

2015

Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition in Pregnancy

Kara M. Whitaker
University of South Carolina - Columbia

Follow this and additional works at: <https://scholarcommons.sc.edu/etd>



Part of the [Exercise Science Commons](#)

Recommended Citation

Whitaker, K. M.(2015). *Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition in Pregnancy*. (Doctoral dissertation). Retrieved from <https://scholarcommons.sc.edu/etd/3180>

This Open Access Dissertation is brought to you by Scholar Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact digres@mailbox.sc.edu.

Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition in
Pregnancy

by

Kara M. Whitaker

Bachelor of Science
University of Michigan, 2009

Master of Public Health
University of South Carolina, 2011

Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in

Exercise Science

The Norman J. Arnold School of Public Health

University of South Carolina

2015

Accepted by:

Sara Wilcox, Major Professor

Steven Blair, Committee Member

Jihong Liu, Committee Member

Russell Pate, Committee Member

Lacy Ford, Vice Provost and Dean of Graduate Studies

© Copyright by Kara M. Whitaker, 2015
All Rights Reserved.

DEDICATION

To my husband, Michael Scott Whitaker.

ACKNOWLEDGEMENTS

I am deeply thankful to my advisor and committee chair, Dr. Sara Wilcox for her time, guidance, and support over the years. This dissertation would not have been possible without her. I would also like to thank my committee members, Drs. Steven Blair, Jihong Liu, and Russell Pate for their valuable assistance with my dissertation.

I would like to thank Kimberly Humphries and Stanette Brown for their assistance with study logistics and participant recruitment at Palmetto Health. I could not have successfully recruited patients or providers without their help. I would like to thank all the women and physicians who took part in this study, as well as Santiago Tovar-Diaz, who assisted with qualitative data coding. I would also like to thank the Office of the Vice President for Research at the University of South Carolina and the Department of Exercise Science for their financial support.

Lastly, I would like to thank my family. I would like to thank my Mom and Dad for always believing in me and encouraging me. I deeply appreciate their advice, enthusiasm, and support over the years. I also want to thank my husband Michael. I could not have done this without his unconditional love, support, and patience throughout this entire process.

ABSTRACT

Background: The high percentage of women who enter pregnancy overweight or obese and gain excessive weight during pregnancy is a growing public health problem. Health care providers are recommended to counsel women on weight gain, physical activity (PA), and nutrition during pregnancy. However, little is known about patient or provider perceptions of these topics. **Purpose:** Guided by the Theory of Planned Behavior (TPB), this study examined women's and health care providers' perceptions of weight gain, PA, and nutrition in pregnancy. This study also examined the role of the health care provider in optimizing pregnancy weight gain. **Methods:** Pregnant women between 20-30 weeks gestation were recruited to take part in qualitative interviews (N=30) or to complete an Internet-based survey (N=189) to assess perceptions of weight gain, PA, nutrition, and provider counseling on these topics. Prenatal care providers (N=11) were also recruited to take part in qualitative interviews to assess perceptions of weight gain, PA, and nutrition counseling during prenatal visits. **Results:** Qualitative interviews with pregnant women (15 African American, 15 White) revealed several gaps in knowledge as well as race differences in perceptions and intentions toward weight gain, PA, and nutrition during pregnancy. The majority of women and providers reported counseling on weight gain and related behaviors during prenatal visits (87-100%). However, provider counseling was limited and many barriers to counseling were discussed. In the separate sample of women who completed the Internet-based survey, the TPB constructs (attitude, subjective norm, and perceived behavioral control) explained

23-39% of the variance in weight gain, PA, and nutrition intentions, and made varying contributions across outcomes. In this sample, fewer women reported provider counseling on weight gain, PA, or nutrition during prenatal visits (52-63%). Patient report of provider counseling on weight gain was largely consistent with existing guidelines while counseling on PA and nutrition was limited in scope. Provider advice was significantly associated with women's weight-related intentions. **Conclusion:** We used the TPB framework to examine perceptions of weight gain, PA, nutrition, and provider counseling on these topics during pregnancy using a mixed methods approach in two populations. Findings can be used to help guide the development of future gestational weight gain interventions. Across studies, counseling content was limited and not fully consistent with guidelines. Initial evidence suggests that provider counseling influences women's weight-related intentions during pregnancy. Future studies are needed to develop and evaluate the efficacy of interventions to help providers overcome perceived barriers and more effectively counsel women on weight and healthy lifestyles during pregnancy.

TABLE OF CONTENTS

DEDICATION.....	iii
ACKNOWLEDGEMENTS.....	iv
ABSTRACT.....	v
LIST OF TABLES.....	xi
CHAPTER ONE: INTRODUCTION.....	1
1.1 SCOPE.....	3
1.2 AIM 1.....	3
1.3 AIM 2.....	4
1.4 AIM 3.....	5
1.5 AIM 4.....	5
CHAPTER TWO: LITERATURE REVIEW.....	7
2.1 WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION RECOMMENDATIONS IN PREGNANCY.....	7
2.2 PREVALENCE AND CORRELATES OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY.....	12
2.3 HEALTH EFFECTS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY.....	18
2.4 WOMEN’S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY.....	21
2.5 PROVIDER COUNSELING ON WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY.....	26
2.6 GESTATIONAL WEIGHT GAIN INTERVENTIONS.....	30

2.7 THEORY OF PLANNED BEHAVIOR.....	33
CHAPTER THREE: METHODS.....	42
3.1 STUDY 1.....	42
3.2 PURPOSE.....	42
3.3 DESIGN.....	44
3.4 CONCEPTUAL FRAMEWORK.....	44
3.5 PARTICIPANTS.....	45
3.6 PROCEDURES.....	46
3.7 INTERVIEW GUIDES AND MEASURES.....	47
3.8 DATA MANAGEMENT AND ANALYSES.....	52
3.9 STUDY 2.....	54
3.10 PURPOSE.....	54
3.11 DESIGN.....	55
3.12 PARTICIPANTS.....	55
3.13 PROCEDURES.....	56
3.14 MEASURES.....	57
3.15 DATA MANAGEMENT AND ANALYSES.....	63
CHAPTER FOUR: AFRICAN AMERICAN AND WHITE WOMEN’S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION DURING PREGNANCY: A QUALITATIVE STUDY.....	71
4.1 ABSTRACT.....	72
4.2 INTRODUCTION.....	73
4.3 METHODS.....	75
4.4 RESULTS.....	78

4.5 DISCUSSION.....	86
4.6 ACKNOWLEDGEMENTS.....	90
CHAPTER FIVE: PATIENT AND PROVIDER PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION COUNSELING DURING PREGNANCY: A QUALITATIVE STUDY	96
5.1 ABSTRACT.....	97
5.2 INTRODUCTION	98
5.3 METHODS	100
5.4 RESULTS	102
5.5 DISCUSSION.....	109
5.6 CONCLUSIONS.....	114
5.7 PRACTICE IMPLICATIONS	114
5.8 ACKNOWLEDGEMENTS.....	115
CHAPTER SIX: PREGNANT WOMEN’S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION USING THEORY OF PLANNED BEHAVIOR CONSTRUCTS.....	120
6.1 ABSTRACT.....	121
6.2 INTRODUCTION	122
6.3 METHODS	125
6.4 RESULTS	131
6.5 DISCUSSION.....	135
6.6 ACKNOWLEDGEMENTS.....	142
CHAPTER SEVEN: PROVIDER COUNSELING AND WOMEN’S INTENTIONS TO MEET WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION RECOMMENDATIONS DURING PREGNANCY	152
7.1 ABSTRACT.....	153

7.2 INTRODUCTION	154
7.3 MATERIALS & METHODS	156
7.4 RESULTS	159
7.5 DISCUSSION.....	163
7.6 ACKNOWLEDGEMENTS.....	168
CHAPTER EIGHT: OVERALL SUMMARY AND CONCLUSIONS	176
8.1 MANUSCRIPT 1.....	177
8.2 MANUSCRIPT 2.....	178
8.3 MANUSCRIPT 3.....	179
8.4 MANUSCRIPT 4.....	180
8.5 LIMITATIONS AND STRENGTHS.....	181
8.6 CONCLUSIONS.....	183
REFERENCES	185
APPENDIX A: PATIENT INTERVIEW GUIDE	211
APPENDIX B: PROVIDER INTERVIEW GUIDE	219
APPENDIX C: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNIARE.....	225
APPENDIX D: INTERNET-BASED PARTICIPANT SURVEY.....	228

LIST OF TABLES

Table 2.1. Absolute and Relative Contraindications to Exercise during Pregnancy	39
Table 2.2. Warning Signs to Terminate Exercise during Pregnancy	40
Table 3.1. 2009 Institute of Medicine Recommendations for Total and Rate of Weight Gain during Pregnancy, by Pre-pregnancy BMI.....	69
Table 3.2. Summary of Scales Used to Quantify Hypothesized Constructs from the Theory of Planned Behavior	70
Table 4.1. Sample Questions from Interview Guide.....	91
Table 4.2. Participant Characteristics	92
Table 4.3. Women’s Perceptions of Weight Gain, Physical Activity, and Nutrition during Pregnancy.....	94
Table 5.1. 2009 Institute of Medicine Recommendations for Total and Rate of Weight Gain during Pregnancy, by Pre-pregnancy BMI.....	116
Table 5.2. Patient Characteristics.....	117
Table 5.3. Provider Characteristics	118
Table 5.4. Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition Counseling	119
Table 6.1. Participant Characteristics	143
Table 6.2. Salient Behavioral, Normative, and Control Beliefs for Meeting Weight Gain Recommendations during Pregnancy	144
Table 6.3. Salient Behavioral, Normative, and Control Beliefs for Meeting Physical Activity Recommendations during Pregnancy.....	146
Table 6.4. Salient Behavioral, Normative, and Control Beliefs for Meeting Nutrition Recommendations during Pregnancy	148

Table 6.5. Correlations, Means, and Standard Deviations, and Ranges Among the Theory of Planned Behavior Constructs	150
Table 6.6. Hierarchical Regression Analyses for the Theory of Planned Behavior Constructs and Weight Gain, Physical Activity, and Nutrition intentions...	151
Table 7.1. Participant Characteristics	170
Table 7.2. Predictors of Patient Report of Being Counseled or Not on Weight Gain, Physical Activity, or Nutrition	172
Table 7.3. Patient’s Report of Provider Recommended Weight Gain and Patient Intended Weight Gain	174
Table 7.4. Physical Activity and Nutrition Recommendations, Major Themes	175

CHAPTER ONE

INTRODUCTION

The high and increasing prevalence of women who enter pregnancy overweight or obese is a major public health concern. Approximately 75% of Non-Hispanic Black women and 50% of Non-Hispanic White women of childbearing age are overweight or obese (Flegal et al., 2012). The increasing trend in pre-pregnancy body mass index (BMI) seems to parallel the increasing trend of excessive gestational weight gain, with up to 50% of women exceeding weight gain recommendations during pregnancy (Institute of Medicine, 2007; Olson, 2008; Simas et al., 2011). Excessive gestational weight gain is associated with many adverse health outcomes for both the mother and child, including an increased risk of new or persistent overweight or obesity in women, as well as an increased risk for overweight or obesity in the offspring (Olson, 2008). It is critical to develop effective interventions to decrease the proportion of women gaining excessive weight in pregnancy. Gestational weight gain interventions may be a promising strategy to prevent the development of overweight and obesity in women and their children.

Pregnancy has been defined as a “teachable moment,” where women may be more receptive to making health lifestyle changes for the sake of their baby (Phelan, 2010). Pregnancy is therefore an opportune time for intervention, especially given women’s regular and frequent contact with the health care system. The American College

of Obstetricians and Gynecologists (ACOG) recommends that health care providers determine a woman's body mass index at the initial prenatal visit, and counsel her on the benefits of appropriate weight gain, physical activity, and nutrition, with emphasis placed on the need to limit excessive weight gain to achieve optimal pregnancy outcomes (2013). The implication of these guidelines is that providers are well positioned to play an important role in helping women achieve appropriate gestational weight gain.

However, there is a lack of data regarding provider compliance with and perceptions of counseling on weight gain, physical activity, and nutrition in the prenatal care setting. Furthermore, little is known about women's perceptions and intentions related to weight gain, physical activity, and nutrition during pregnancy, or the extent to which women are motivated to comply with provider recommendations. These research gaps, which are the focus of this dissertation, must be addressed in order to develop more effective gestational weight gain interventions in the prenatal care setting, thus improving the immediate and long-term health outcomes of both mother and child.

The Theory of Planned Behavior is used to explain the relationship between beliefs and behaviors (Ajzen, 1985, 1991) and guided the development of this dissertation project. This theory posits that attitudes, subjective norms, and perceived behavioral control influence intentions and behaviors. Attitudes, subjective norms, and perceived behavioral control are in turn influenced by behavioral, normative, and control beliefs (expectancy beliefs) and the value placed on these beliefs. The primary proposition of this theory is that people will intend to engage in a behavior if they view it positively (attitudes), believe that important others, such as a health care provider, want them to participate in certain behaviors (subjective norms), and perceive that the behavior is

under their control (perceived behavioral control). Intention and perceived behavioral control, in turn, are posited to directly influence behavior. This theory has been used extensively in research examining and predicting health related behaviors, including research with health care providers and pregnant women (Downs & Hausenblas, 2003; Godin et al., 2008; Hardeman et al., 2002). The Theory of Planned Behavior is therefore well suited to serve as the framework guiding this project.

SCOPE

Guided by the Theory of Planned Behavior, this dissertation will examine patient and provider perceptions of weight gain, physical activity, and nutrition in pregnancy. This dissertation will also examine the role of the health care provider in optimizing pregnancy weight gain.

AIMS, QUESTIONS, HYPOTHESES

AIM 1

Use the Theory of Planned Behavior to examine pregnant women's attitudes, subjective norms, perceived behavioral control, and intentions towards weight gain, physical activity, and nutrition during pregnancy using qualitative research methods.

QUESTIONS

- 1.1 *Attitudes*: How do women view weight gain, physical activity, and nutrition in pregnancy (perceived positive and negative outcomes)?
- 1.2 *Subjective Norms*: Who are influential sources of information on weight gain, physical activity, and nutrition in pregnancy?

1.3 *Perceived Behavioral Control*: What are the perceived barriers and facilitators to meeting weight gain, physical activity, and nutrition recommendations in pregnancy?

1.4 *Intentions*: Do women intend to follow the weight gain, physical activity, and nutrition guidelines during pregnancy?

AIM 2

Use the Theory of Planned Behavior to examine patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy using qualitative research methods.

QUESTIONS

2.1 *Attitudes*: How do providers view weight gain, physical activity, and nutrition counseling in prenatal care (perceived positive and negative outcomes)? How do patients view provider counseling on these topics?

2.2 *Subjective Norms*: Do providers know the current counseling recommendations for weight gain, physical activity, and nutrition during pregnancy? What do providers think of these recommendations? To what extent are women motivated to comply with provider recommendations on these topics?

2.3 *Perceived Behavioral Control*: What are the perceived barriers and facilitators to counseling women on weight gain, physical activity, and nutrition in prenatal care?

2.4 *Intentions*: Do providers intend to counsel women on weight gain, physical activity, and nutrition in prenatal care and how will they do so? To what extent do women intend to follow provider recommendations on these topics?

AIM 3

Use the Theory of Planned Behavior to explore women's beliefs regarding weight gain, physical activity, and nutrition in pregnancy and to examine if attitudes, subjective norms, and perceived behavioral control predict weight gain, physical activity, and nutrition intentions during pregnancy.

QUESTION

Because the research documenting beliefs toward weight gain, physical activity, and nutrition in pregnancy is limited, the hypothesis for Aim 3.1 is presented as a research question.

- 3.1 What are women's behavioral, normative, and control beliefs towards weight gain, physical activity, and nutrition during pregnancy?

HYPOTHESIS

- 3.2 Attitude will explain the greatest variation in weight gain, physical activity, and nutrition intentions, followed by perceived behavioral control, and subjective norm.

AIM 4

To examine women's report of provider counseling on weight gain, physical activity, and nutrition during pregnancy and to determine if provider counseling is associated with weight gain, physical activity, and nutrition intentions during pregnancy.

QUESTIONS

Because the research documenting provider counseling on weight gain, physical activity, and nutrition in pregnancy is limited, the hypothesis for Aim 4.1 and 4.2 are presented as research questions.

- 4.1. What proportion of women report provider counseling on weight gain, physical activity, and nutrition during prenatal care visits?
- 4.2. Is provider counseling on weight gain, physical activity, and nutrition during pregnancy consistent with current guidelines?

HYPOTHESIS

- 4.3. Report of provider counseling on weight gain, physical activity, and nutrition will be associated with more favorable weight gain, physical activity, and nutrition intentions during pregnancy.

CHAPTER TWO

LITERATURE REVIEW

This chapter will first describe the recommendations for weight gain, physical activity, and nutrition in pregnancy. The prevalence and correlates of women meeting or not meeting these recommendations will then be discussed, as well as the health effects of excessive weight gain, physical inactivity, and poor dietary intake during pregnancy. The existing research examining women's perceptions of these health behaviors in pregnancy as well as limitations and gaps in the literature will be examined. Next, this chapter will discuss provider counseling on weight gain, physical activity, and nutrition. The efficacy and limitations of current gestational weight gain interventions will then be described. Finally, the chapter will conclude with a discussion of the Theory of Planned Behavior (TPB), and explain how this theory is an appropriate framework to guide the development of this dissertation.

WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION RECOMMENDATIONS IN PREGNANCY

Weight Gain

In the United States, gestational weight gain recommendations have changed considerably over the last century. In the early 1900's, women were often recommended to restrict weight gain to 15-20 pounds in pregnancy (Eastman & Helman, 1966). By the

1970's women were recommended to gain 20-25 pounds (National Research Council, 1970). In 1990, the Institute of Medicine (IOM) published recommended ranges that varied by women's pre-pregnancy weight (Institute of Medicine: Committee on Nutritional Status During Pregnancy and Lactation, 1990). Body mass index (BMI) categories were selected to coincide with 90%, 120%, and 135% of the Metropolitan Life Insurance ideal weight-for-height standards. Underweight women (BMI < 19.8 kg/m²) were recommended to gain 28-40 pounds, normal weight women (BMI 19.8-25.9 kg/m²) 25-35 pounds, overweight women (BMI 26.0-29.0 kg/m²) 15-25 pounds, and obese women (BMI > 29.0 kg/m²) ≥ 15 pounds. The 1990 guidelines also included specific recommendations for black women, women of short stature, and adolescents.

In 2009, the IOM updated the existing gestational weight gain guidelines to reflect the current state of research for optimizing maternal and fetal health outcomes (Institute of Medicine and National Research Council, 2009). The pre-pregnancy BMI cut-points were modified to reflect the World Health Organization (WHO) BMI categories (underweight BMI < 18.5 kg/m²; normal weight BMI 18.5-24.9 kg/m²; overweight BMI 25.0-29.9 kg/m²; and obese BMI ≥ 30.0 kg/m²). This change decreased the percentage of women classified as underweight and increased the percentage of women classified as overweight. Weight gain recommendations remained the same for all BMI categories except for obese women, where recommendations were modified from ≥15 pounds to 11-20 pounds. Average assumed weight gain in the first trimester is 1.1-4.4 pounds for women from all BMI categories, and recommended rates of weight gain (and ranges) in the second and third trimester for underweight, normal weight, overweight, and obese women are 1.0 (1-1.3), 1.0 (0.8-1), 0.6 (0.5-0.7), and 0.5 (0.4-0.6)

pounds per week, respectively. The updated guidelines do not include specific recommendations for black women, women of short stature, or adolescents.

Physical Activity

The 2008 Physical Activity Guidelines for Americans recommend that healthy women who are not already highly active or doing vigorous-intensity activity should get at least 150 minutes of moderate-intensity aerobic activity a week during pregnancy (U.S. Department of Health and Human Services, 2008). Preferably, this activity should be spread throughout the week. Women who habitually engage in vigorous-intensity aerobic activity or who are highly active can continue this high level/intensity of physical activity during pregnancy, provided that they remain healthy and discuss with their health-care provider how and when activity should be adjusted over time.

The American College of Obstetricians and Gynecology (ACOG) currently recommends that pregnant women participate in 30 minutes or more of moderate intensity physical activity on most, if not all, days of the week in the absence of any medical or obstetrical complications or contraindications (2002). These recommendations are in agreement with the 2008 Physical Activity Guidelines, although there are no specific recommendations for vigorous intensity activities.

