliefs regarding the main contributors to pregnancy weight gain. *Matern Child Health J.* PMC 2012 February 13.

USAID. Guidance for Formative Research on Maternal Nutrition. USAID's Infant and Young Child Nutrition Project. February 2012.

Text for Prenatal Health Study: Post-Intervention Interview Questions

I want to thank you for taking the time to meet with me today. My name is _____ and I would like to talk to you about experiences while pregnant. Specifically, I want to find out what motivated you during your pregnancy to make decisions related to nutrition and weight gain and how receiving text messages and information of the Facebook site played a role in your decision-making process.

The interview should take about an hour and a half. I will be taping the session because I don't want to miss any of your comments. Although, I will be taking some notes during the session I will not be able to write down everything we discuss so we both need to be sure to speak up so that the recorder doesn't miss our comments. All responses will be kept confidential which means that once your responses are typed, they will not be associated with your name. Only our research team will have access to your responses and your name will never be mentioned in any report or publications that come from this research.

Are there any questions about what I have just explained?
Are you willing to participate in this interview?

General Introduction and Media Access Questions

1. It has been a while since we last talked, so I want to catch up on what has been happening. I am going to start by asking you questions to describe your pregnancy which will be important when we look at your answers later on.
 - a. How has your pregnancy been going?
 - b. What has been the best part of your pregnancy?
 - c. Last time we talked, I asked you what hopes and dreams you had for your unborn child. How have these hopes and dreams changed?

2. Have you changed any of the ways that you prepare food since you have been pregnant?
 - a. For example, what about fried foods?
 - b. What about foods with salt or sugar?
 - c. How much dairy food are you consuming?
 - d. Have you been craving any non-food items? (PICA feeler)
 - e. What smells do you like more or less now that you are pregnant?
 - f. What challenges have you faced during your pregnancy?

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- i. How did you overcome this challenge?
 - ii. What helped you through the challenge?
 - g. What things have you done throughout your pregnancy to make sure your baby is born healthy?
- 3. Where or who did you ask for advice or information about your pregnancy?
 - a. Did you ever use the internet for information?
 - i. How did you gain access to the internet? Did you have a computer at home?
 - ii. What types of information did you search for most often?
 - iii. Are there any sites that you thought were really helpful?
 - 1. How often did you visit these sites?
 - iv. How often did you use the Facebook site that you joined at the beginning of your pregnancy?
 - 1. How helpful was this group?
 - 2. How often did you visit the site?
 - 3. What was your favorite part?
 - 4. What was your least favorite part?
 - 5. What motivated you to visit the site or kept you from logging in?
 - 6. Which information was most relevant to you?
 - 7. Did you change any of your behaviors after seeing something posted on the Facebook site?
 - 8. Did anyone disagree with the information you received?
 - 9. If you did not like the information on the Facebook site, where did you find better information?

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10. Did you change your view about weight gain during pregnancy after seeing the Facebook site?
 - a. Did you gain more or less weight during pregnancy because of information on the Facebook site?
11. Did you change any of your eating habits after seeing the Facebook site?
 - a. What behaviors did you change?
 - b. How did you change what you eat?
 - c. How did your role change in preparing and shopping for food?
 - d. How did the Facebook site affect how and when you take your prenatal vitamins?
12. Did you change your physical activity level after seeing the Facebook site?
 - a. What behaviors did you change?
 - b. How did you change your activity level?
 - c. How did this make you feel?
 - d. What specifically, motivated you to change your physical activity behaviors?
- v. Did you have access to a cell phone during your pregnancy?
 1. Did you have your own phone or were you borrowing / sharing a phone?
 2. Did you read the text messages that were sent to you about pregnancy?
 3. What text messages had the biggest effect on your pregnancy?
 4. What messages were your favorites?
 5. What messages were your least favorites?

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6. Did any of the messages inspire you to change your behaviors during pregnancy?
 - a. What behaviors did you change?
 - b. How did you change your behaviors?
7. How did these messages influence how you felt about weight gain during pregnancy?
 - a. Did you gain more or less weight during pregnancy because of information in a text message? Why?
8. How did these messages influence how you felt about the foods you were eating?
 - a. How did your diet change because of these messages?
 - b. What foods did you add?
 - c. What foods did you avoid?
 - d. How did you change how you prepared foods?
 - e. How did text messages change how you take your prenatal vitamins?
9. How did text messages change your physical activity behaviors?
 - a. How did the text messages motivate you to change your behavior?
 - b. What messages specifically influenced these changes?
 - c. What affect do you think these changes will have on your baby?
10. Did you ever search for health information on your phone? If so, where did you search for information?
 - a. What kind of information did you search for?

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- b. How helpful is it to be able to look up health information on your phone?
 - c. Who do you share this information with?
 - i. Did you ever share this information with teens you met at RAMP or on the Facebook site?
 - ii. What did you share? Why?
- 4. Have you joined any other email, text message, twitter, blog, or Facebook groups for additional information?
 - a. What were they?
 - b. What information did you get from these methods?
 - c. How often did you receive information or search these sites for information?
- 5. Based on your experiences, is there a place or person that provides you with the best information on pregnancy?
- 6. What is a good number of posts to add to a webpage like Facebook to improve your pregnancy health?
- 7. What is a good number of text messages to receive by phone for improved pregnancy health?
- 8. How often do you think a healthcare provider should send you information?
 - a. What information is most helpful?
 - b. What information motivates you to make healthy choices?
 - c. Would you recommend using text messages for other teens in the future?
 - d. Are text messages or Facebook a good way to reach teens that are pregnant?
 - e. What other digital or mobile apps would be good for reaching pregnant teens?

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References used to create questions:

Tovar et al. Beliefs regarding the main contributors to pregnancy weight gain. *Matern Child Health J.* PMC 2012 February 13.

USAID. Guidance for Formative Research on Maternal Nutrition. USAID's Infant and Young Child Nutrition Project. February 2012.