The ACOG guidelines also list specific activities to avoid during pregnancy, including recreational sports with a high potential for contact, such as soccer and basketball, as well as activities with an increased risk of falling, such as gymnastics and horseback riding. Scuba diving should be avoided, as well as exertion at altitudes greater than 6,000 feet. Exercises conducted in the supine position are not recommended in the second and third trimesters of pregnancy. A complete list of absolute and relative

contraindications to exercise as well as warning signs to terminate exercise while pregnant can be found in Tables 2.1 and 2.2, respectively. While there are circumstances when women should not engage in physical activity, it is generally considered safe and beneficial for healthy women to be physically active during pregnancy.

Nutrition

Dietary recommendations for women during pregnancy include consuming a variety of foods consistent with the 2010 Dietary Guidelines for Americans, appropriate vitamin and mineral supplementation and avoidance of alcohol, tobacco, or other illicit drugs (Kaiser & Allen, 2008; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Energy needs are not different from the Estimated Energy Requirement for non-pregnant women in the first trimester of pregnancy. In the second and third trimesters, 340 and 452 additional kilocalories are required, respectively, to support the nutritional needs of the growing fetus (Kaiser & Allen, 2008).

The Dietary Guidelines for Americans are jointly issued and updated every five years by the United States Department of Agriculture (USDA) and the Department of Health and Human Services (HSS). The MyPlate communication initiative was designed to help individuals make healthier food choices in accordance with the 2010 Dietary Guidelines. MyPlate emphasizes 5 major food groups: grains, fruits, vegetables, protein foods, and dairy. General recommendations include making half your plate fruits and vegetables, about one-quarter grains, and one-quarter protein. At least half of your grains should be whole grains and dairy options should be fat-free or low-fat. Foods should be selected that are high in fiber and low in sugar, solid fats, and sodium.

Nutritional recommendations for women during pregnancy vary based on age, pre-pregnancy BMI, trimester, and physical activity level. With MyPlate, women can retrieve a personalized nutrition plan using a program called “SuperTracker,” that makes recommendations based on the five food groups. For example, in the first trimester of pregnancy, the average woman is recommended to consume 6 servings (ounces) of grains, 2 servings (cups) of fruits, 3 servings (cups) of vegetables, 6-7 servings (ounces) of protein, and 3 servings (cups) of dairy (California Department of Public Health, 2013).

During pregnancy, the Recommended Dietary Allowance (RDA) increases for various macronutrients (National Research Council, 2011). The RDA for carbohydrates is 175 grams/day for pregnant women, as compared to 130 grams/day for non-pregnant women. Protein requirements increase from 0.8 grams/kg/day to 1.1 grams/kg/day during pregnancy. It is also important for women to get the right amount of various vitamins and minerals during pregnancy to optimize the growth and development of the fetus. Pregnant women should consume 600 µg/day of synthetic folic acid from fortified foods or supplements, 27 mg/day of iron, 15 µg/day of vitamin D, and 1,000 mg/day of calcium to meet the RDA for these nutrients (National Research Council, 2011).

Specific foods to avoid during pregnancy include: alcohol; unpasteurized milk or juice; soft cheeses like feta and brie; unheated deli meats and hot dogs; refrigerated, smoked seafood; undercooked poultry, meat or seafood; and fish that can be high in mercury (Kaiser & Allen, 2008). Foods to limit during pregnancy include fish that have small amounts of mercury as well as food and drinks that have caffeine.

PREVALENCE AND CORRELATES OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY

Weight Gain

The high and increasing prevalence of women who enter pregnancy overweight or obese is a major public health concern (Fisher et al., 2013). Nearly 60% of women of child-bearing age are overweight or obese, with approximately 50% of White women and 75% of Black women having a BMI ≥ 25 kg/m² (Flegal et al., 2012). This increasing trend in pre-pregnancy BMI seems to parallel the increasing trend of excessive gestational weight gain. Only one-third of women in the United States gain weight within the IOM recommended ranges during pregnancy (Institute of Medicine, 2007). High gestational weight gain occurs more frequently than inadequate weight gain, with up to 50% of women gaining excessively during pregnancy (Institute of Medicine, 2007; Olson, 2008; Simas et al., 2011). Data from the Pregnancy Nutrition Surveillance System (PNSS) shows that since the late 1990's, the rates of excessive weight gain have increased, rates of inadequate weight gain have decreased, and rates of women gaining an appropriate amount have remained relatively stable (Institute of Medicine and National Research Council, 2009).

There are many complex factors that influence gestational weight gain, including physiological, psychological, behavioral, family, social, cultural, and environmental factors. The most consistently demonstrated risk factor for excessive gestational weight gain is high pre-pregnancy BMI (>25 kg/m²), with overweight and obese women being two to three times more likely to exceed recommendations as compared to normal weight women (Olson & Strawderman, 2003; Stotland et al., 2006; Wells et al., 2006). Women

who are lower socioeconomic status and who report receiving weight gain advice from providers above the IOM recommendations are also more likely to exceed recommendations (Althuisen et al., 2009; Olson & Strawderman, 2003; Stotland et al., 2006; Wells et al., 2006). Evidence is conflicting regarding the association between race/ethnicity and excessive gestational weight gain. An older study conducted by Parker et al., reported that Black women are more likely to exceed weight gain recommendations than White women (1993). Conversely, a more recent review found no racial or ethnic differences in excessive weight gain with 50%, 48%, and 43% of White, Black, and Hispanic women exceeding the IOM guidelines, respectively (Headen et al., 2012). However, this review article also found that Black and Hispanic women are more likely to experience inadequate weight gain as compared to White women, and Black women are more like to retain weight in the postpartum period.

Two key behavioral elements related to weight gain in pregnancy are energy expenditure through physical activity and energy intake. Low perceived physical activity and increased food intake are both associated with an increased risk of excessive gestational weight gain (Althuisen et al., 2009; Olson & Strawderman, 2003). Olson and colleagues found that women who reported less physical activity during pregnancy were 1.7 times more likely to exceed IOM weight gain recommendations than women who reported maintaining or increasing physical activity (2003). Furthermore, women who reported eating “much more” in pregnancy were 2.35 times more likely to exceed the weight gain recommendations as compared to women who ate “a little more” in pregnancy. Physical inactivity and excessive dietary intake are two modifiable risk

factors that should be targeted in interventions to reduce excessive gestational weight gain.

Physical Activity

Physical activity levels are low across residents of the United States and are also a concern for pregnant women. During pregnancy, women are less likely to meet physical activity recommendations than non-pregnant women (Evenson et al., 2004; Petersen et al., 2005). Using self-report data from the 2000 Behavioral Risk Factor Surveillance System (BRFSS), Evenson and colleagues reported the prevalence of any leisure activity in the past month among pregnant women to be 65.6% (95% CI: 62.0-69.1), as compared to 73.1% (95% CI: 72.4-73.9) among non-pregnant women (2004). Only 15.8% (95% CI: 13.2-18.5) of pregnant women reported meeting physical activity recommendations as compared to 26.1% (95% CI: 25.4-26.8) of non-pregnant women. In this study, recommended physical activity was defined as leisure activity of moderate intensity done at least 5 times per week for at least 30 min each time or vigorous intensity activity done at least 3 times per week for at least 20 min each time or both in the preceding month. The prevalence of meeting physical activity recommendations was higher in those with more than a high school education. Petersen and colleagues also found a correlation between more education and recommended physical activity when examining self-report data from the 1994-2000 BRFSS survey (2005). In this larger sample, pregnant women were also more likely to meet physical activity recommendations if they were younger, non-Hispanic White, not married, nonsmokers, and of higher socioeconomic status.

Using self-report data from the National Health and Nutrition Examination Survey (NHANES), researchers found that 13.8% of pregnant women met the

recommendation for moderate physical activity when using the 2008 Physical Activity Guidelines for Americans (Evenson & Wen, 2010). When including vigorous intensity physical activities, 23% of women reported meeting the recommendations. The odds of meeting physical activity recommendations were higher among White participants, those with health insurance, and also among women in the first trimester compared to the third trimester. This decline in physical activity in the third trimester of pregnancy has been demonstrated consistently using both self-report and objective measures of physical activity in various populations (Borodulin et al., 2008; Evenson & Wen, 2011; Pereira et al., 2007; Schmidt et al., 2006).

Using accelerometer data from the NHANES, average moderate to vigorous physical activity in pregnant women was 11.5 minutes/day in the first trimester, 14.3 min/day in the second trimester, and 7.6 minutes/day in the third trimester (Evenson et al., 2012). Activity was significantly greater in the first and second trimesters of pregnancy as compared to the third trimester ($p=0.02$, $p<0.001$, respectively). It is important for interventions to encourage women to meet the physical activity recommendations in pregnancy, with additional emphasis placed on continuation of activity late in pregnancy.

Nutrition

The majority of women of childbearing age in the United States do not meet federal nutritional recommendations (Krebs-Smith et al., 2010). Over 80% of women between the ages of 19-50 years do not consume adequate servings of fruits, vegetables, whole grains, and milk. Furthermore, 97% of women report exceeding the maximum energy allowance for solid fats and added sugars (Krebs-Smith et al., 2010). Few studies

have assessed dietary intake of women in pregnancy. However, evidence suggests that the majority of pregnant women do not meet the dietary guidelines (Fowles, 2002; Siega-Riz et al., 2002; Watts et al., 2007). Data from the Pregnancy, Infection, and Nutrition (PIN) study indicate that over 50% of pregnant women consumed diets high in fat (>30% of total kilocalories) and also did not meet the minimum recommendations for dietary fiber (Siega-Riz et al., 2002). A study examining the dietary intake of low-income White and Native American pregnant women found that the majority of participants did not meet the recommendations for vegetables or whole grains (Watts et al., 2007). Mean intake of total fat and saturated fat was high, comprising 33.8% and 12.4% of total kilocalories, respectively. Less than 60% of participants met the RDA for folate and fewer than 50% met the RDA for iron.

Epidemiological data have consistently demonstrated socioeconomic and racial disparities in diet quality in the general population (Darmon & Drewnowski, 2008; Dunlop et al., 2011). More affluent individuals report consuming higher quality diets, including whole grains, lean meats, fish, low-fat dairy products and fresh vegetables and fruit (Darmon & Drewnowski, 2008). Individuals of lower socioeconomic status are more likely to consume energy dense diets that are nutrient poor, including refined grains and added fats. A study examining nutrient intake in pregnant women reported that Black women are more likely to experience nutrient deficiencies in iron, folic acid, zinc, vitamin D, calcium and magnesium as compared to White women (Dunlop et al., 2011). Interventions should encourage women in pregnancy to reduce fat and refined grain intake while increasing fruit, vegetable and whole grain consumption. Women who are of

lower socioeconomic status and racial/ethnic minorities are particularly at risk for poor dietary consumption and therefore should be targeted in future interventions.

Conclusions

In summary, most women in the United States exceed the IOM gestational weight gain guidelines and do not meet physical activity or dietary recommendations during pregnancy. Low socioeconomic status is associated with excessive gestational weight gain, reduced physical activity, and poor diet. Women who are overweight or obese and those who report reductions in physical activity and substantial increases in dietary intake are more likely to exceed gestational weight gain recommendations. Racial/ethnic minorities are less likely to meet physical activity recommendations and report poor diet quality in comparison to White women. Finally, less education and older age are associated with lower levels of physical activity.

Given the high prevalence of excessive gestational weight gain, physical inactivity, and poor diet quality, the majority of pregnant women could benefit from interventions to facilitate appropriate weight gain, increase or maintain physical activity, and improve dietary intake. It is critical to first understand women's perceptions of these health behaviors during pregnancy, which is a focus of this dissertation, to aid in the development of more targeted and effective interventions. This dissertation will also include certain sub-groups of the population who are at higher risk for not meeting these recommendations.

HEALTH EFFECTS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY

Weight Gain

The amount of weight a woman gains during pregnancy can directly influence pregnancy outcomes and the long-term health of both mother and child. The IOM gestational weight gain guidelines were created to optimize maternal and fetal health outcomes. Weight gain below and above these guidelines are associated with many adverse health outcomes. Inadequate weight gain is associated with an increased risk of infant mortality, preterm birth, and small-for-gestational-age or intrauterine growth retardation (Institute of Medicine and National Research Council, 2009). It is worth noting that a small body of literature suggests that obese women (pre-pregnancy BMI ≥ 30 kg/m²) may experience favorable pregnancy outcomes with little to no weight gain (Kiel et al., 2007; Thornton et al., 2009). While inadequate weight gain is an important public health topic that requires additional research, the majority of women gain excessive weight in pregnancy. Therefore, the emphasis of this review and dissertation will focus on excessive gestational weight gain.

During pregnancy, women who exceed weight gain recommendations have an increased risk of gestational diabetes (Carreno et al., 2012; Gibson et al., 2012; Hedderson et al., 2010), preeclampsia (de la Torre et al., 2011; DeVader et al., 2007; Kiel et al., 2007), failed induction, and cesarean delivery (DeVader et al., 2007). Infants born to mothers with excessive weight gain are more likely to experience low 5-minute Apgar scores, hypoglycemia, meconium aspiration syndrome, and large for gestational age compared with women who gain within the recommended guidelines (Stotland et al.,

2006; Vesco et al., 2011). After birth, women with excessive gestational weight gain are at increased risk for postpartum weight retention and the development of new or persistent overweight or obesity (Hernandez, 2012; Nehring et al., 2011; Olson, 2008). A meta-analysis conducted by Nehring and colleagues found that women who exceeded gestational weight gain recommendations retained an additional 6.7 pounds after 3 years and 10.4 pounds after ≥ 15 years postpartum on average as compared to women who gained weight within the recommended ranges during pregnancy (2011).

Evidence also suggests an association between excessive gestational weight gain and overweight and obesity in the offspring. This relationship has been found in early childhood through adolescence (Deierlein et al., 2012; Fraser et al., 2010; Oken et al., 2008; Oken et al., 2007; Olson et al., 2009). A prospective cohort study of 1,044 mother-child dyads found that mothers with higher gestational weight gain had children with more adiposity as measured by BMI z-score and skinfold thickness at age 3 years (Oken et al., 2007). A study of mothers from the Nurses' Health Study II reported that in comparison to women who gained weight within the IOM guidelines, women with excessive pregnancy weight gain had adolescent children (ages 9-14) with significantly higher BMI z-scores and greater odds of obesity (Oken et al., 2008). Reducing the percentage of women with excessive gestational weight gain is therefore one strategy to prevent the development of overweight and obesity in both mothers and their children.

Physical Activity

Early studies examining physical activity during pregnancy primarily focused on whether the active woman was causing harm to herself or the fetus (Pivarnik et al., 2006). With few exceptions, the research has consistently demonstrated that physical activity is

safe during pregnancy, and may also provide substantial health benefits (Clapp, 2000; Lokey et al., 1991). Women who exercise during pregnancy experience improvements in physical fitness and well-being, similar to that of non-pregnant women (Kramer & McDonald, 2006; Melzer et al., 2010; Morris & Johnson, 2005). Evidence from observational studies indicate that physical activity in pregnancy is associated with a reduced risk of gestational diabetes (Tobias et al., 2011), preeclampsia (Kasawara et al., 2012), depression (Da Costa et al., 2003; Loprinzi et al., 2012), and excessive gestational weight gain (Harris et al., 2014; Jiang et al., 2012; Olson & Strawderman, 2003; Stuebe et al., 2009).

Stuebe and colleagues examined the association of physical activity and excessive weight gain in nearly 1,400 pregnant women from the Project Viva Cohort (2009). Self-reported walking, vigorous activity, and total activity were all inversely associated with excessive weight gain. While not statistically significant, there was also an association between sedentary lifestyle (< 2.5 hours/week of total activity) and excessive weight gain. A study examining Chinese pregnant women found that active women, as measured by pedometer step counts, had a 40% reduction in risk of excessive gestational weight gain in comparison to those who were least active (Jiang et al., 2012). Some evidence also suggests that interventions including physical activity are successful in reducing gestational weight gain (Streuling et al., 2010). Gestational weight gain interventions will be discussed in more detail in a later section.

Nutrition

The nutritional status of a woman during pregnancy has important health implications. Under-nutrition is associated with an increased risk of preterm delivery, low

birth weight, fetal growth retardation, birth defects and preeclampsia (Scholl & Johnson, 2000; Thompson et al., 2010). Over-nutrition is associated with an increased risk of gestational diabetes and preeclampsia (Ostlund et al., 2004), excessive gestational weight gain (Olson & Strawderman, 2003), large for gestational age infants or macrosomia (Lawlor et al., 2010), and postpartum weight retention (Abrams et al., 2000; Siega-Riz et al., 2010). Furthermore, there is growing evidence that maternal nutrition in pregnancy can have long lasting health consequences in the offspring as a result of epigenetic changes. The offspring of women who are both under- or over-nourished are at increased risk of developing future type 2 diabetes, hypertension, cardiovascular disease, and obesity (Dyer & Rosenfeld, 2011; Martin-Gronert & Ozanne, 2006).

Conclusions

Excessive gestational weight gain is associated with immediate and long-term adverse health outcomes for both the mother and child. Physical activity has shown to be safe during pregnancy and is also associated with health promoting benefits. Over-nutrition increases the risk for multiple health complications for mother and child. During pregnancy, it is important for women to gain weight within the ranges recommended by the IOM, meet the physical activity recommendations, and eat a healthy, well-balanced diet for optimal outcomes.

WOMEN'S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY

Given the high prevalence and associated risks of excessive gestational weight gain, physical inactivity, and poor dietary intake in pregnancy, there is a clear need for

behavioral intervention. To better inform intervention messages it is first necessary to elicit information on women's perceptions of appropriate weight gain, physical activity, and nutrition in pregnancy, along with their barriers to and enablers of meeting recommendations. A very limited body of research has explored women's perceptions on these health topics.

Researchers at the University of South Carolina conducted in-depth qualitative interviews with 33 overweight or obese African American women to investigate perceptions of appropriate weight gain, barriers to and enablers of exercise and healthy eating, and other influencers on healthy weight gain during pregnancy (Goodrich et al., 2013). The purpose of this study was to inform the development of an intervention designed to prevent excessive gestational weight gain and promote postpartum weight loss (Liu et al., 2014). Key findings from qualitative interviews are summarized below.

Over 50% of participants thought they should gain more weight in pregnancy than recommended by the IOM based on their pre-pregnancy BMI. Women reported many benefits of exercise during pregnancy, such as limiting weight gain and improving their own health. However, women also cited many risks of and barriers to exercise. Women were fearful that exercise would harm their baby. Exercise was thought to increase the risk of premature labor, miscarriage, or the umbilical cord to wrap around the baby's neck. Commonly cited barriers to exercise during pregnancy included fatigue, pain, nausea, laziness and lack of childcare support. Awareness of the maternal and fetal benefits of healthy eating was high. Women discussed how healthy eating would result in a healthy baby, help with weight control, and improve their own health. Women discussed various risks of unhealthy eating, stating that poor diets would result in an

unhealthy baby, contribute to the development of chronic health conditions, and lead to excessive gestational weight gain. However, women also cited many barriers to healthy eating, including: cravings, availability of fast food or unhealthy foods, and seeing others eat unhealthy foods.

This study uncovered a number of misconceptions and barriers related to weight gain, exercise, and healthy eating. The high prevalence of women reporting an incorrect weight gain target is especially concerning. Lack of healthcare provider advice or advice that is inconsistent with recommendations has been consistently reported as a barrier to appropriate gestational weight gain (Claesson et al., 2008; Clarke & Gross, 2004; Cogswell et al., 1999; Doran & O'Brien, 2007; Olson, 2008; Stotland et al., 2005).

Women in this study were asked where they learned about weight gain in pregnancy; however, questions were not specifically asked about the role of the healthcare provider in weight gain counseling. It is also unknown if providers counseled women on physical activity or nutrition in prenatal care. This dissertation addressed this gap in the literature by asking women specifically about their discussions with their healthcare provider about weight gain, physical activity, and nutrition in prenatal care.

Groth and colleagues conducted a qualitative study with women from diverse racial and ethnic backgrounds in New York to examine perceptions of gestational weight gain (2009). The participants were not asked about physical activity or nutrition. Women in this study expressed concerns that inadequate weight gain would adversely affect the health of the infant, but did not consistently identify consequences of excessive gestational weight gain. These findings have since been replicated in multiple studies of Black pregnant women (Brooten et al., 2012; Groth et al., 2012; Herring et al., 2012). A

study of predominantly White women reported higher levels of awareness regarding adverse maternal health consequences of excessive gestational weight gain while knowledge related to neonatal complications was limited (Sui et al., 2012). There is clearly a need for enhanced education across all racial and ethnic groups regarding the risks associated with high weight gain in pregnancy. However, there appears to be some racial differences in attitudes and beliefs towards excessive gestational weight gain. To our knowledge, no studies have examined this difference in attitudes between Black and White women. This dissertation explored racial differences in these beliefs.

Several studies have examined women's perceptions of physical activity or exercise during pregnancy. Women identified multiple benefits of physical activity, such as having a healthy pregnancy, easier labor and healthy baby, staying in shape and feeling better (Cioffi et al., 2010; Evenson & Bradley, 2010). Interestingly, Evenson and colleagues found that White women reported more health benefits of moderate exercise than Black women (2010). Motivators to exercise included encouragement from a health care provider or family members, reducing gestational weight gain, and facilitating a return to pre-pregnancy weight after delivery (Cioffi et al., 2010; Sui & Dodd, 2013; Weir et al., 2010). Women also identified many internal and external barriers to physical activity. The most commonly reported barriers to physical activity include: pregnancy symptoms, lack of time, access to childcare, and concerns about the safety of activity for the mother and unborn child (Sui & Dodd, 2013). Other identified barriers are lack of time, living in unsafe neighborhoods, weather, lack of motivation or energy, physical discomfort or pain, cost, shortness of breath, and lack of advice or knowledge regarding the benefits of physical activity (Cioffi et al., 2010; Clarke & Gross, 2004; Evenson et al.,

2009; Sui et al., 2012; Weir et al., 2010). Overall, some barriers to physical activity are common across all women while others are unique to pregnant women.

Few studies have examined women's perceptions of healthy eating during pregnancy. The most commonly cited benefits or motivators of healthy eating are to enhance the health and growth of the fetus and improve the health of the mother (Goodrich et al., 2013; Sui et al., 2012; Weir et al., 2010). Weir and colleagues conducted interviews with overweight or obese pregnant women and found that women generally perceived healthy eating to be more important for the health of the baby than physical activity. Barriers to healthy eating include lack of support, insufficient time to prepare healthy meals, and cost (Goodrich et al., 2013; Sui et al., 2012).

Across studies, women report receiving information on weight gain, physical activity, and healthy eating from books, magazines, web sites, family or friends, and health care providers (Cioffi et al., 2010; Clarke & Gross, 2004; Gross & Bee, 2004). Importantly, women consistently note that advice is often vague, confusing, and conflicting. The existing research has identified a general lack of knowledge regarding the risks of excessive gestational weight gain and the benefits of physical activity. This lack of knowledge may be due to lack of advice or inconsistent advice. Researchers have called for a more in-depth investigation into the role of the health professional in providing information on gestational weight gain, physical activity, and healthy eating (Evenson & Bradley, 2010). This dissertation further investigated this topic, fulfilling this call for additional research.

PROVIDER COUNSELING ON WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION IN PREGNANCY

Prenatal care is an opportune time to discuss weight gain, physical activity, and nutrition. Most women are in regular contact with the health care system during pregnancy and are more receptive to making healthy lifestyle changes for the sake of their baby. Pregnancy has been referred to as a “teachable moment” because it is a time characterized by: increased perceptions of perceived risk and outcome expectancies; heightened emotional responses; and a redefinition in self-concept or social roles (McBride et al., 2003; Phelan, 2010). Pregnant women also report that they both value and trust the advice of their providers (Hesse et al., 2005; Stengel et al., 2012). Health care providers are therefore ideally positioned to counsel women on weight gain, physical activity, and nutrition in pregnancy.

The ACOG recently released recommendations for prenatal care providers regarding counseling on weight gain in pregnancy (2013). It is recommended that health care providers determine a woman’s BMI at the initial prenatal visit and counsel her on the benefits of appropriate weight gain, nutrition, exercise and the need to limit excessive weight gain to achieve best pregnancy outcomes. This report reiterates and expands upon existing prenatal care guidelines issued by the IOM (Institute of Medicine and National Research Council, 2009). The implication of these guidelines is that providers are well positioned to play an important role in helping women achieve appropriate gestational weight gain. However, little is known about provider compliance with and perceptions of counseling on these topics.

Some evidence suggests that counseling on weight gain, physical activity, and nutrition is inadequate in prenatal care. Approximately 30-50% of women report no advice from a health care provider on pregnancy weight gain (Cogswell et al., 1999; Ferrari & Siega-Riz, 2013; McDonald et al., 2011; Phelan et al., 2011; Stotland et al., 2005; Taffel et al., 1993). Of those who receive advice, 15-88% of women report provider recommendations outside of IOM guidelines (Cogswell et al., 1999; McDonald et al., 2011; Phelan et al., 2011; Stotland et al., 2005). Overweight or obese women are more likely to report receiving advice above the IOM guidelines (Cogswell et al., 1999; Phelan et al., 2011). Women with a high pre-pregnancy BMI may therefore be receiving advice that would be appropriate for normal weight women (i.e., above recommendations). These inaccurate recommendations are consistent with findings from a survey of U.S. obstetricians, where only 64% of providers modified their recommendations for gestational weight gain based on pre-pregnancy BMI (Power et al., 2006). These findings suggest that some providers lack knowledge regarding the updated IOM weight gain recommendations based on pre-pregnancy BMI.

Few studies have examined the impact of provider recommendations on gestational weight gain (Cogswell et al., 1999; Ferrari & Siega-Riz, 2013; Herring et al., 2012; Stotland et al., 2005; Taffel et al., 1993). Three studies reported associations between provider advised weight gain and actual weight gain in pregnancy (Cogswell et al., 1999; Herring et al., 2012; Taffel et al., 1993). Using data from the 1980 National Natality Survey (NNS) and the 1988 National Maternal and Infant Health Survey (NMIHS), Taffel and colleagues examined provider advice and women's actual weight gain according to the ACOG weight gain guideline of 22-27 pounds for a normal

pregnancy in effect at that time (1993). The researchers found that the proportion of mothers gaining at least 22 pounds increased significantly as provider weight gain advice increased from less than 22 pounds to more than 27 pounds. Cogswell and colleagues found that women who received weight gain advice both below and above the IOM guidelines were 3.6 times more likely to have inadequate or excessive gestational weight gain (1999). A more recent study examining lower income African American women found that clinician advice outside the ranges recommended by the IOM was a significant predictor of excessive gestational weight gain (Herring et al., 2012).

Stotland and colleagues also identified an association between provider advice and women's weight gain goal, with provider advice to gain below or above the guidelines associated with inadequate or excessive gestational weight gain goals, respectively (2005). However, the researchers did not measure actual weight gain, only target (goal) weight gain. The most recently published study conducted by Ferrari and colleagues did not find an association between provider advice on weight gain and actual gestational weight gain (2013). This study did not assess the amount of weight gain recommended by providers. Rather, participants were asked if a provider discussed weight gain with them during pregnancy (yes or no). This binary approach gives an incomplete picture of the patient-provider discussion on weight gain, and therefore may not accurately reflect the association with actual weight gain. This limited evidence suggests that provider recommendations influence women's weight gain during pregnancy. Other studies examining non-pregnant patients have also found a positive effect of physician advice and patient weight related behaviors (Rose et al., 2012; Sciamanna et al., 2000).

Little is known about provider recommendations on physical activity or nutrition in prenatal care. Since both physical activity and dietary intake play a critical role in energy balance and appropriate weight gain in pregnancy, it is important to understand what recommendations, if any, are provided in the prenatal care setting and how these topics are addressed. Women have reported receiving little or no advice on physical activity during pregnancy (Duthie et al., 2013; Ferrari et al., 2013; Stengel et al., 2012). Stengel and colleagues found that overweight and obese pregnant women were often advised to be cautious and limit exercise (2012). Women have also reported that physical activity advice in prenatal care is generally vague and largely limited to being told to walk (Ferrari et al., 2013).

Advice on dietary intake also appears to be both limited and confusing. A study by McDonald and colleagues found that only half of women were counseled to consume an amount or range of additional calories each day by their provider (2011). Women have also reported that dietary advice is often overwhelming, not individualized, and constantly changing (Ferrari et al., 2013). Although women report feeling frustrated and confused by physical activity and dietary advice, they also report following their provider's advice because they want to have a healthy pregnancy and child (Ferrari et al., 2013). These efforts to comply with provider advice further illustrates the extent to which women value and trust their provider, again demonstrating the potential role of the health care provider in eliciting positive behavior change and maximizing the likelihood of a healthy pregnancy.

No studies were identified that examined the effect of provider recommendations in prenatal care on physical activity or nutrition. However, studies conducted in non-

pregnant populations have found that provider counseling on physical activity and nutrition can produce modest changes in behavior (Lin et al., 2010; Orrow et al., 2012). For example, dietary counseling interventions in primary care settings have shown to reduce consumption of total fat and increase consumption of fruits and vegetables (Lin et al., 2010). It is therefore possible for interventions placed in the prenatal care setting to positively impact the physical activity and dietary behaviors of women during pregnancy.

While the prenatal care setting is a promising venue for intervention, there are also many barriers to provider counseling on weight gain, physical activity, and nutrition in this setting. Stotland and colleagues conducted a qualitative study of general obstetrician/gynecologists, midwives and nurse practitioners to examine how they approach weight gain counseling in prenatal care. Three major themes emerged regarding barriers to counseling on weight gain: insufficient training, concern about the sensitivity of the topic, and the perception that counseling is ineffective (Stotland et al., 2010). Lack of time has also been cited as a barrier to discussing weight management in the primary care setting (Ruelaz et al., 2007). Despite these barriers, prenatal care providers are well positioned to positively influence weight gain, physical activity, and nutrition in pregnancy if given the appropriate intervention tools.

GESTATIONAL WEIGHT GAIN INTERVENTIONS

A growing body of literature has examined the efficacy of interventions to reduce excessive gestational weight gain. The results have been modest and there is substantial heterogeneity across studies (Muktabhant et al., 2012; Oteng-Ntim et al., 2012; Thangaratinam et al., 2012). A Cochrane review examined 28 randomized and quasi-

randomized trials of interventions to prevent excessive weight gain, including 3,976 women (Muktabhant et al., 2012). Overall, most studies did not show statistically significant effects of the intervention, and the authors concluded there was not enough evidence to recommend any intervention for preventing excessive weight gain in pregnancy due to methodological limitations and small effect sizes of the included studies. A different systematic review examined 30 randomized trials to reduce or prevent obesity in pregnant women, including 4,503 women (Thangaratinam et al., 2012). This paper found a significant reduction in weight gain in the intervention group of 0.97 kg compared with the control group ($p=0.003$).

Some evidence suggests lifestyle interventions targeting gestational weight gain may have a greater effect in overweight and obese pregnant women. A recent systematic review and meta-analysis of lifestyle interventions for overweight and obese pregnant women identified 16 controlled trials (10 randomized, 6 non-randomized) to examine gestational weight gain (Oteng-Ntim et al., 2012). The smaller meta-analysis of randomized controlled trials found that taking part in a dietary and lifestyle intervention was significantly associated with less gestational weight gain (2.21 kg) as compared to controls. The meta-analysis of non-randomized controlled trials found a weak effect on gestational weight gain with an average difference of 0.41 kg between intervention and comparison groups. The authors acknowledge that the studies conducted were of poor to medium quality and therefore must be interpreted with caution.

Gestational weight gain intervention studies have included dietary counseling, physical activity promotion, weight gain tracking charts, as well as behavioral change strategies. However, the majority of the interventions were not grounded in behavioral

theories and also largely focused on nutrition education. This lack of emphasis on physical activity is surprising as exercise has been shown to be a safe and valuable component of a healthy pregnancy (Ferraro et al., 2012). Furthermore, evidence suggests that physical activity during pregnancy may independently reduce the risk of excessive pregnancy weight gain (Streuling et al., 2011). There is a clear need for theoretically designed interventions that emphasize both physical activity participation and nutrition education.

An additional limitation in the existing intervention literature is the paucity of studies including Black women. The majority of studies to date have focused exclusively on White women. Only five studies were identified that included a sub-sample of Black women (Artal et al., 2007; Asbee et al., 2009; Polley et al., 2002; Shirazian et al., 2010; Thornton et al., 2009). While the majority of interventions reported a statistically significant reduction in weight gain for those in the intervention group, no studies examined the effect of the intervention on women by race. Therefore, little is known about the effectiveness of these interventions in Black women.

Finally, the majority of interventions targeting gestational weight gain have been individual-based with few involving providers or the health care setting. Considering the importance of provider advice on health behaviors as well as the opportunity for frequent contact in prenatal care, there is a need for provider-based interventions. In order to develop effective interventions in the prenatal setting, research is first needed to explore the perceptions, experiences, and intentions of both women and health care providers regarding weight gain, physical activity, and nutrition during pregnancy. This dissertation

project includes the formative work needed to inform the development of gestational weight gain interventions in the prenatal care setting.

THEORY OF PLANNED BEHAVIOR

Many different theories and models have been developed in an attempt to understand and predict behavior, including the TPB (Ajzen, 1985; Ajzen, 1991). This theory is an extension of the Theory of Reasoned Action (TRA), which was originally developed by Martin Fishbein and Icek Ajzen (1975, 1980). The TRA is in turn grounded by multiple theories of attitude, including expectancy-value theory. According to expectancy-value theory, behavior is a function of the expectations one has and the value placed on these expectations. The behavior chosen will be the one with the greatest expected success and value.

The TPB posits that intention is the primary determinant of behavior. As seen in Figure 2.1, intention is determined by attitudes toward a behavior, subjective norms, and perceived behavioral control (Montano & Kasprzyk, 2002). Attitude is defined as a person's positive or negative appraisal of the behavior and is determined by behavioral beliefs and evaluation of behavioral outcomes. Subjective norm is the perceived social pressure from significant others to engage or not engage in a certain behavior. This construct is determined by a person's normative beliefs (whether important others approve or disapprove of the behavior) and motivation to comply. Perceived behavioral control is the degree of personal control the person believes he or she has over the behavior and is determined by control beliefs related to the presence or absence of barriers and enablers to behavioral performance as well as perceived power of each factor

to inhibit or enable the behavior. Perceived behavioral control is also thought to directly influence behavior, irrespective of intention. The primary hypothesis of the TPB is that people will intend to engage in a behavior if they view it positively, believe that important others, such as a health care provider, want them to participate in the behavior and perceive that the behavior is under their control.

The TPB is commonly used to explain and predict health behaviors, including addictive behaviors (i.e. smoking), sexual behaviors, clinical and screening behaviors, as well as physical activity, dietary, and weight related behaviors (Blue, 1995; Conner et al., 2002; Godin & Kok, 1996). Evidence suggests the theory performs well for the explanation of intention, with attitude toward the behavior and perceived behavioral control explaining a significant portion of the variation in intention (Godin & Kok, 1996; Hausenblas et al., 1997; Symons Downs & Hausenblas, 2005). Subjective norm has not shown to be as predictive of intention; however this may reflect a problem with how this construct is measured. Intention and perceived behavioral control appears to be the most important predictors of behavior.

Many studies have used the TBP to better understand health related intentions and behaviors in a variety of populations, including pregnant and postpartum women (Downs & Hausenblas, 2003; Hales et al., 2010; Hausenblas et al., 2008). This is an appropriate framework to use in this population because it includes factors that may be influenced by aspects of the pregnancy. For example, a woman's attitude towards physical activity may change during pregnancy due to beliefs about the risks or benefits of exercise in pregnancy. Similarly, a woman may excessively increase caloric intake because her family members tell her she needs to eat for two during pregnancy, or the woman may

improve her diet quality and begin taking a multivitamin because her health care provider recommends she do so (subjective norms). Likewise, a woman may believe she has no control over how much weight she gains in pregnancy, therefore impacting her intention to restrict her weight gain within a certain range (perceived behavioral control).

While this theory has been commonly used to explore health-related intentions and behaviors, the majority of TPB guided research in pregnant women has focused on physical activity (Downs & Hausenblas, 2003; Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004). No studies were identified that used the TPB to examine women's intentions or behaviors related to weight gain or nutrition in pregnancy. Given that pregnancy weight gain and nutrition are two key determinants of health-related outcomes for the mother and child during pregnancy, it is important to examine the utility of the TPB in predicting weight gain and nutrition intentions for intervention development purposes. This dissertation filled this existing gap in the literature by examining pregnant women's attitudes, subjective norms, perceived behavioral control, and intentions towards all three health behaviors: weight gain, physical activity, and nutrition.

A second limitation of the existing TPB literature is that the majority of research studies have only measured the higher-level constructs (attitudes, subjective norms, perceived behavioral control). However, these constructs are proposed to be influenced by underlying behavioral, normative, and control beliefs. These lower-level (indirect) measures are rarely included in studies using the TPB, despite the fact that some researchers suggest that these measures are very important to understanding the key factors that drive behavior and should also be targets for interventions (Montano &

Kasprzyk, 2002). In order to assess the appropriate behavioral, normative, and control beliefs of a given population (e.g. pregnant women), elicitation studies must be conducted to determine the common barriers and perceptions that are particularly salient to the population of interest. Currently, little is known about the behavioral, normative, and control beliefs towards weight gain, physical activity, and nutrition in pregnancy. This dissertation further explored these beliefs, therefore enabling the development of more comprehensive questionnaires to assess the indirect measures of attitudes, subjective norms, and perceived behavioral control towards weight gain, physical activity, and nutrition in pregnant women. Furthermore, a better understanding of these behavioral, normative, and control beliefs will be useful when designing interventions and recruiting women into programs.

The TPB is also the most frequently used behavioral change theory to examine health care providers' intentions, behaviors, and practices (Godin et al., 2008). A systematic review of studies found that the TPB explained 35% the variance in provider behavior, whereas other social cognitive theories explained only 6% of the variance (Godin et al., 2008). The TPB was also found to explain 59% of the variance in provider intention. Furthermore, this theory has been used when examining factors associated with provider counseling in various populations and settings (Faulkner & Biddle, 2001; Herbert et al., 2006; Millstein, 1996). The TPB appears to be a relevant and useful framework when trying to understand the factors associated with health care provider intentions and behaviors.

The TPB was selected to guide the development of this dissertation project for multiple reasons. First, this theory has been commonly used to describe physical activity,

healthy eating and weight related behaviors, which is the focus of this project. Second, this theory has been used to examine health related intentions and behaviors in both pregnant women and health care providers, the primary populations of interest for this dissertation. Third, this theory provides a useful framework for examining the role of the provider in eliciting changes in women's intentions and health behaviors through the construct of subjective norms. Earlier research has shown subjective norms to be less predictive of intentions. However, most studies do not identify particular individuals when asking about subjective norms (i.e. health care provider, spouse, friend, etc.). This project asked women specifically about the extent to which they are motivated to comply with the recommendations of their health care provider as compared to other influential individuals, and if provider recommendations influence intentions to engage in certain behaviors. Finally, this theory uncovers salient attitudes and beliefs in the study population that can be used to create more targeted interventions. Findings from this dissertation project can be used to guide the development of interventions targeted to those constructs that are most strongly associated with intentions related to pregnancy weight gain, physical activity, and nutrition.

Conclusions

Interventions are needed to help women achieve appropriate weight gain, meet physical activity recommendations, and consume a healthy diet during pregnancy. It is recommended that prenatal care providers counsel women on these health behaviors. However, there is a lack of data regarding providers' attitudes, subjective norms, perceived behavioral control, and intentions regarding counseling on weight gain, physical activity, and nutrition in pregnancy. Furthermore, little is known regarding

women's attitudes, subjective norms, perceived behavioral control, or intentions toward these health behaviors, or the extent to which women are motivated to comply with provider recommendations. The TPB is a useful framework for examining these questions, which addresses an existing gap in the literature and can help facilitate the development of future interventions in the prenatal care setting.

Table 2.1: Absolute and Relative Contraindications to Exercise during Pregnancy
(American College of Obstetricians and Gynecologists, 2002)

Absolute	Relative
<ul style="list-style-type: none"> ▪ Hemodynamically significant heart disease ▪ Restrictive lung disease ▪ Incompetent cervix/cerclage ▪ Multiple gestation at risk for premature labor ▪ Persistent second or third trimester bleeding ▪ Placenta previa after 26 weeks gestation ▪ Premature labor during the current pregnancy ▪ Ruptured membranes ▪ Pregnancy induced hypertension 	<ul style="list-style-type: none"> ▪ Severe anemia ▪ Unevaluated maternal cardiac arrhythmia ▪ Chronic bronchitis ▪ Poorly controlled type I diabetes ▪ Extreme morbid obesity ▪ Extreme underweight (body mass index <12 kg/m²) ▪ History of extremely sedentary lifestyle ▪ Intrauterine growth restriction in current pregnancy ▪ Poorly controlled hypertension/pre-eclampsia ▪ Orthopedic limitations ▪ Poorly controlled seizure disorder ▪ Poorly controlled thyroid disease ▪ Heavy smoker

Table 2.2: Warning Signs to Terminate Exercise during Pregnancy (American College of Obstetricians and Gynecologists, 2002)

- Vaginal bleeding
 - Dyspnea prior to exertion
 - Dizziness
 - Headache
 - Chest pain
 - Muscle weakness
 - Calf pain or swelling (need to rule out thrombophlebitis)
 - Preterm labor
 - Decreased fetal movement
 - Amniotic fluid leakage
-

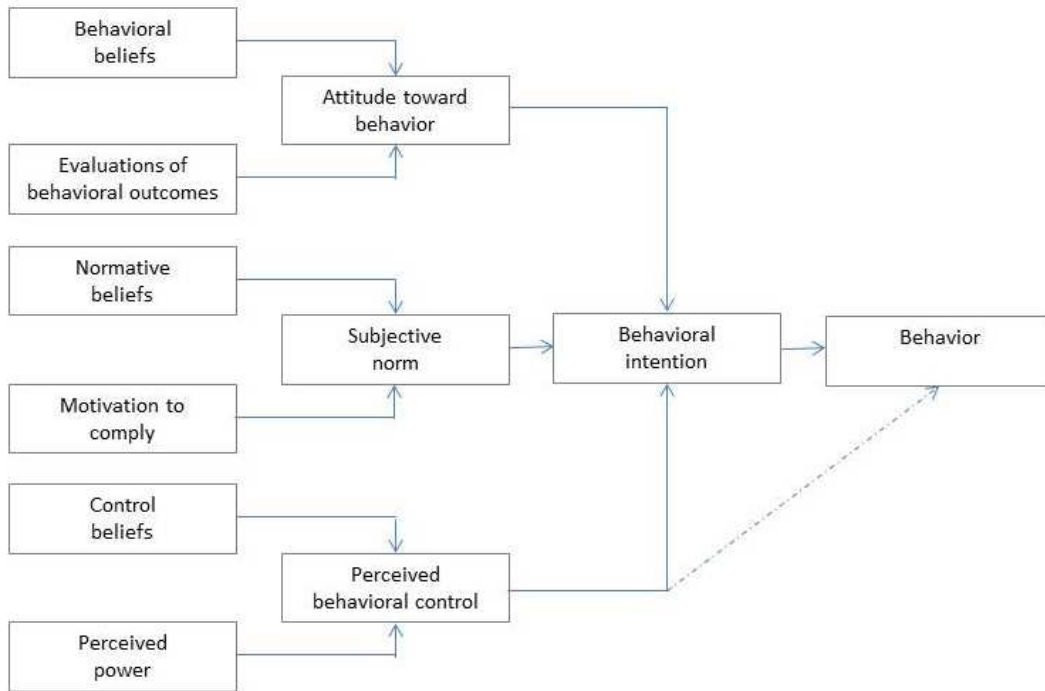


Figure 2.1: Theory of Planned Behavior (modified from Montaño & Kasprzyk, 2002)

CHAPTER THREE

METHODS

This project was funded by an internal grant sponsored by the Office of the Vice President for Research at the University of South Carolina. The SPARC graduate fellowship is a merit-based award designed to promote research and creative excellence across all disciplines throughout the University setting. The overall goal of the following two studies was to better understand pregnant women's perceptions and intentions regarding weight gain, physical activity, and nutrition in pregnancy and to explore prenatal care providers' perceptions and intentions regarding counseling on these health behaviors. Findings from these studies will help guide the development of future gestational weight gain interventions in the prenatal care setting.

STUDY 1

PURPOSE

This study addressed two dissertation aims. Aim 1: Use the Theory of Planned Behavior to examine pregnant women's attitudes, subjective norms, perceived behavioral control, and intentions towards weight gain, physical activity, and nutrition during pregnancy using qualitative research methods. Aim 2: Use the Theory of Planned Behavior to examine patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy using qualitative research methods.

AIM 1 QUESTIONS

- 1.1 *Attitudes*: How do women view weight gain, physical activity, and nutrition in pregnancy (perceived positive and negative outcomes)?
- 1.2 *Subjective Norms*: Who are influential sources of information on weight gain, physical activity, and nutrition in pregnancy?
- 1.3 *Perceived Behavioral Control*: What are the perceived barriers and facilitators to meeting weight gain, physical activity, and nutrition recommendations in pregnancy?
- 1.4 *Intentions*: Do women intend to follow the recommendations for weight gain, physical activity, and nutrition during pregnancy?

AIM 2 QUESTIONS

- 2.1 *Attitudes*: How do providers view weight gain, physical activity, and nutrition counseling in prenatal care (perceived positive and negative outcomes)? How do patients view provider counseling on these topics?
- 2.2 *Subjective Norms*: Do providers know the current counseling recommendations for weight gain, physical activity, and nutrition during pregnancy? What do providers think of these recommendations? To what extent are women motivated to comply with provider recommendations on these topics?
- 2.3 *Perceived Behavioral Control*: What are the perceived barriers and facilitators to counseling women on weight gain, physical activity, and nutrition in prenatal care?
- 2.4 *Intentions*: Do providers intend to counsel women on weight gain, physical activity, and nutrition in prenatal care and how will they do so? To what extent do women intend to follow provider recommendations on these topics?

DESIGN

This study used a cross-sectional qualitative research design. A qualitative study design was deemed the most appropriate method, as it allows for a more in-depth understanding of patient and provider perceptions and intentions related to weight gain, physical activity, and nutrition in pregnancy.

CONCEPTUAL FRAMEWORK

The Theory of Planned Behavior (TPB) was used to guide the development of the patient and provider interview guides. This theory was developed to predict and explain behaviors and serves as a framework for behavior change interventions (Ajzen, 1985, 1991) The TPB posits that attitudes, subjective norms, and perceived behavioral control influence intentions and behaviors. Attitudes, subjective norms, and perceived behavioral control are in turn influenced by behavioral, normative, and control beliefs and the value placed on these beliefs. The primary proposition of the TPB is that people will intend to engage in a behavior if they view it positively (attitudes), believe that important others, such as a health care provider, want them to participate in certain behaviors (subjective norms), and perceive that the behavior is under their control (perceived behavioral control). This theory has been used extensively in research examining and predicting behaviors, including research with health care providers and pregnant women (Downs & Hausenblas, 2003; Godin et al., 2008; Hardeman et al., 2002). The methods developed for data collection and analysis using the TPB have generally been quantitative in nature; however, this theory can be effectively used as an exploratory framework to guide the

development of questions in qualitative research, as was done in this dissertation (Ajzen, 2004). The TPB was therefore well suited to serve as the framework guiding this project.

The patient and provider conceptual frameworks that guided this study can be found in Figures 3.1 and 3.2, respectively. The patient model depicts how women's attitudes, subjective norms, and perceived behavioral control toward weight gain, physical activity, and nutrition influence intentions to engage in these health behaviors. The potential role of the health care provider is also a key component of the model. The provider model depicts how attitudes, subjective norms, and perceived behavioral control toward counseling on weight gain, physical activity, and nutrition influence intentions to counsel patients on these behaviors. In these two models, attitudes, subjective norms, and perceived behavioral control are each influenced by expectancy beliefs (behavioral, normative, and control beliefs) and the value placed on these beliefs.

PARTICIPANTS

The proposed study took place in Columbia, South Carolina. This state is recognized as having a high obesity prevalence and poor maternal and child health outcomes (South Carolina Department of Health and Environmental Control, 2008). Approximately half of mothers in South Carolina gain weight above the IOM recommendations during pregnancy (Liu et al., 2012). A total of 30 pregnant women (15 Black, 15 White) were recruited from two local Ob/Gyn clinics. Eligibility criteria for patients were: Black or White women, 20-30 weeks gestation, singleton pregnancy, pre-pregnancy BMI of 18.5-45.0 kg/m², 18-44 years old, able to speak/read English and initiated prenatal care \leq 16 weeks gestation. We recruited five Black and five White

women who were normal weight, overweight, and obese in order to better represent the views of women resembling the general South Carolina population. Women were ≥ 20 weeks gestation to allow sufficient time for provider counseling on weight gain, physical activity, and nutrition during prenatal visits, but ≤ 30 weeks in order to capture a more homogenous population. Morbidly obese women ($BMI > 45\text{kg/m}^2$) were excluded due to increased risk for pregnancy complications, as were underweight women due to their low risk of excessive gestational weight gain.

We attempted to recruit 12 prenatal care providers from the same two clinics to take part in qualitative interviews. However, due to staff turnover during the recruitment window we were only able to recruit 11 providers. A sample of residents, attending physicians, and nurse practitioners were recruited to allow for a more comprehensive investigation of provider perspectives. While this is a small sample of providers, major themes in qualitative research have been identified as early as 6 interviews, with data saturation occurring by 12 interviews (Guest et al., 2006). Providers were eligible to participate if they regularly saw prenatal patients.

PROCEDURES

The PI personally recruited women in the waiting room during a prenatal visit at one clinic. In person recruitment was not possible at the second clinic due to space and workflow limitations. Flyers with study and contact information were posted in both clinics, which allowed interested persons to contact the PI directly. Flyers were also distributed to women participating in the Centering Pregnancy Program through Palmetto Health. Study eligibility was determined through a screening form administered in person

by the PI at a prenatal visit or by telephone as necessary. If women were eligible and consented to participate, a face-to-face semi-structured qualitative interview was scheduled at the clinic following their existing or future prenatal visit or at the participants' home. Both clinics had private rooms available for interviews. The PI conducted all interviews.

The PI recruited providers from the two clinics with the assistance of the Nurse Managers. E-mail announcements were also sent to providers with study contact information. Study eligibility was evaluated by asking providers if they currently see prenatal patients. If providers were eligible and consented to participate, a face-to-face semi-structured qualitative interview was scheduled around the providers work schedule and took place in their office or an available private room within the clinic.

All interviews were digitally recorded and transcribed verbatim using a professional transcription service (Verbal Ink). Patient and provider interviews were expected to last approximately 40 and 30 minutes, respectively. Both patients and providers were also asked to complete a brief survey. All participants were compensated \$30 for their participation.

PATIENT INTERVIEW GUIDE

An interview guide was developed for patients, which was informed by a literature review and the TPB (see Appendix A). *Intentions* were assessed first to limit social desirability bias by asking patients how much weight they intend to gain in pregnancy and to describe their physical activity and dietary plans to help them meet this weight gain goal. *Attitudes* were assessed by asking patients to describe their personal

beliefs toward weight gain, physical activity, and nutrition in pregnancy, including perceived consequences and importance of those consequences. *Subjective norms* were evaluated by asking women to describe the beliefs and views of important others (spouse/partner, family, friends and health care provider) toward weight gain, physical activity, and nutrition in pregnancy. Participants were asked whose advice or opinion they most value and trust. If not discussed spontaneously, women were specifically asked if a provider had spoken with them about these health behaviors. Perceptions of provider advice were assessed, including women's motivation to comply with provider recommendations. If participants reported provider counseling on these topics, what advice was given and how providers approached counseling was also assessed.

The interviewer then discussed the current recommendations for weight gain, physical activity, and nutrition in pregnancy. These recommendations were framed as recently released guidelines in case they did not match with patient beliefs or provider recommendations. Recommendations were verbally described and participants also received a printed version to use for reference during the remainder of the interview.

Perceived behavioral control was evaluated by asking women what they think about the recommendations for weight gain, physical activity, and nutrition in pregnancy, and what barriers/facilitators exist to gaining an appropriate amount of weight, achieving physical activity recommendations, and consuming a healthy diet. Finally, women were asked questions about how they would prefer to receive information on weight gain, physical activity, and nutrition from their health care provider in a way that is meaningful and would increase their intention to engage in these health behaviors.

PATIENT MEASURES

Following the qualitative interviews, participants completed an interviewer-administered survey.

Sociodemographics. Participants were asked to report their race, ethnicity, age, gestational age, highest grade or years of education, income level, employment status, marital status, parity, and number of dependent children.

Anthropometrics. Self-reported data on height and pre-pregnancy weight was used to calculate pre-pregnancy BMI. Self-reported weight is the most commonly used measure of pre-pregnancy weight and has shown to be both reliable and valid (Shin et al., 2014; Tomeo et al., 1999). Current weight was also assessed through self-report.

Health Conditions. Participants were asked if they have been diagnosed with preeclampsia, gestational diabetes, or any other complications during this pregnancy.

Physical Activity. The short form of the International Physical Activity Questionnaire (IPAQ) was used to assess hours per week of moderate to vigorous intensity physical activity, walking, and sitting over the previous seven days (Craig et al., 2003). The short form was used to reduce participant burden, and has shown to have acceptable reliability (Craig et al., 2003; van Poppel et al., 2010) and criterion validity (Ekelund et al., 2006) among adults. This questionnaire has been validated and used in research with pregnant women (Aittasalo et al., 2010; Bertolotto et al., 2010; Leppanen et al., 2014; Takahasi et al., 2013).

Nutrition. Dietary intake of fruits and vegetables was estimated using the 2-item cup fruit and vegetable screener (Yaroch et al., 2012). While this screener is not designed to estimate precise intake levels, it has demonstrated adequate validity and is appropriate

for obtaining gross estimates and for use when ranking individuals with respect to fruit and vegetable intake. The 2-item *cup* screener was selected as it has shown to outperform the 2-item *serving* screener, and also reflects the 2010 Dietary Guidelines for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010; Yaroch et al., 2012).

Additional Measures. Self-rated health, smoking status, alcohol consumption, sleep habits, breastfeeding intentions, and major chronic health conditions were also assessed.

PROVIDER INTERVIEW GUIDE

An interview guide was developed for providers, which was informed by a literature review and the TPB (see Appendix B). First, providers were asked how they discuss weight gain, physical activity, and nutrition recommendations with their patients during prenatal visits, if at all, as well as what recommendations are given. To assess *attitudes*, providers were asked to describe the advantages and disadvantages of counseling women on weight gain, physical activity, and nutrition during pregnancy. To what extent do providers think their recommendations will impact women's health behaviors? *Subjective norms* were evaluated by asking about the beliefs and practices of other important people, groups, or organizations regarding counseling on these health behaviors. Participants were presented with a printed version listing the IOM weight gain recommendations and ACOG counseling recommendations, and were then asked to describe what they think of the current recommendations. *Perceived Behavioral Control* was examined by asking providers what barriers/facilitators exist to counseling women

on these health behaviors. Providers were asked to describe how their training prepared them to counsel women on weight gain, physical activity, and nutrition as well as their level of comfort initiating these discussions. *Intention* was evaluated by asking providers how likely they are to counsel women on these topics in future prenatal sessions, and how they will do so.

PROVIDER MEASURES

Before taking part in qualitative interviews, providers were asked to complete a brief survey. The survey was given prior to the interview to assess provider knowledge of current weight gain, physical activity, and nutrition guidelines before these guidelines were explicitly discussed in the interviews.

Demographics. Providers were asked to report their race, ethnicity, age, year of graduation from medical school, number of years in practice, and number of years at current clinic.

Anthropometrics. Self-reported height and weight were used to calculate BMI.

Physical Activity. As discussed above, the validated short form of the IPAQ was used to assess hours per week of moderate to vigorous intensity physical activity, walking and sitting over the previous 7 days (Craig et al., 2003).

Nutrition. Dietary intake of fruits and vegetables was estimated using the 2-item cup fruit and vegetable screener (Yaroch et al., 2012).

Knowledge of current recommendations. Providers were asked if they are familiar with the 2009 IOM guidelines for gestational weight gain as well as the ACOG weight

gain, exercise, and nutrition counseling recommendations for prenatal care providers (yes/no).

Additional Measures. Self-rated health, smoking status, alcohol consumption, sleep habits, and major chronic health conditions was also assessed.

DATA MANAGMENT

The PI downloaded all digitally recorded interviews and uploaded the data directly to the transcription company's website (Verbal Ink). Data was uploaded on an ongoing basis as interviews were completed. Upon receipt of the transcripts, the PI verified the accuracy of transcription and removed all identifying information. Transcribed files were saved on a password-protected server known only to the PI and primary advisor. Files were then imported into QRS NVivo 10 for data management. The original digital recordings were destroyed after completion of the study.

DATA ANALYSIS

Participant survey data was analyzed using SAS version 9.3. Patient measures include: race, ethnicity, age, income, employment status, highest grade or years of education, marital status, number of dependent children, pre-pregnancy BMI, gestational age, diagnosed health conditions, self-rated health, breastfeeding intentions, quality and quantity of sleep, smoking behaviors, alcohol consumption, physical activity, and fruit/vegetable consumption. Variables were compared across races (Black and White) using independent t-tests (continuous variables) or chi-square tests (categorical variables) as appropriate. Provider measures include: race, ethnicity, age, year of graduation from

medical school, number of years in practice, number of years at current clinic, BMI, self-rated health, quality and quantity of sleep, smoking behaviors, alcohol consumption, physical activity, and fruit/vegetable consumption. All statistical tests were performed at a .05 level of significance.

Transcripts were examined for patterned responses within the data and key, overarching themes. The PI and a second person independently read and coded two patient transcripts and two provider transcripts, then met to compare and discuss similarities and differences in definitions and codes. This provided a form of analytic triangulation as it offered an opportunity for additional insights to emerge based on how two people viewed the same set of data (Patton, 2002). After reaching consensus on each code's definition and meaning, the inductive analysis method of "open coding" was utilized to develop a composite code list (Strauss & Corbin, 1998; Strauss & Corbin, 1990). Open coding as defined by Strauss and Corbin is the analytic process through which concepts are identified and their properties and dimensions are discovered in data (1998). This is a commonly used approach in qualitative research, including studies examining patient and provider communication in the prenatal care setting (Duthie et al., 2013; Stengel et al., 2012; Sword et al., 2012).

Two composite code lists were developed, one for patients and one for providers. Each code list was organized to form an initial codebook draft. The patient and provider codebooks were entered separately into QRS NVivo 10 for computer assisted qualitative data management. To promote consistency, the PI coded all manuscripts and a second person reviewed the work to ensure codes were correctly applied. The two codebooks

were revised as additional data was collected, and all transcripts were recoded to reflect these changes.

Data saturation was reached after completion of the 30 patient and 11 provider interviews; therefore, no additional interviews were conducted. Data saturation was defined as the point in category development at which no new properties, dimensions, or relationships emerged during analysis (Strauss & Corbin, 1998). A theme was defined as 20% or more of participants addressing a topic. This approach was successfully used in a prior qualitative study examining health behaviors in pregnant and postpartum women (Goodrich et al., 2013). Once patterns or themes were established through inductive analysis, a deductive approach was used to form hypotheses about the relationships between concepts. As the patient and provider interview guides were developed using the TPB, this may bias the participant answers towards this framework. However, using the proposed analysis method of “open coding” as described above allowed for the exploration of broader themes or themes inconsistent with the theory.

STUDY 2

PURPOSE

This study addressed two dissertation aims. Aim 3: Use the Theory of Planned Behavior to explore women’s beliefs regarding weight gain, physical activity, and nutrition in pregnancy and to examine if attitudes, subjective norms, and perceived behavioral control predict weight gain, physical activity, and nutrition intentions during pregnancy. Aim 4: To examine women’s report of provider counseling on weight gain, physical activity, and nutrition during pregnancy and to determine if provider counseling

is associated with weight gain, physical activity, and nutrition intentions during pregnancy.

AIM 3 QUESTION & HYPOTHESIS

- 3.1 What are women's behavioral, normative, and control beliefs towards weight gain, physical activity, and nutrition during pregnancy?
- 3.2 Attitude will explain the greatest variation in weight gain, physical activity, and nutrition intentions, followed by perceived behavioral control, and subjective norm.

AIM 4 QUESTIONS & HYPOTHESIS

- 4.1. What proportion of women report provider counseling on weight gain, physical activity, and nutrition during prenatal care visits?
- 4.2. Is provider counseling on weight gain, physical activity, and nutrition during pregnancy consistent with current guidelines?
- 4.3. Report of provider counseling on weight gain, physical activity, and nutrition will be associated with more favorable weight gain, physical activity, and nutrition intentions during pregnancy.

DESIGN

This study used a cross-sectional research design.

PARTICIPANTS

Eligibility criteria for patients were: Black or White women, 20-30 weeks gestation, singleton pregnancy, pre-pregnancy BMI of 18.5-45.0 kg/m², 18-44 years old,

able to read English, initiated prenatal care \leq 16 weeks gestation, and living in the United States or Canada.

PROCEDURES

The study survey was distributed and data collected via the Internet using the commercially available Internet-based survey company SurveyGizmo. An Internet-based approach was selected due to its broad potential reach and reduced participant burden. In 2011, the U.S. Census Bureau found that 71.7% of households reported accessing the Internet with a home computer (U.S. Census Bureau, 2013). While household Internet usage varies by race, with 76.2% of White and 56.9% of Black households reporting home Internet use, it appears that these racial disparities are decreasing over time. For example, in 2000 the differences between household Internet use for White and Blacks was approximately 23%, in 2011 these differences decreased to 19%. Furthermore, respondents are able complete SurveyGizmo surveys from most mobile web browsers (i.e. smart phones). In 2013, approximately 56% of American adults reported owning a smartphone of some kind, with Blacks being significantly more likely than Whites to own a smartphone (64% vs. 53%) (Pew Research Center, 2013). Therefore, while an Internet-based approach may limit generalizability of the findings to those with Internet access, the majority of the population has available Internet access through their home computer or smart phone. Furthermore, work computers and public access computers (e.g. libraries) will future increase access to those without home computers or smart phones.

Participants were recruited to complete the survey through various mechanisms. Announcements were posted on Internet forums and blogs related to pregnancy, e-mails

were sent out through various listserves, and flyers were posted in prenatal clinics. The solicitation announcement described the purpose of the study and criteria for participation. Interested participants were invited to access a link that directed them to the survey.

After accessing the provided link to the survey, potential participants were directed to a screen that provided a more detailed description of the study. Potential participants were asked to complete a brief screening form to verify eligibility. Those who did not meet the inclusion criteria were brought to a page stating they are not eligible to participate in the study and thanked them for their time. Eligible participants had the opportunity to enter a drawing to win 1 of 8 \$50 Amazon gift certificates (\$400 total) by entering their contact information. Upon completion of the survey, participants were thanked for their time and the PI's contact information was provided to answer any questions or comments.

MEASURES

The survey developed for this study was informed by an extensive literature review and consisted of a demographic questionnaire, Likert-scale items, and open item response questions. Participants were given the opportunity to skip any questions they did not want to answer. The terms “exercise” and “healthy eating” were used in the participant surveys, as these are more understandable and recognized terms than “physical activity” and “nutrition.” The following measures were collected.

Sociodemographics. Participants were asked to report their race, ethnicity, age, gestational age, highest grade or years of education, income level, employment status, marital status, parity and number of dependent children.

Anthropometrics. Self-reported height and pre-pregnancy weight were used to calculate pre-pregnancy BMI. Self-reported weight is the most commonly used measure of pre-pregnancy weight and has shown to be both reliable and valid (Shin et al., 2014; Tomeo et al., 1999)

Health Conditions. Participants were asked if they have been diagnosed with preeclampsia, gestational diabetes, or any other complications during this pregnancy.

Intention. Participant intentions were assessed first to reduce social desirability bias. Weight gain intentions were assessed using two different methods. Women were first asked how much weight they plan on gaining during pregnancy using a multiple-choice question that listed ranges of weight gain in 5 pound increments. Finally, intentions were assessed with the statement “I plan on gaining between 25-35 / 15-25 / 11-20 total pounds during this pregnancy,” using a seven-point Likert scale ranging from -3 (strongly disagree) to +3 (strongly agree). The weight range listed was determined by the participants’ pre-pregnancy BMI and corresponded to the 2009 IOM gestational weight gain guidelines (see Table 3.1).

Physical activity and nutrition intentions were assessed using the statements “I plan on exercising at a moderate intensity for 150 minutes per week (e.g. 30 minutes per day, 5 days per week) during my pregnancy,” and “I plan on eating a healthy diet during my pregnancy,” using the same seven-point Likert scale. Participants read a short description explaining the terms “moderate intensity” and “healthy eating” before

answering these questions. Intentions were assessed using the score on the 1-item question with a possible range of -3 to +3 for each health behavior. Higher scores indicate stronger intentions to meet weight gain, physical activity, and nutrition recommendations in pregnancy.

Provider Recommendations. In three separate questions, participants were asked if a health care provider had discussed weight gain, exercise, or healthy eating with them since becoming pregnancy with a binary response (yes or no for each). If women selected yes for any of these questions, specific recommendations were assessed using an open-ended response. For example, “How many pounds did your health care provider recommend that you gain during this pregnancy?” These questions were asked before participants are informed of the current recommendations to limit social desirability bias.

Attitudes. Participant attitudes towards weight gain, physical activity, and nutrition recommendations were assessed using the following seven discrepant word pairs that have been commonly used in the existing literature: (1) bad-good, (2) useless-useful, (3) foolish-wise, (4) harmful-beneficial, (5) unpleasant-pleasant, (6) boring-interesting and (7) unenjoyable-enjoyable (Ajzen, 1991, 2002; Downs & Hausenblas, 2003; Hausenblas et al., 2008). Participants first read a short description explaining the current weight gain, physical activity, and nutrition recommendations for women during pregnancy. They were then asked to respond to a statement by rating each of the word pairs listed above using a seven-point Likert scale ranging from -3 (bad, useless, foolish, harmful, unpleasant, boring, unenjoyable) to +3 (good, useful, wise, beneficial, pleasant, interesting, enjoyable). For example, “Exercising during my pregnancy for 150 minutes per week at a moderate intensity level (e.g. brisk walking) will be...”

Consistent with the recommended TPB analytical procedures (Ajzen & Fishbein, 1980; Montano & Kasprzyk, 2002), the direct measure of attitude for weight gain, physical activity and nutrition was assessed by summing the scores from the corresponding seven discrepant word pairs. Possible scores for each health behavior range from -21 to +21. Higher scores indicate a more positive attitude toward the corresponding health behavior.

Behavioral Beliefs. Women's behavioral beliefs (an indirect measure of attitude) toward weight gain, physical activity, and nutrition was explored using open-ended questions. More specifically, women were asked to list the advantages and disadvantages of gaining the recommended amount of weight, exercising regularly, and eating a healthy diet during pregnancy. For example, "Please list some of the advantages of gaining 25-35 / 15-25 / 11-20 pounds during pregnancy." This statement was followed by "Please list some of the disadvantages of gaining 25-35 / 15-25 / 11-20 pounds during pregnancy." The specific weight ranges listed in these questions were tailored to the participant based on their pre-pregnancy BMI.

Subjective Norms. Subjective norms were assessed by asking participants what important others think about weight gain, physical activity, and nutrition in pregnancy. For example "Most people who are important to me think that I should exercise regularly during pregnancy." A seven-point Likert scale ranging from -3 (strongly disagree) to +3 (strongly agree) was used to assess subjective norms. The direct measure of subjective norms was assessed using the score on the 1-item question with a possible range of -3 to +3 for each health behavior. Higher scores indicate greater perceived pressure to engage in the corresponding behavior.

Normative Beliefs. Normative beliefs (an indirect measure of subjective norms) about weight gain, physical activity, and nutrition was explored using open-ended questions. Women were asked to list significant others who influence their health behaviors during pregnancy. For example, “Please list the individuals in your life who influence your eating behaviors during pregnancy.”

Perceived Behavioral Control. Participants’ perceived behavioral control over meeting the recommendations for weight gain, physical activity, and nutrition in pregnancy was assessed in three ways for each health behavior. First, participants were asked how much control they have over their weight gain, physical activity, and eating habits during pregnancy using a seven-point Likert scale ranging from -3 (very little control) to +3 (complete control). For example, “How much control do you have over your weight gain during pregnancy?” The ease or difficulty of meeting these recommendations was assessed using a seven-point Likert scale ranging from -3 (extremely difficult) to +3 (extremely easy). For example, “For you to gain between 25-35 / 15-25 / 11-20 total pounds in pregnancy will be...” As stated above, the specific weight range listed in this question was tailored to the participant based on their pre-pregnancy BMI. Finally, women were asked if they can meet the recommendations for these health behaviors using a seven-point Likert scale ranging from -3 (strongly disagree) to +3 (strongly agree). For example, “If you wanted to, you can easily control how much weight you gain during this pregnancy.” Summing the scores from the three corresponding survey items assessed the direct measure of perceived behavioral control for each health behavior, with a possible range of -9 to +9. Higher scores indicate higher levels of perceived control to engage in the corresponding health behavior.

Control Beliefs. Women's control beliefs (an indirect measure of perceived behavioral control) of weight gain, physical activity, and nutrition were explored using open-ended questions. Participants were asked to list the factors that make it difficult or easier to engage in certain health behaviors. For example, "Please list some things that might make it difficult for you to exercise regularly during pregnancy." This statement was followed by "Please list some things that might make it easier for you to exercise regularly during pregnancy." The quantitative TPB scales that were measured in this study (attitude, subjective norm, perceived behavioral control, intention) can be found in Table 3.2.

Weight gain. Women were asked to self-report their current weight using a continuous open-ended response. Pre-pregnancy weight was subtracted from current weight to determine weight gain at time of interview. Rate of weight gain was calculated based on current gestational age.

Physical Activity. As in Study 1, the validated short form of the IPAQ was used to assess hours per week of moderate to vigorous intensity physical activity, walking, and sitting over the previous 7 days (Craig et al., 2003).

Nutrition. As in Study 1, dietary intake of fruits and vegetables was estimated using the 2-item cup fruit and vegetable screener (Yarooh et al., 2012).

Additional Measures. Self-rated health, smoking status, alcohol consumption, sleep habits, breastfeeding intentions, and major chronic health conditions were also assessed.

DATA MANAGEMENT

The survey was accessible on the SurveyGizmo website until all incentive funds were used. Participant responses remained anonymous and data for completed surveys was encrypted through Secure Sockets Layer (SSL) and stored electronically by surveygizmo.com. All extracted data was saved on a password-protected server known only to the PI and primary advisor. After completion of the study, all data stored on surveygizmo.com was destroyed. Once the Amazon gift cards were distributed, the participant names and contact information were removed to deidentify the dataset.

DATA ANALYSIS

Basic descriptive analyses were conducted with SAS 9.3, including frequencies and means for key variables (sociodemographics, anthropometrics, health conditions, and behavioral outcomes). The distribution and skewness of all continuous variables were examined. Variables were compared across races (Black and White) using independent t-tests (continuous variables) or chi-square tests (categorical variables) as appropriate. Intercorrelations between independent variables of interest were also examined.

Question 3.1. Qualitative responses collected from 15 open-ended survey questions were content analyzed into themes to assess salient beliefs towards weight gain, physical activity, and nutrition in pregnancy. Data was organized by health behavior and then categorized further by belief type (behavioral, normative, or control beliefs) using a qualitative software package (QRS NVivo 10). As recommended for TPB guided content analysis, verbatim statements were placed in the following lists: (1) positive and negative behavioral beliefs about outcomes or attributes of the action, (2) people or groups that

influence the action, and (3) factors or situations that make it easier or more difficult to perform the action (Montano & Kasprzyk, 2002). To increase the validity of the analysis, the PI and a second rater independently read and coded a subset of response data.

Discussion and consensus between the two raters guided the organization of the statements in each list into major themes. The PI coded all open-ended survey questions and the second rater reviewed a subset of questions to ensure codes were correctly applied. The codebook was revised as additional data was collected. The identified themes are presented in order, from those most frequently mentioned to those least frequently mentioned.

Hypothesis 3.2. Pearson's correlations examined the bivariate associations of behavioral intentions and the direct measures of attitude, subjective norm, and perceived behavioral control for each of the three health behaviors: weight gain, physical activity, and nutrition.

Hierarchical regression analyses were used to examine the predictive utility of the TPB on behavioral intentions using recommended analytical procedures, (Ajzen, 1991). Construct entry order and grouping was based on the theoretical principles of the TPB and previous research (Ajzen, 1991; Downs & Hausenblas, 2003). The first model regressed weight gain intention (dependent variable) on attitude and subjective norm toward weight gain (block 1). The second model regressed weight gain intention on attitude, subjective norm, and perceived behavioral control (block 2). Using this same method, hierarchical regression analyses were repeated for physical activity and nutrition intentions. Interactions between race and the TPB constructs were tested individually. None were significant and therefore not retained in final models. The variance explained

by the models and the unique variance explained by each independent variable was assessed. For each model, the variance inflation factors were computed as a multicollinearity diagnostic statistic to test the impact of multicollinearity among the covariates.

Hypothesis 3.3. Associations between women's report of provider counseling on weight gain, physical activity, or nutrition (yes or no) with women's intentions toward the corresponding health behavior (7-point Likert scale) were assessed using Wilcoxon rank sum tests for non-parametric data. Pearson's correlations examined the bivariate correlations of provider recommended weight gain in pounds with women's intended weight gain in pounds as continuous variables. Chi-square tests also examined associations between provider recommended weight gain and women's intended weight gain as categorical variables.

The 2009 IOM guidelines were used to define whether women's report of provider weight gain advice and women's self-reported intended weight gain were correct or not according to these guidelines (Institute of Medicine and National Research Council, 2009). Based on pre-pregnancy BMI categories, provider advice on weight gain was further categorized in the following groups: below, within, or exceeding IOM guidelines. Similarly, women's weight gain intentions were categorized into the following groups: below, within, or exceeding IOM guidelines. Associations between provider recommended weight gain (independent variable) and women's intended weight gain (dependent variable) were also assessed using both linear and logistic regression models while controlling for maternal race, age, education, parity, and pre-pregnancy BMI.

Power. Based on regression models with three and four predictor variables, power of 0.80, alpha of .05, and a medium effect size (ES $d = 0.56$), the sample size required to test the hypothesis that the population multiple correlation equals 0 to 0.2 is 84 participants (Green, 1991). A medium effect size was conservatively estimated based off two meta-analytic reviews of the TPB and exercise literature, which reported medium to large effect size relationships for intention-attitude (ES $d = 1.22$), intention-subjective norm (ES $d = 0.56$), and intention-perceived behavioral control (ES $d = 0.97$) (Hagger et al., 2002; Hausenblas et al., 1997). If we estimate that 60% of those who initiate participation will complete the survey, then a minimum of 140 women were needed to enroll in the study.

Patient Conceptual Framework

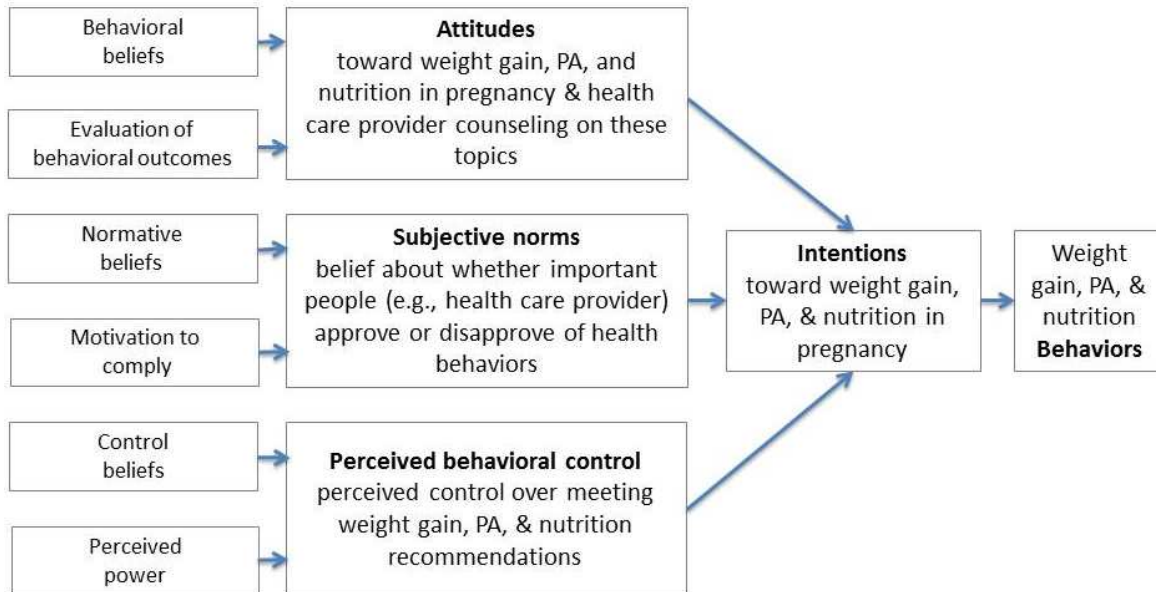


Figure 3.1: Patient Perceptions and Intentions toward Weight Gain, Physical Activity and Nutrition in Pregnancy and Role of the Health Care Provider

Note: PA = Physical Activity

Provider Conceptual Framework

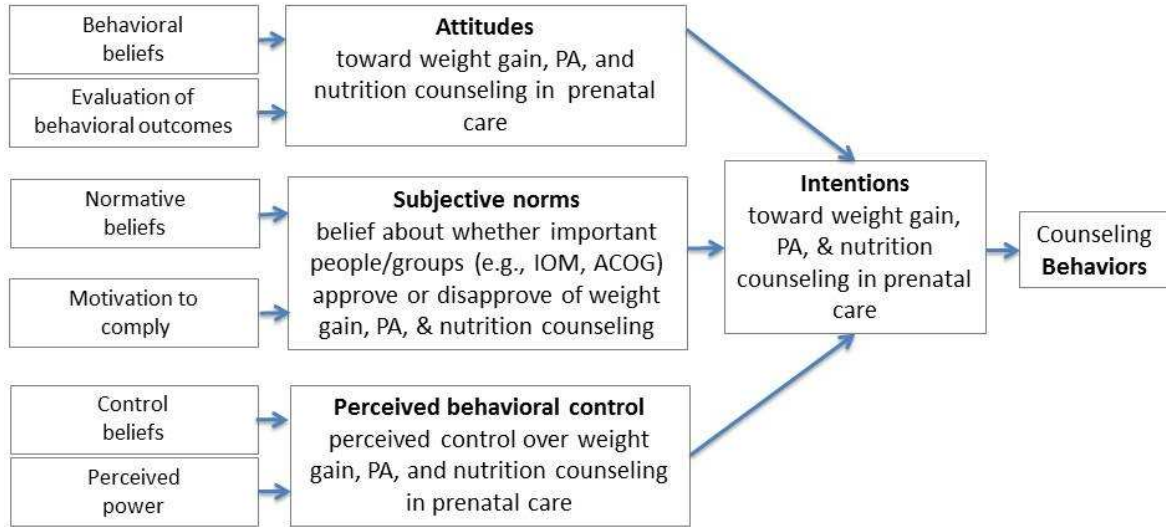


Figure 3.2: Provider Perceptions and Intentions toward Weight Gain, Physical Activity and Nutrition Counseling in Prenatal Care

Note: PA = Physical Activity; IOM = Institute of Medicine; ACOG = American College of Obstetricians and Gynecologists

Table 3.1: 2009 Institute of Medicine Recommendations for Total and Rate of Weight Gain during Pregnancy, by Pre-pregnancy BMI

Pre-pregnancy BMI ^a	BMI (kg/m ²) (WHO)	Total Weight Gain Range (lbs)	Rates of Weight Gain ^b 2 nd and 3 rd Trimester (Mean Range in lbs/week)
Underweight	<18.5	28-40	1 (1-1.3)
Normal weight	18.5-24.9	25-35	1 (0.8-1)
Overweight	25.0-29.9	15-25	0.6 (0.5-0.7)
Obese (includes all classes)	≥30	11-20	0.5 (0.4-0.6)

^aRecommendations for weight gain differ by pre-pregnancy BMI to increase the percentage of women who have appropriate for gestational age (2.5-4.0 kg) infants (Institute of Medicine and National Research Council, 2009).

^bCalculations assume a 0.5–2 kg (1.1–4.4 lbs) weight gain in the first trimester.

Table 3.2: Summary of Scales Used to Quantify Hypothesized Constructs from the Theory of Planned Behavior

Scale	Definition of what scale is measuring	# of items in scale
<i>Weight Gain</i>		
Attitude	Beliefs toward weight gain recommendations	7
Subjective Norm	Perceived social pressure to gain the recommended amount of weight	1
PBC	Perceived ease/difficulty of gaining the recommended amount of weight	3
Intention	Weight gain goal	2
<i>Physical Activity</i>		
Attitude	Beliefs toward physical activity recommendations	7
Subjective Norm	Perceived social pressure to be physically active	1
PBC	Perceived ease/difficulty of being physically active	3
Intention	Physical activity plan	1
<i>Healthy Eating</i>		
Attitude	Beliefs toward nutrition recommendations	7
Subjective Norm	Perceived social pressure to eat healthy diet	1
PBC	Perceived ease/difficulty of healthy eating	3
Intention	Healthy eating plan	1

PBC: Perceived Behavioral Control

CHAPTER FOUR

AFRICAN AMERICAN AND WHITE WOMEN'S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION DURING PREGNANCY: A QUALITATIVE STUDY¹

¹ Whitaker KM, Wilcox S, Liu J, Blair SN, Pate RR. To be submitted to *Midwifery*.

Abstract

Objective: To describe African American (AA) and White women's perceptions of weight gain, physical activity, and nutrition during pregnancy and to explore differences in perceptions by race.

Design: Qualitative interview study.

Setting: Two Ob/Gyn clinics in Columbia, South Carolina.

Participants: Thirty pregnant women (15 AA, 15 White) between 20-30 weeks gestation, equally represented across pre-pregnancy BMI categories (10 normal weight, 10 overweight, and 10 obese).

Findings: White women more frequently described intentions to meet weight gain, physical activity, and dietary guidelines in pregnancy than AA women. AA women were more concerned with inadequate weight gain while White women more commonly expressed concerns about excessive weight gain. More White women discussed the importance of physical activity for weight management. Regardless of race, few women described risks of excessive weight gain or benefits of physical activity as it relates to the baby's health. The primary cited barrier of healthy eating was the high cost of fresh produce.

Key conclusions and implications for practice: Several knowledge gaps as well as race differences were identified in women's perceptions and intentions toward weight gain, physical activity, and nutrition during pregnancy. Future interventions should seek to educate women about common misperceptions. It may be necessary to culturally tailor gestational weight gain interventions to optimize health outcomes.

Introduction:

The high and increasing prevalence of women who enter pregnancy overweight or obese is a major public health concern. Approximately 75% of Non-Hispanic Black women and 50% of Non-Hispanic White women of childbearing age are overweight or obese (Flegal et al., 2012). The increasing trend in pre-pregnancy BMI seems to parallel the increasing trend of excessive gestational weight gain, with up to 50% of women exceeding the Institute of Medicine (IOM) weight gain guidelines during pregnancy (Institute of Medicine, 2007; Olson, 2008; Simas et al., 2011).

Excessive gestational weight gain is associated with many adverse health outcomes, including an increased risk of gestational diabetes, preeclampsia, cesarean delivery, macrosomia, and new or persistent overweight or obesity in the mother (Guelinckx et al., 2008; Hernandez, 2012; Nehring et al., 2011). Evidence also suggests an association between excessive gestational weight gain and future overweight and obesity in the offspring (Oken et al., 2008; Olson et al., 2009). Given the high prevalence of excessive weight gain and the adverse health implications for both mother and child, there is a clear need for effective gestational weight gain interventions.

A growing body of literature has examined the efficacy of interventions to limit gestational weight gain. Interventions have included dietary counseling, physical activity promotion, weight gain tracking charts, as well as behavioral change strategies (Muktabhant et al., 2012; Thangaratinam et al., 2012). Overall, results have been modest and there is substantial heterogeneity across studies. A Cochrane review including 27 randomized controlled trials and semi-randomized trials concluded there was insufficient evidence to recommend any intervention for preventing excessive pregnancy weight gain

in part due to the small observed effect sizes (Muktabhant et al., 2012). In order to develop more effective gestational weight gain interventions, it is first necessary to better understand women's perceptions of weight gain and related behaviors during pregnancy.

Few studies have examined women's attitudes toward weight gain, physical activity, or nutrition in pregnancy. Some evidence suggests that there is a general lack of knowledge of the risks of excessive weight gain (Brooten et al., 2012; Groth & Kearney, 2009; Groth et al., 2012). Other studies have identified misperceptions about the risks and benefits of exercise during pregnancy (Evenson & Bradley, 2010; Goodrich et al., 2013). While it appears the health benefits of proper nutrition are better understood, women consistently cite many barriers to healthy eating (Goodrich et al., 2013; Sui et al., 2012). Some data also suggest there may be race differences in how women view these topics, particularly for weight gain and exercise (Brooten et al., 2012; Evenson & Bradley, 2010; Groth & Kearney, 2009; Groth et al., 2012; Sui et al., 2012). However, research examining race differences in women's perceptions is limited and warrants further investigation.

The Theory of Planned Behavior (TPB) was developed to predict and explain behaviors and serves as a framework for behavior change interventions (Ajzen, 1985, 1991). This theory posits that attitudes, subjective norms, and perceived behavioral control influence behavioral intentions and thus behaviors. This theory has been used extensively in research examining health behaviors such as physical activity and diet (McEachan et al., 2011; Symons Downs & Hausenblas, 2005), and has also been used in pregnant populations (Downs & Hausenblas, 2003). The TPB is therefore well suited to guide the exploration of women's perceptions of weight-related behaviors in pregnancy.

The aim of the current study is to use the TPB framework to describe African American and White women's perceptions of weight gain, physical activity, and nutrition during pregnancy using qualitative methods and to explore differences in perceptions by race. Findings may facilitate the development of more effective gestational weight gain interventions.

Methods:

Participants

A total of 30 patients were recruited from two obstetrics and gynecology (Ob/Gyn) clinics in Columbia, South Carolina to take part in qualitative interviews from June-August, 2014. Patients were recruited using flyers posted in the clinics and via in-person recruitment during a prenatal visit. Eligibility criteria for patients include: African American or White women, 20-30 weeks gestation, singleton pregnancy, pre-pregnancy BMI of 18.5-45.0 kg/m², 18-44 years old, and initiated prenatal care \leq 16 weeks gestation. Five African American and five White women were recruited who were normal weight, overweight, and obese, respectively, in order to better represent the views of women resembling the general South Carolina population.

Interview Guide

An interview guide was developed using the TPB to assess women's perceptions of weight gain, physical activity, and healthy eating during pregnancy. The guide addressed the following areas: (1) weight gain, physical activity, and dietary intentions during pregnancy; (2) personal beliefs toward weight gain, physical activity, and healthy eating during pregnancy, including perceived advantages and disadvantages; (3) beliefs of important others about weight gain, physical activity, and healthy eating during

pregnancy, and (4) perceptions of current weight gain, physical activity, and nutrition guidelines during pregnancy, including barriers and facilitators to meeting guidelines. Sample questions are included in Table 4.1.

Behavioral intentions were assessed before women were informed of guidelines to limit social desirability bias. Women were then provided with a verbal and written description of the current weight gain, physical activity, and nutrition guidelines during pregnancy in order to assess perceptions of these guidelines. Weight gain recommendations were based on the 2009 IOM guidelines and were tailored based on the woman's pre-pregnancy body mass index (BMI). It is recommended that normal weight women (BMI 18.5-24.9 kg/m²) gain 25-35 pounds in pregnancy, overweight women (BMI 25.0-29.9 kg/m²) gain 15-25 pounds, and obese women (BMI \geq 30.0 kg/m²) gain 11-20 pounds (Institute of Medicine and National Research Council, 2009). Physical activity recommendations during pregnancy were based on the 2008 Physical Activity Guidelines for Americans, or 150 minutes of moderate to vigorous intensity physical activity per week (U.S. Department of Health and Human Services, 2008). Nutrition recommendations were based on the 2010 Dietary Guidelines for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Specifically, women were told that a healthy diet includes plenty of fruits and vegetables, low fat dairy products, protein, fiber, and whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta. It also recommended women to watch portion sizes and to avoid eating too much of very sugary or fatty foods.

Additional Measures

Participants completed an interviewer-administered survey following the interview. Sociodemographic measures included: age, highest grade or years of education, income level, employment status, marital status, and parity. Self-rated health, fruit and vegetable consumption, smoking status, and major chronic health conditions were also assessed. Physical activity was measured using the validated short form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003; Ekelund et al., 2006). Respondents were categorized as low, moderately, or highly active.

Data Collection and Analysis

All interviews were conducted at the two Ob/Gyn clinics or the participants' home. Interviews were audio-recorded and transcribed using a professional transcription service. A study investigator verified accuracy of transcription. Transcripts were examined for patterned responses within the data and key, overarching themes. To increase validity, the first author (KW) and a second person independently read and coded two transcripts, then met to compare and discuss similarities and differences in definitions and codes. After reaching consensus on each code's definition and meaning, the inductive analysis method of "open coding" was utilized to develop a composite code list (Strauss & Corbin, 1998; Strauss & Corbin, 1990).

A code list was developed and organized to form an initial codebook draft. The codebook was entered into QRS NVivo 10 for computer assisted qualitative data management. To promote consistency, one investigator coded the manuscripts and a second person reviewed the codes to verify they were correctly applied. The two codebooks were revised as additional data was collected, and all transcripts were recoded

to reflect these changes. A theme was defined as 20% or more of participants addressing a topic (6 patients). Differences by race were also examined across themes, and noted when there was a 20% response difference (n=3). Palmetto Health and the University of South Carolina Institutional Review Boards approved all study protocols.

Results:

Patient characteristics

Patient characteristics can be found in Table 4.2. A total of 30 patients were interviewed (15 AA, 15 White) with equal representation across pre-pregnancy BMI categories (10 normal weight, 10 overweight, 10 obese). Participants averaged 26.6 ± 5.7 years of age (range 18.0-41.0). Approximately 50% of patients had a high school education or less, reported a household income below \$15,000 per year, and were currently unemployed. White women were more likely to report their health as excellent or very good as compared to African American women (p=0.027). There were no other race differences in participant characteristics. Patient interviews averaged 38.5 ± 8.8 minutes (range 28.0-65.0).

Perceptions of Pregnancy Weight Gain

As seen in Table 4.3, 43% of women reported an intended weight gain within the IOM guidelines (n=13; 5 AA, 8 White), 37% above recommendations (n=11; 5 AA, 6 White), and 17% below recommendations (n=5; 4 AA, 1 White). One African American participant stated she did not have a target weight gain. When examining weight gain intentions by pre-pregnancy BMI category, more overweight (n=6) and obese women (n=5) cited an intended weight gain above guidelines as compared to normal weight women (n=0).

After viewing the IOM weight gain guidelines, the majority of women agreed with the recommendations for their pre-pregnancy BMI (n=19; 8 AA, 11 White). However, 11 women disagreed with the guidelines (7 AA, 4 White), with nine stating the recommendations were too low and two stating they were too high. All women who said recommendations were too low were overweight (n=4) or obese (n=5). For example, after hearing the recommended weight gain was 11-20 pounds for her pre-pregnancy BMI, a participant said *“I disagree. I just feel like if you're healthy and your baby is healthy it shouldn't matter how much you weigh or how much you gain just as long as the baby's healthy and you're healthy too. I mean I hope that people don't try to starve themselves while they're pregnant, but if you're okay and the baby is okay I think weight gain shouldn't be an issue”*(AA, obese, age 27).

The most commonly cited advantages of appropriate pregnancy weight gain were discussed in relationship to benefits for the baby (n=26; 13 AA, 13 White). More specifically, women stated that appropriate weight gain would lead to a healthy baby (n=19; 9 AA, 10 White), positively influence the size of the baby (n=11; 6 AA, 5 White) and reduce the risk of complications for the infant (n=6; 4 AA, 2 White). For example, one participant stated healthy weight gain would lead to *“good birth weight for the baby. You don't want a baby that's underweight for the baby's health, but you also don't want a baby that's too large, especially for concerns at delivery”* (White, normal weight, age 30). The majority of women also discussed personal benefits of appropriate weight gain (n=22; 11 AA, 11 White). For example, women said healthy weight gain would benefit their own health (n=7; 3 AA, 4 White), and many stated it would be easier to lose the weight after the baby was born (n=6; 2 AA, 4 White).

All women discussed how excessive pregnancy weight gain would negatively impact their personal health. Some women specifically discussed the risk of diabetes, high blood pressure, or heart disease (n=17; 8 AA, 9 White). Women also stated it would be difficult to lose the weight in the postpartum period (n=12; 5 AA, 7 White), and discussed how excessive weight gain makes it more challenging to maintain an active lifestyle (n=9; 2 AA, 7 White). Less than half of women discussed negative outcomes for their child as a result of excessive pregnancy weight gain (n=12; 6 AA, 6 White). Women said excess weight gain would increase the risk of health complications for the baby (n=10; 5 AA, 5 White) and lead to a larger baby (n=7; 4 AA, 3 White). Without prompting, only eight women described negative outcomes for the baby as a result of excessive pregnancy weight gain. An additional four women discussed disadvantages for the baby after prompting, and seven women stated they did not know of any disadvantages of high weight gain as it related to the baby's health.

When asked who influences their pregnancy weight gain, women most commonly listed their doctor (n=14; 8 AA, 6 White), themselves (n=12; 3 AA, 9 White), partner (n=8; 3 AA, 5 White), and mother (n=7; 4 AA, 3 White). When asked whose advice they most value and trust about pregnancy weight gain, the majority of women stated their doctor (n=20; 10 AA, 10 White). For example, one participant stated she trusted her doctor's advice on pregnancy weight gain because *"for one, they went to school for it. And also, I feel like they've been doing it for so long and they see a wide variety of cases, that ideally they know what to do, what not to do, and warning signs of what's too much, too little, or what's right. And they have tips, probably, of what to do to get you at your ideal weight"* (White, overweight, age 21).

When discussing barriers to appropriate weight gain, the majority discussed factors that made it difficult to avoid excessive weight gain (n=22; 9 AA, 13 White). Poor dietary habits (n=7; 3 AA, 4 White) and cravings (n=6; 2 AA, 4 White) were commonly cited barriers to appropriate weight gain. Lack of exercise was discussed as a barrier to appropriate weight gain in White women only (n=5). Some women also cited factors that would make it difficult to gain adequate weight gain in pregnancy (n=9; 7 AA, 2 White), including nausea, food aversions, and lack of appetite. When discussing what would help them meet weight gain recommendations, the majority of women discussed factors that would keep them from gaining too much weight in pregnancy (n=26; 13 AA, 13 White), including: eating a healthy diet (n=17; 9 AA, 8 White), exercise (n=13; 5 AA, 8 White), and portion control (n=7; 5 AA, 2 White).

Perceptions of Physical Activity during Pregnancy

Women were asked to describe their plans for exercise during the rest of their pregnancy before viewing the current physical activity guidelines. Less than half of women described a plan sufficient to meet guidelines (n=13; 5 AA, 8 White). Half of women stated they intended to exercise during their pregnancy but reported insufficient duration to meet guidelines. For example, *“I plan to walk at least two to three days a week for a half an hour”* (White, obese, age 32). Two African American participants said they had no intentions to exercise during their pregnancy. When examining intentions by pre-pregnancy BMI, more normal weight women discussed an exercise plan that met current guidelines (n=6) compared with overweight (n=3) or obese (n=4) women.

After viewing the physical activity guidelines, the majority of women thought the recommendations were reasonable (n=26; 13 AA, 13 White). For example, one

participant stated *“That’s something that anybody should be able to do” (African American, obese, age 18)*. Four women disagreed with the recommendations, citing that it was too much activity during pregnancy. For example, one participant said *“It could be healthy, but in a way it wouldn’t be because too much work and too much activity while you’re pregnant could put a strain on you” (AA, normal weight, age 22)*.

When discussing advantages of exercise, a large percentage of women said that exercise during pregnancy would help with labor and delivery (n=21; 10 AA, 11 White). For example, one participant said, *“Well I know they say if you walk a lot, it’ll help you have a much easier labor. I’m for anything that’s going to make it easy” (AA, obese, age 41)*. Women also discussed how exercise improves their personal health (n=11; 6 AA, 5 White), and the health of the baby (n=10; 5 AA, 5 White).

When discussing the risks or disadvantages of exercise, the majority cited risks to themselves (n=20; 7 AA, 13 White) and their baby (n=19; 9 AA, 10 White). When discussing personal risks, women talked about the possibility of injury (n=9; 2 AA, 7 White) and how doing too much may strain your body (n=8; 3 AA, 5 White). *“You know that your joints and ligaments are stretching out and preparing for labor and delivery...so it’s definitely easier to strain muscles, to sprain things, to pull things” (White, normal weight, age 28)*. Women also discussed how too much exercise might lead to preterm labor (n=11; 6 AA, 5 White). Seven women stated that exercise could hurt the baby (1 AA, 6 White).

When asked who influences their exercise during pregnancy, almost half of women stated themselves (n=14; 4 AA, 10 White), followed by their partner (n=13; 7 AA, 6 White) and mother (n=7; 6 AA, 1 White). When asked whose exercise advice they

most valued or trusted during pregnancy, twelve women cited their doctor (5 AA, 7 White).

The most commonly discussed barrier to exercise was the weather being too hot (n=8; 2 AA, 6 White), followed by lack of motivation (n=7; 6 AA, 1 White), and lack of time (n=6; 2 AA, 4 White). While not considered themes, many other barriers were discussed, including: existing health problems, not feeling well, swollen feet, fatigue, lack of access to facilities, and lack of social support. Women most commonly stated that social support would help them exercise regularly during pregnancy (n=14; 8 AA, 6 White). Other discussed enablers to exercise included having access to facilities, exercise classes for pregnant women, cooler weather, and more time.

Perceptions of Nutrition during Pregnancy

All participants stated that they wanted to eat a healthy diet during pregnancy. However, when asked to describe the types of foods they plan on eating during their pregnancy, one-third of women described a diet that did not meet dietary guidelines (n=10; 8 AA, 2 White), primary due to the high reported consumption of unhealthy fast foods (n=7; 7 AA, 0 White). More obese women (n=6) described a diet that did not meet dietary guidelines as compared to normal weight (n=2) or overweight (n=2) women. Many women also described positive changes they had made in their diet since becoming pregnant, including increasing consumption of fruits and vegetables (n=29; 15 AA, 14 White), and eating less fried foods (n=9; 7 AA, 2 White).

After hearing a description of general healthy eating practices consistent with the USDA dietary guidelines, the majority of women said the recommendations were reasonable (n=26; 13 AA, 13 White). However, seven of the women who agreed with the

recommendations also said these guidelines were hard to follow (4 AA, 3 White). For example, *“I think that’s a great diet for not being pregnant as well, and I think that’s perfect for me, if I could just do it all the time, but I do crave sweets”* (White, overweight, age 26).

When discussing advantages of healthy eating, all women discussed positive effects for their baby. Women commonly said healthy eating would lead to a healthy baby (n=21; 11 AA, 10 White) and help with the baby’s growth and development (n=11; 4 AA, 7 White). The majority of women also discussed how eating a healthy diet would directly benefit themselves (n=28; 14 AA, 14 White). For example, women said a healthy diet would lead to a healthy mom (n=16; 9 AA, 7 White) and result in appropriate weight gain (n=11; 6 AA, 5 White).

When discussing disadvantages of unhealthy eating during pregnancy, almost all women discussed negative health consequences for themselves (n=29; 14 AA, 15 White). Women most commonly discussed how unhealthy eating practices would lead to excessive weight gain (n=14; 3 AA, 11 White), increase the risk of health complications (n=13; 6 AA, 7 White), and more generally make them unhealthy (n=11; 5 AA, 6 White). For example, *“You can gain way too much weight, which is going to make you unhappy and unhealthy. Can give you high blood pressure, the hypertension, preeclampsia. You can get the diabetes from it. It’s a very long list of things you can get from a really bad diet while you’re pregnant”* (White, obese, age 26). The majority of women also discussed disadvantages of unhealthy eating for the baby (n=25; 11 AA, 14 White). For example, women stated an unhealthy diet would lead to an unhealthy baby (n=10; 4 AA, 6 White) and have a negative impact on the baby’s weight (n=6; 3 AA, 3 White).

Women most commonly named themselves as having the biggest influence over their eating habits during pregnancy (n=16; 6 AA, 10 White), followed by their partner (n=13; 7 AA, 6 White), and doctor (n=11; 5 AA, 6 White). When asked whose advice women most value or trust, 60% cited their doctor (n=18; 10 AA, 8 White). While not considered a theme, five women stated they most valued the advice of their mother (4 AA, 1 White).

When asked to describe barriers to healthy eating, 10 women discussed cost or lack of access (4 AA, 6 White). *“In a perfect world this would be good for a family who has the financial income. But for a person that don’t have financial income to eat like this, that won’t happen. I mean it’s very expensive to eat healthy”* (AA, overweight, age 32). Other commonly cited barriers were the negative influence of others (n=8; 4 AA, 4 White), taste preference for unhealthy options (n=8; 5 AA, 3 White), and cravings (n=7; 3 AA, 4 White).

Factors that would help women meet dietary guidelines include having increased access to healthy foods (n=9; 5 AA, 4 White). Women also cited social support (n=8; 3 AA, 5 White), more knowledge about healthy foods (n=8; 4 AA, 4 White), and having motivation or willpower for the sake of their child (n=6; 4 AA, 2 White) as enablers to healthy eating. *“The reason why I say willpower is because right now I have willpower for my child, because like I said I want her to come into this world, at least have a fighting chance to come out and, you know, have her own eating habits instead of me killing her with mine”* (AA, obese, age 41).

Discussion:

This study described African American and White women's perceptions of weight gain, physical activity, and nutrition during pregnancy. The majority of women had positive perceptions of weight-related guidelines during pregnancy, although fewer expressed intentions to meet these guidelines. Commonly discussed beliefs about physical activity and healthy eating were similar to those reported in non-pregnant populations (Downs & Hausenblas, 2005; Eikenberry & Smith, 2004; White et al., 2007), with some pregnancy specific beliefs. We found several notable differences in women's perceptions and intentions toward weight gain, physical activity, and nutrition by race.

Less than half of women reported an intended weight gain within IOM guidelines, with more African American women discussing a target weight gain outside guidelines. African American women were also more likely to disagree with the weight gain guidelines, often reporting they were too low or restrictive. Overall, it appears that White women were more concerned with excessive weight gain, while African American women were more concerned with inadequate weight gain. These differences in perceptions toward pregnancy weight gain are congruent with findings from several large U.S. studies that reported higher rates of excessive weight gain in White women and higher rates of inadequate weight gain African American women (Headen et al., 2012). It appears that the African American women in our study were aware of the risks of inadequate gain, but there was a knowledge gap regarding the risks of excessive weight gain. Brooten and colleagues also found that African American women perceive low risk of excessive pregnancy weight gain and high perceived risk of inadequate gain (Brooten et al., 2012).

Regardless of race, few women identified excessive weight gain as a risk factor to the baby. Other qualitative studies examining perceptions of excessive weight gain have also reported that knowledge of neonatal risks is low (Groth et al., 2012; Herring et al., 2012; Sui et al., 2012). Infants born to mothers with excessive weight gain are at increased risk for many health complications, including low 5-minute Apgar scores, hypoglycemia, large for gestational age, and future overweight or obesity as compared with women who gain within the recommended guidelines (Olson et al., 2009; Stotland et al., 2006; Vesco et al., 2011). It is critical that women understand how excessive pregnancy weight gain can adversely impact the short and long term health of their child.

Knowledge of the benefits of healthy eating for the infant was high; however, only one-third of women discussed health benefits of physical activity for the infant. Evidence suggests that physical activity has many positive health benefits to the fetus that extend into childhood and possibly adulthood via fetal programming (Barker et al., 1989). Physical activity in pregnancy enhances placental functional capacity, circulation, and gas exchange, all of which increase nutrient delivery to the fetus (Clapp et al., 2000). Women who are active during pregnancy are at lower risk of large-for-gestational age infants (Mudd et al., 2013) and these beneficial effects on the child's weight status persist into early childhood (Mattran et al., 2011). Interventions should seek to increase awareness about the benefits of physical activity for the baby.

More White women reported intentions to meet physical activity guidelines as compared to African American women. White women also discussed the importance of exercise in the context of weight management with greater frequency than African American women. Evenson and colleagues also identified race differences in how

pregnant women perceive exercise, with White women being more likely to agree that moderate intensity exercise can benefit the health of the mother and should be done 3 or more times per week as compared to African American women (Evenson & Bradley, 2010). Interestingly, White women in our study more commonly stated that exercise could lead to injury or hurt the baby as compared to African American women. However, it does not appear that this perception limited women's intentions to be active.

When describing the diet they intended to eat during their pregnancy, African American women were less likely to report a diet consistent with dietary guidelines as they commonly reported consumption of unhealthy fast foods, specifically fried foods. This is consistent with a recent report using data from the National Health and Nutrition Examination Survey, where consumption of calories from fast food was significantly greater in non-Hispanic Blacks as compared to non-Hispanic Whites (Fryar & Ervin, 2013). This is concerning as frequent fast food intake is associated with higher energy and fat intake and lower intake of healthful nutrients (Bowman & Vinyard, 2004; Paeratakul et al., 2003). It may be particularly beneficial to emphasize the importance of limiting fast food intake in interventions with African American women.

Women discussed themselves as well as their doctor, partner, and mother as influencing their weight gain, physical activity, and nutrition during pregnancy. More women discussed their doctor as influencing their weight gain, followed by their diet. Interestingly, few women discussed their doctor as influencing their exercise during pregnancy. This may indicate that providers are not discussing exercise with their prenatal patients, or not counseling women in a way that is meaningful. Other qualitative studies have also found women report insufficient or no provider counseling on exercise

during pregnancy (Ferrari et al., 2013; Stengel et al., 2012). White women were more likely to cite themselves as influencing their weight gain and exercise, while African American women more frequently discussed their mothers as influencing their exercise and dietary behaviors. It may be more effective to involve family members, particularly mothers in lifestyle interventions targeting African American women during pregnancy.

Study findings have important intervention implications. First, there appears to be a lack of awareness of the risks of excessive weight gain for the baby and benefits to the baby of physical activity. Data suggests that pregnant women are highly motivated to engage in behaviors that protect the fetus and avoid those that may cause harm (Groth & Kearney, 2009; McBride et al., 2003). Interventions should seek to increase women's understanding of how weight gain and physical activity can directly impact the health of the fetus. Second, it appears there are differences by race in women's perceptions and intentions toward weight gain, physical activity, and healthy eating. It may be necessary to develop culturally tailored gestational weight gain interventions to optimize outcomes.

A major strength of this study is the use of qualitative methods, which provides rich data that could not be captured through a quantitative survey. We also explored women's perceptions of three distinct topics: weight gain, physical activity, and nutrition. This contributes to the literature as few studies have examined women's perceptions of all three of these importantly related topics. Finally, we examined race differences in women's perceptions, something that is notably absent from the existing literature.

While this study contributes novel findings to the literature, several limitations must be noted. We recruited from two clinics in South Carolina that primarily serve lower income women, therefore the findings have limited generalizability. It is possible

that patients who took part in this study were more interested in weight gain and related topics. All information was self-reported and therefore subject to recall and social desirability bias. Finally, we had a relatively small sample size to examine differences in perceptions by race, therefore study findings should be interpreted with caution.

In summary, this study described women's perceptions of weight gain, physical activity, and nutrition during pregnancy. We identified several gaps in knowledge as well as race differences in perceptions and intentions toward weight-related behaviors. This may warrant the development of culturally tailored gestational weight gain interventions to better meet the specific needs of women during pregnancy. Future studies are needed using larger sample sizes to further investigate race differences in women's perceptions of weight gain, physical activity, and diet during pregnancy.

Acknowledgements:

This work was partially supported by a SPARC Graduate Research Grant from the Office of the Vice President for Research at the University of South Carolina. The participation of KW in this research was supported in part by research training grant T32-GM081740 from the National Institutes of Health, National Institute of General Medical Sciences. The authors would like to thank all women who participated in this study. The authors acknowledge and thank the contributions of Santiago Tovar-Diaz, who assisted with qualitative data coding.

Table 4.1: Sample Questions from Interview Guide

Topics	Sample questions
Weight Gain	
Intentions	How much total weight do you plan on gaining during this pregnancy?
Attitude	What are some good things that could happen if you gain a healthy amount of weight during pregnancy? What are some bad things that could happen if you gain too much weight during this pregnancy?
Subjective Norm	Who influences how you think about your pregnancy weight gain? Whose advice or opinion about pregnancy weight gain do you most value or trust?
Perceived Behavioral Control	What do you think about the weight gain guidelines? What could make it hard for you meet these guidelines during this pregnancy? What could help you meet these guidelines during this pregnancy?
Physical Activity	
Intentions	What plans do you have to exercise during the rest of your pregnancy, if any?
Attitude	What are some good things that could happen if you exercise during your pregnancy? What are some risks or bad things that could happen if you exercise during your pregnancy?
Subjective Norm	Who influences your exercise behaviors during pregnancy? Whose advice or opinion about exercise during pregnancy do you most value or trust?
Perceived Behavioral Control	What do you think about the exercise guidelines? What could make it hard for you meet these exercise guidelines during this pregnancy? What could help you meet these exercise guidelines during this pregnancy?
Nutrition	
Intentions	What type of diet do you plan on eating during this pregnancy?
Attitude	What are some good things that could happen if you eat a healthy diet during pregnancy? What are some bad things that could happen if you eat an unhealthy diet during pregnancy?
Subjective Norm	Who influences your nutrition behaviors during pregnancy? Whose advice or opinion about nutrition during pregnancy do you most value or trust?
Perceived Behavioral Control	What do you think about the nutrition guidelines? What could make it hard for you meet these nutrition guidelines during this pregnancy? What could help you meet these nutrition guidelines during this pregnancy?

Table 4.2: Participant Characteristics

Characteristic	All (N=30)		AA (N=15)		White (N=15)		p-value ^a
	N	%	N	%	N	%	
Marital Status							0.427
Single	21	70.0	12	80.0	9	60.0	
Married	9	30.0	3	20.0	6	40.0	
Education ^b							0.068
< HS graduate	5	16.7	4	26.7	1	6.7	
HS graduate or GED	10	33.3	6	40.0	4	26.7	
Some college	10	33.3	4	26.7	6	40.0	
College graduate	5	16.7	1	6.7	4	26.7	
Employment Status							0.464
Employed	14	46.7	6	40.0	8	53.3	
Unemployed	16	53.3	9	60.0	7	46.7	
Annual household income ^c							0.096
< \$15,000	15	50.0	9	64.3	5	33.3	
\$15,000-\$24,999	5	17.2	3	21.4	2	13.3	
\$25,000-\$49,999	4	13.8	0	0.0	4	26.7	
> \$50,000	6	20.7	2	14.3	4	26.7	
Parity ^d							0.717
0	17	56.7	8	53.3	9	60.0	
1	6	20.0	3	20.0	3	20.0	
≥ 2	7	23.3	4	26.7	3	20.0	
Self-Rated Health ^e							0.027
Excellent	2	6.7	0	0.0	2	13.3	
Very good	13	43.3	4	26.7	9	60.0	
Good	13	43.3	9	60.0	4	26.7	
Fair	2	6.7	2	13.3	0	0.0	
Physical Activity ^f							0.450
Low Active	8	24.2	3	20.0	2	13.3	
Moderately Active	6	18.2	1	6.7	5	33.3	
Highly Active	19	57.6	11	73.3	8	53.3	
Fruit & Vegetable Intake							0.456
< 5 servings/day	12	40.0	7	46.7	5	33.3	
≥ 5 servings/day	18	60.0	8	53.3	10	66.7	
Smoking							
Before pregnancy	15	50.0	7	46.7	8	53.3	0.715
During pregnancy	7	23.3	2	13.3	5	33.3	0.195
Chronic Health Conditions	5	16.7	4	26.7	1	6.7	0.330
	Mean	Range	Mean	Range	Mean	Range	p-value
	(SD)		(SD)		(SD)		
Age, years	26.6	18.0-	25.9	18.0-	27.2	20.0-	0.551
	(5.7)	41.0	(6.9)	41.0	(4.3)	34.0	

Table 4.2 Continued

	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	p-value
Pre-pregnancy BMI, kg/m ²	28.2 (6.6)	19.0- 45.2	28.6 (7.6)	19.0- 45.2	27.8 (5.6)	19.0- 39.9	0.747

Abbreviations: AA = African American, HS = High School, BMI = Body Mass Index

^aDifferences by race in participant characteristics were tested using chi-square, fisher's exact tests, or t-tests as appropriate (p<.05).

^bFor statistical analyses, education was categorized as HS graduate or less and some college or more.

^cAnnual household income was categorized as <\$15,000 or ≥15,000.

^dParity was categorized as nulliparous or parous.

^eSelf-rated health was categorized as excellent/very good or good/fair.

^fPhysical activity was categorized as low/moderate or high.

Table 4.3: Women’s Perceptions of Weight Gain, Physical Activity, and Nutrition during Pregnancy

Topic	Themes	Overall N=30	AA N=15	White N=15
Weight Gain				
Intentions	Below IOM guidelines*	5	4	1
	Within IOM guidelines*	13	5	8
	Above IOM guidelines	11	5	6
	Unsure	1	1	0
Advantages	Good for baby’s health	19	9	10
	Good for baby’s weight	11	6	5
	Good for mother’s health	7	3	4
	Baby won’t have health complications	6	4	2
Disadvantages	Easier to lose weight	6	2	4
	Health risks for mother	17	8	9
	Harder to lose the weight	12	5	7
	Health risks for baby	10	5	5
Influential others	Hard to be active*	9	2	7
	Large baby	7	4	3
	Doctor	14	8	6
	Self*	12	3	9
Barriers	Partner	8	3	5
	Mother	7	4	3
	Poor dietary habits	7	3	4
Enablers	Cravings	6	2	4
	Eating a healthy diet	17	9	8
	Exercise*	13	5	8
	Portion control*	7	5	2
Physical Activity				
Intentions	Meeting guidelines*	13	5	8
	Insufficiently active	15	8	7
	Inactive	2	2	0
Advantages	Labor and delivery benefits	21	10	11
	Healthy mother	11	6	5
	Less weight gain	11	7	4
Disadvantages	Healthy baby	10	5	5
	Preterm labor	11	6	5
	Risk of injury*	9	2	7
	Strain on your body	8	3	5
Influential others	May harm the baby*	7	1	6
	Self*	14	4	10
	Partner	13	7	6
	Mother*	7	6	1

Table 4.3 Continued

Topic	Themes	Overall N=30	AA N=15	White N=15
Physical Activity				
Barriers	Hot weather*	8	2	6
	Lack of motivation*	7	6	1
	Lack of time	6	2	4
Enablers	Social support	14	8	6
Nutrition				
Intentions	Increase fruit & vegetable intake	29	15	14
	Meeting dietary guidelines*	19	7	12
	Not meeting dietary guidelines*	10	8	2
	Decrease fried foods*	9	7	2
	Unsure	1	0	1
Advantages	Healthy baby	21	11	10
	Healthy mother	16	9	7
	Helps with growth and development of baby*	11	4	7
Disadvantages	Healthy weight gain for mother	11	6	5
	Excessive weight gain*	14	3	11
	Increased risk of health complications for mother	13	6	7
	Unhealthy for mother	11	5	6
	Unhealthy for baby	10	4	6
Influential others	Negative impact on baby's weight	6	3	3
	Self*	16	6	10
	Partner	13	7	6
Barriers	Doctor	11	5	6
	Cost or access	10	4	6
	Negative influence of others	8	4	4
Enablers	Taste preference	8	5	3
	Cravings	7	3	4
	Increased access	9	5	4
	Social support	8	3	5
	Knowledge	8	4	4
	Motivation or willpower	6	4	2

Data presented as n; *differences ≥ 3 in themes by race

CHAPTER 5

PATIENT AND PROVIDER PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION COUNSELING DURING PREGNANCY: A QUALITATIVE STUDY¹

¹ Whitaker KM, Wilcox S, Liu J, Blair SN, Pate RR. To be submitted to *Patient Education and Counseling*.

Abstract

Objective: This study investigated patient and provider perceptions of weight gain, physical activity (PA), and nutrition counseling during prenatal care visits.

Methods: Pregnant women between 20-30 weeks gestation (15 African American, 15 White) and 11 prenatal care providers (5 Attending Physicians, 5 Residents, 1 Nurse Practitioner) were recruited from two Ob/Gyn clinics in Columbia, South Carolina to take part in qualitative interviews from June-August, 2014.

Results: The majority of patients and providers reported counseling on weight gain, PA, and nutrition (87-100%). Discussion of counseling content was largely consistent between patients and providers. However, counseling was limited and not fully consistent with current weight gain, PA, or dietary guidelines during pregnancy. The majority of patients responded positively to provider counseling, but some wanted additional information. Providers discussed many barriers to lifestyle counseling, including: lack of time, inadequate training, concern about the sensitivity of the topic, lower education or income level of the patient, cultural differences, and lack of patient interest.

Conclusion: Providers are counseling women on weight gain, PA, and nutrition during prenatal care visits and women accurately recall this advice. However, counseling is limited and not fully consistent with guidelines.

Practice Implications: Future studies are needed to develop and evaluate the efficacy of interventions to help providers overcome perceived barriers and more effectively counsel women on weight and healthy lifestyles during pregnancy. It may also be helpful for prenatal care settings to utilize a referral system or a model of integrated care.

Introduction:

In the United States, the majority of women of childbearing age are overweight or obese (Flegal et al., 2012), and up to 50% of women exceed the Institute of Medicine (IOM) gestational weight gain guidelines (Institute of Medicine, 2007; Olson, 2008; Simas et al., 2011). High pre-pregnancy BMI and excessive gestational weight gain are associated with numerous adverse health outcomes, including an increased risk of gestational diabetes, preeclampsia, cesarean delivery, macrosomia, and new or persistent overweight or obesity in the mother (Guelinckx et al., 2008; Hernandez, 2012; Nehring et al., 2011). Evidence also suggests an association between excessive gestational weight gain and future overweight and obesity in the offspring (Oken et al., 2008; Olson et al., 2009), thus perpetuating the cycle of risk.

Pregnancy has been defined as a “teachable moment,” where women may be more receptive to making health lifestyle changes for the sake of their baby (Phelan, 2010). Pregnancy is therefore an opportune time for intervention, especially given women’s regular and frequent contact with the health care system. The American College of Obstetricians and Gynecologists (ACOG) recommends that health care providers determine a woman’s body mass index (BMI) at the initial prenatal visit, and counsel her on the benefits of appropriate weight gain, physical activity, and nutrition, with emphasis placed on the need to limit excessive weight gain to achieve optimal pregnancy outcomes (2013). The implication of these recommendations is that providers are well positioned to play an important role in helping women achieve appropriate weight gain in pregnancy.

However, little is known about patient-provider communication on weight gain, physical activity, or nutrition in the prenatal care setting. Limited evidence suggests that

provider counseling on pregnancy weight gain is inadequate. While the majority of providers report counseling patients on pregnancy weight gain (Moore Simas et al., 2013; Power et al., 2006), approximately 30-50% of women report no weight gain advice from a health care provider during pregnancy (Cogswell et al., 1999; Ferrari & Siega-Riz, 2013; McDonald et al., 2011; Phelan et al., 2011; Stotland et al., 2005; Taffel et al., 1993), indicating a discrepancy in perceptions. Qualitative research suggests providers do not view counseling on pregnancy weight gain as a high priority and many believe their counseling has little impact on women's actual habits (Chang et al., 2013; Stotland et al., 2010). Less is known about provider compliance or perceptions of physical activity or nutrition counseling in prenatal care. However, women have reported receiving little or no provider advice on physical activity during pregnancy, and dietary advice is reported as overwhelming and confusing (Duthie et al., 2013; Ferrari et al., 2013; McDonald et al., 2011; Stengel et al., 2012). Given that physical activity and diet play an essential role in appropriate weight gain and promoting positive maternal and fetal health, it is important to examine patient and provider perceptions of counseling across all three topics.

The purpose of this study was to describe the perceptions of pregnant women and their health care providers regarding their discussions about weight gain, physical activity, and nutrition during prenatal visits. Specifically, we aimed to assess: (1) provider knowledge and perceptions of weight gain, physical activity, and nutrition guidelines during pregnancy, (2) patient and provider descriptions of counseling content on these topics; (3) patient and provider attitudes toward counseling; and (4) perceived barriers and facilitators to counseling.

Methods:

Participants

A total of 30 patients and 11 health care providers were recruited from two Ob/Gyn clinics in Columbia, South Carolina to take part in qualitative interviews. Patients were recruited using flyers posted in the clinics and via in-person recruitment during a prenatal visit. Eligibility criteria for patients include: African American or White women, 20-30 weeks gestation, singleton pregnancy, pre-pregnancy BMI of 18.5-45.0 kg/m², 18-44 years old, and initiated prenatal care \leq 16 weeks gestation. Five African American and five White women were recruited who were normal weight, overweight, and obese in order to better represent the views of women resembling the general South Carolina population. Providers were recruited through e-mail, referral from other providers in the clinic, and via in-person recruitment. Providers were eligible to participate if they regularly saw prenatal patients.

Data Collection

One study investigatory (KW) conducted all patient and provider interviews from June-August, 2014 using two semi-structured interview guides, one for patients and one for providers. A team of researchers with expertise in maternal and child health, psychology, and exercise science reviewed the interview guides. All participants completed a brief survey to assess basic demographic and health measures. Physical activity was measured using the validated short form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003; Ekelund et al., 2006). Respondents were categorized as low, moderately, or highly active. Providers were asked to complete surveys prior to the interview to assess knowledge of the IOM weight gain guidelines and

the ACOG counseling recommendations before these guidelines were explicitly discussed in the interviews. The IOM weight gain guidelines can be found in Table 5.1. Interviews were audio-recorded and transcribed using a professional transcription service. All participants were compensated \$30 for their participation. Palmetto Health and the University of South Carolina Institutional Review Boards approved all study protocols.

Data Analysis

Transcripts were examined for patterned responses within the data and key, overarching themes. To increase validity, the first author (KW) and one other person independently read and coded two patient and two provider transcripts, then met to compare and discuss similarities and differences in definitions and codes. After reaching consensus on each code's definition and meaning, the inductive analysis method of "open coding" was utilized to develop a composite code list (Strauss & Corbin, 1998; Strauss & Corbin, 1990). Two code lists were developed, one for patients and one for providers. Each code list was organized to form an initial codebook draft. The patient and provider codebooks were entered separately into QRS NVivo 10 for computer assisted qualitative data management. To promote consistency, one person (KW) coded the manuscripts and a second person reviewed the codes to verify they were correctly applied. The two codebooks were revised as additional data was collected, and all transcripts were recoded to reflect these changes. A theme was defined as 20% or more of participants addressing a topic (6 patients; 3 providers). This approach was successfully used in a prior qualitative study examining health behaviors in pregnant and postpartum women (Goodrich et al., 2013).

Results:

Patient characteristics

Patient characteristics can be found in Table 5.2. A total of 30 patients were interviewed (15 African American, 15 White) with equal representation across pre-pregnancy BMI categories (10 normal weight, 10 overweight, 10 obese). Participants averaged 26.6 ± 5.7 years of age (range 18.0-41.0). White women were more likely to report their health as excellent or very good as compared to African American women ($p=0.027$). There were no other race differences in participant characteristics. Patient interviews averaged 38.5 ± 8.8 minutes (range 28.0-65.0).

Provider characteristics can be found in Table 5.3. A total of five residents, five attending physicians, and one nurse practitioner were interviewed (N=11, 7 female, 4 male). Because only one nurse practitioner was included, this individual was grouped with attending physicians when providing quotations to protect anonymity. Mean age was 40.5 ± 14.6 years old (range 28.0-68.0). All residents had been in practice for fewer than three years, the attending physicians and nurse practitioner reported practicing medicine for 6-40 years. Provider interviews averaged 25.4 ± 5.8 minutes (range 18.0-35.0) in length.

Patient Perceptions of Provider Counseling on Weight Gain

As seen in Table 5.4, the majority of women said their doctor discussed weight gain with them during pregnancy (n=26). However, of those who reported provider counseling, nearly half stated they were not given specific recommendations (n=12). One patient said her doctor talked with her about weight gain “*a little bit, she just mentioned*

that I would be gaining some weight but it was completely normal. She didn't really say how much I would gain" (AA, normal weight, age 20).

Of the 26 women who reported provider advice, 18 viewed the advice positively, six viewed the advice negatively, and two were neutral. For example, those with positive perceptions of provider advice stated they were highly motivated to follow the advice (n=16), that it was good advice (n=15), and that the advice fit in with their existing goals (n=10). However, women who held negative perceptions of provider advice on weight gain said the advice was not helpful, they wanted more information, and two women who had exceeded recommendations said it was impossible advice to follow.

Patient Perceptions of Provider Counseling on Exercise

The majority of women reported provider advice on exercise during pregnancy (n=26). Of those who reported advice, more than half said their doctor discussed the health benefits of exercise (n=15). Women also reported provider recommendations to walk, swim, or perform yoga during pregnancy (n=14). After prompting, four reported provider advice on exercise frequency, and three women reported advice on exercise duration and intensity. While providers were largely encouraging of women to be active during their pregnancy, few women reported receiving recommendations consistent with current guidelines (i.e. 150 minutes of moderate to vigorous intensity activity per week or 30 minutes of moderate activity, 5 days per week) (American College of Obstetricians and Gynecologists, 2002; U.S. Department of Health and Human Services, 2008).

Most women who reported provider counseling on exercise had positive perceptions of the advice (n=22). Most women said they were motivated to follow their doctor's exercise recommendations (n=18), and that it was good advice (n=16). Three

women said they wanted more information from their provider on exercise.

Approximately 30% of participants who reported counseling stated that the advice from their provider changed their exercise habits (n=7). For example, *“I’ve actually started walking more since then...with the doctor saying exercise a little bit more frequently...it’s kind of given me the extra little push I needed to stay fit during pregnancy”* (White, overweight, age 21). However, nearly half of women who reported counseling said the advice did not change their exercise habits, even if they agreed with the recommendations (n=12).

Patient Perceptions of Provider Counseling on Nutrition

All women reported provider counseling on nutrition during a prenatal care visit. Women most commonly stated their provider encouraged them to increase consumption of fruits and vegetables (n=17), follow a diet consistent with the Food Pyramid or MyPlate (n=14), consume plenty of water (n=10), and eat less fried foods (n=7) and sugar (n=6). Eight women also discussed how their providers talked about foods to avoid during pregnancy, such as fish high in mercury.

The majority of women viewed provider advice on nutrition positively (n=29), and said they were motivated to follow the advice (n=26). One woman reported feeling dissatisfied with her provider’s advice on nutrition because she didn’t receive adequate information. Women also reported that provider advice on nutrition changed their eating habits (n=24). For example, one participant said *“my eating habits were really awful before they started telling me about it. Then I just made a 360 change on eating better. I really do eat much better than what I did before”* (AA, obese, age 27). Women most

commonly said they began eating more fruits and vegetables (n=11) and less junk food (n=8) as a result of provider counseling.

Provider Perceptions of Weight Gain Counseling

All providers said they spoke with women about pregnancy weight gain, and the majority stated that weight gain recommendations depended on the patient's pre-pregnancy BMI (n=10). Six providers specifically stated the amount of weight gain they recommend for their patients. Even after prompting, five providers did not quantify their weight gain recommendations, although they did say they use the guidelines. No providers discussed recommendations consistent with IOM guidelines for all pre-pregnancy BMI ranges. Five providers discussed weight gain recommendations for normal weight women; three were within the IOM guidelines, two were below guidelines (i.e. 11-20 pounds and 15-25 pounds). Three discussed the amount of weight they recommend for overweight women: one was within guidelines, two reported values less than 15 pounds (below guidelines). When discussing weight gain recommendations for obese women, providers reported recommending less than 20 pounds (n=2) or less than 15 pounds (n=2). Five providers recommended morbidly obese women gain minimal to no weight, and two stated that weight loss would not be a bad thing.

Perceived advantages of weight gain counseling were that it would lead patients to develop better health habits (n=5), cause women to carry these habits forward into the postpartum period (n=4), and prevent future health complications (n=4). However, providers also discussed how weight gain counseling might offend the patient (n=8). *“But I do think it sometimes can step on people's toes because it can be a sensitive subject, so someone that is overweight may not want to have that conversation. Or they may feel*

like you're singling them out when really you're just trying to make sure they have a healthy life for themselves and for their baby” (Resident).

Lack of time and competing priorities during the clinic visit were the most commonly discussed barriers to weight gain counseling (n=5). For example, *“A lot of times we have patients that have comorbidities, so hypertension, diabetes...those are the things that get addressed. When you try to put someone in a certain time slot and figure out the most important things to talk about, weight gain can sometimes get pushed down the list” (Resident).* Three providers also stated it was difficult to counsel women with lower education levels. The primary factor that facilitated counseling was having a patient who expressed interest and asked questions (n=3).

Provider Perceptions of Exercise Counseling

All but one provider reported counseling women on exercise during pregnancy, with more than half recommending continuation of pre-pregnancy activities (n=6). Providers also reported specific types of exercises they recommend during pregnancy, including walking and swimming (n=6). Five providers reported regularly discussing duration and intensity recommendations with patients. Providers also said they discussed what activities to avoid during pregnancy, such as contact sports (n=4), and described the benefits of exercise (n=3).

As reported for weight gain, the most commonly cited advantage of exercise counseling was that it could help patients develop better health habits (n=6). Providers also stated that exercise counseling might help women gain an appropriate amount of weight during pregnancy (n=4). Other advantages of counseling were that it could improve women’s health, quality of life, reduce the risk of health complications, and

offers reassurance that exercise is safe during pregnancy. For example, “*I think a lot of times they don't realize that it is safe...you can tell them that the baby still gets normal blood flow, and the studies have shown that. So just knowing that it does not increase rates of preterm labor in a normal patient...I think it just reassures them so that they continue to exercise*” (Attending Physician). As discussed for weight gain, the primary disadvantage of exercise counseling was that it may offend the patient (n=5).

The most commonly discussed barrier to exercise counseling was lack of patient interest (n=4). “*I have some [patients] that will flat tell you the only place they're walking to is from the TV set to the refrigerator or to the car*” (Attending Physician). Lack of time was also discussed as a barrier to exercise counseling (n=3), as well as the socioeconomic status of the patient (n=3). For example, “*A lot of them don't really have the time or money to formally exercise*” (Attending Physician). Again, patient interest was the most commonly discussed enabler of exercise counseling (n=5). Two providers also discussed how their personal interest in exercise facilitated counseling on the topic.

Provider Perceptions of Nutrition Counseling

All but one provider reported counseling women on nutrition during pregnancy. Providers primarily counseled women on foods to increase and foods to limit or avoid. For example, providers reported encouraging women to increase their consumption of fruits and vegetables (n=8) and lean meats (n=3) while decreasing their intake of fast food or processed foods (n=4). Six providers stated their counseling was limited, with three specifically discussing how nutrition counseling is only done at the first prenatal visit. For example, “*Nutrition is one of those first visit types of discussions. You talk about things you shouldn't eat, things you can't eat. You talk about fish intake, especially*

appropriate fish intake. We talk about the importance of prenatal vitamins and folic acid. We talk about grains, fruits, and vegetables...the importance of limiting high-fat diets. But again, unfortunately, that's normally a one-time deal” (Attending Physician).

The most commonly discussed advantage of dietary counseling was that it caused patients to change their dietary habits (n=5). Two providers also discussed how counseling could increase patient awareness of healthy eating, and that it might lead to positive changes for the family. For example, *“if you teach them healthy eating for themselves, hopefully they will teach that to their children” (Resident)*. The majority of providers stated there were no disadvantages to counseling women on nutrition during pregnancy, although three discussed the possibility of causing women to become too strict with their dietary intake.

The most commonly discussed barrier to nutrition counseling was the high cost of healthy foods (n=7). *“Sometimes vegetables are expensive. You can buy a box of macaroni and cheese for \$0.50; and you can barely get an apple for \$0.50. So to convince someone that they can buy three boxes of macaroni and cheese and feed their whole family or to get five apples for their family... they look at you and they're like, ‘That's not a financial reality’” (Attending Physician)*. Providers also discussed cultural differences as a barrier to nutrition counseling (n=5). *“If you look at the Hispanic population, you don't tend to see them having a diet full of fruits, vegetables, low carbohydrates just because in their society they eat a lot of corn- and flour-based foods. So when you're trying to talk with someone about diabetes, you're trying to change the way they eat...and so culturally that almost ostracizes them” (Attending Physician)*. As with weight gain and exercise counseling, providers discussed lack of time as a barrier to

nutrition counseling (n=4), and patient interest was cited as the primary factor that enabled provider counseling (n=4).

Provider Knowledge and Perceptions of IOM & ACOG Guidelines

Four of the providers (3 Residents, 1 Attending Physician) said they were not familiar with the IOM weight gain guidelines before taking part in this study. After being shown the guidelines, the majority stated they used similar recommendations in their practice (n=10), although many stated they recommended less weight gain for overweight or obese women (n=7). *“I think they're pretty much what I do. For my obese women, I will tell them it is okay if they don't gain any weight, specifically if they have Class III obesity” (Attending Physician).*

The majority of providers were familiar with the ACOG counseling recommendations before taking part in this study (n=9). All providers responded positively after viewing these recommendations and the majority stated it was important to counsel women on these topics and it was something they tried to do. However, every provider stated that their medical training did not prepare them to counsel women on these topics. *“I don't think that in the curriculum of everything it's probably as stressed as some other things are. And I definitely think, for women who are obese, it's harder to – I don't think we get very much training in how to counsel them” (Attending Physician).* All providers said it would be helpful to receive further training on these topics.

Discussion:

The majority of women and their health care providers reported some counseling on weight gain, exercise, and nutrition during prenatal visits. Discussion of counseling content was similar between women and their providers. However, counseling was

limited in detail and not fully consistent with current guidelines. Providers also cited many barriers to counseling women on weight gain and related behaviors.

Less than half of women reported provider recommendations to gain a specific amount or range of weight and nearly 40% of providers stated they were not familiar with the IOM weight gain guidelines. Taken together, these findings indicate some providers may not be counseling women appropriately on pregnancy weight gain. Consistent with our findings, a qualitative study conducted by Stengel and colleagues found that few women reported receiving specific pregnancy weight gain advice from their doctor (2012). Furthermore, a study of Ob/Gyn and Family Medicine Residents found that approximately 60% of providers were unfamiliar with the 2009 IOM guidelines (Moore Simas et al., 2013). If we are to increase the percentage of women with appropriate pregnancy weight gain, it is imperative that providers are knowledgeable about the IOM weight gain guidelines and discuss these guidelines with their patients. Given the amount of information providers must discuss during a patient visit, tools to facilitate accurate and effective weight gain counseling could prove useful.

Many providers reported recommending less weight gain for their overweight and obese patients than the ranges recommended by the IOM. This is surprising as other studies have shown overweight and obese women are more likely to report provider recommendations above IOM guidelines (Phelan et al., 2011; Stengel et al., 2012). The ACOG has stated that providers are to use clinical judgment when caring for overweight or obese women, and that it appears to be safe for these women to gain less weight than recommended if fetal growth is not negatively affected (2013). It seems that providers in

this study were aware of the risks associated with excessive weight gain and counseled accordingly, especially for overweight and obese patients.

Consistent with existing research (Duthie et al., 2013), the majority of women viewed provider advice on weight gain positively. However, some women were dissatisfied by the advice they received because they wanted more specific information and guidance on how to manage their weight gain. Future research is needed to develop appropriate resources to assist providers in providing consistent and comprehensive weight gain advice to their patients.

Report of physical activity and nutrition counseling was largely consistent between women and providers. Duthie and colleagues found greater inconsistencies between patient and provider report of exercise and nutrition counseling, with providers reporting discussion of these topics with all pregnant patients while patients reported receiving minimal to no advice on these topics (2013). In our study it appears that the advice patients receive is understood and accurately recalled. However, few patients or providers in our study reported receiving or giving specific recommendations on intensity, frequency, or duration of activity. While it is promising that some exercise counseling is occurring in the prenatal setting, it is important that providers offer women detailed recommendations that are consistent with current guidelines.

When discussing nutrition counseling, both patients and providers reported advice to increase fruit and vegetable intake, decrease consumption of fast food or fried foods, and foods to avoid. However, providers admitted dietary counseling was limited and this discussion usually only occurred at the first prenatal visit. Despite limited counseling, 80% of women discussed how the advice they received from their provider changed their

dietary habits. This finding is promising as it indicates that even brief counseling may have an impact on women's health behaviors in pregnancy.

Providers identified both unifying and unique barriers to counseling on weight gain, exercise, and nutrition. Consistent with existing research, lack of time was cited as a barrier to counseling across topics (Hebert et al., 2012; Ruelaz et al., 2007; Yarnall et al., 2003). Providers were also worried that weight gain and exercise counseling might offend patients. Concern about the sensitivity of the topic has been previously cited as a barrier to weight gain counseling in the prenatal care setting (Stotland et al., 2010). However, no women reported feeling offended by provider advice in our study, and many stated they wanted more information on these topics.

All providers stated their education did not prepare them to counsel patients on weight control, exercise, or nutrition. Insufficient training has previously been cited as a barrier to weight gain counseling in the prenatal setting (Stotland et al., 2010) and in general settings (Hebert et al., 2012). A 2010 survey of nutrition education in U.S. medical schools found that nutrition is covered unevenly and inadequately through all levels of medical training (Adams et al., 2010). Given the high prevalence of obesity and excessive pregnancy weight gain, there is a clear need for enhanced medical education and training on weight management, physical activity, and nutrition to better prepare providers to counsel patients on these topics.

It is encouraging that all providers in our study said they wanted additional training to learn how to more effectively counsel patients on health behaviors. Given this interest, it may be useful to offer providers continuing medical education opportunities to

learn more about weight control, exercise, and nutrition as well as effective and brief counseling strategies.

While further education and training for providers is important, there are many other barriers beyond lack of training that prevent providers from counseling patients on lifestyle behaviors. All providers discussed time constraints as a barrier to counseling, and many also noted it was difficult to counsel patients with lower education or income levels or those from different cultural backgrounds. Given these real world challenges, it may be necessary to look at other potential solutions such as referral systems and models of integrated care.

A major strength of this study is the use of qualitative methods to examine women and provider perceptions, which provide rich data that could not be captured through a quantitative survey. Assessment of both patient and provider perceptions adds to the literature as existing studies have commonly only assessed the views of patients or providers, not both. This approach allowed for direct comparison of perceptions. While this study contributes novel findings to the literature, several limitations must be noted. We recruited from two clinics in South Carolina that primarily serve lower income women, therefore the findings have limited generalizability. We did not directly match patients with providers; however, at these clinics women see multiple providers, therefore direct matching may not have been practical. It is possible that patients and providers who took part in this study were more interested in weight gain and related topics. Finally, all information was self-reported and therefore subject to recall and social desirability bias.

Conclusions:

This study described the discussions of women and their providers on weight gain, physical activity, and nutrition in the prenatal care setting. The majority of patients and providers reported counseling on these topics and discussion of counseling content were similar. Most women viewed provider advice on weight gain and related behaviors positively. However, this study also revealed that advice across topics is often limited. Providers discussed many barriers to counseling, but also expressed an interest in further training to learn how to counsel women effectively on these topics.

Practice Implications:

In light of the obesity epidemic and high prevalence of women with excessive pregnancy weight gain, providers should be better equipped to discuss weight gain, physical activity, and nutrition with their patients. A recent report released by the Bipartisan Policy Center recommends integrating a standard nutrition and physical activity curriculum into existing medical school curriculum and offering additional training opportunities in residency as well as continuing education programs (2014). Further education and training is necessary to increase the percentage of providers who counsel patients on these topics. It may also be helpful for prenatal care settings to integrate other health professionals, such as nutritionists, health educators, and physical activity specialists, into the existing healthcare system through a referral system or model of integrated care. Future research is needed to determine the efficacy of different intervention approaches to increase the percentage of women who are counseled accurately and effectively on weight gain, physical activity, and nutrition during pregnancy.

Acknowledgements:

This work was partially supported by a SPARC Graduate Research Grant from the Office of the Vice President for Research at the University of South Carolina. The participation of KW in this research was supported in part by research training grant T32-GM081740 from the National Institutes of Health, National Institute of General Medical Sciences. The authors would like to thank all women who participated in this study. The authors acknowledge and thank the contributions of Santiago Tovar-Diaz, who assisted with qualitative data coding.

Table 5.1: 2009 Institute of Medicine Recommendations for Total and Rate of Weight Gain during Pregnancy, by Pre-pregnancy BMI

Pre-pregnancy BMI ^a	BMI (kg/m ²) (WHO)	Total Weight Gain Range (lbs)	Rates of Weight Gain ^b 2 nd and 3 rd Trimester (Mean Range in lbs/week)
Underweight	<18.5	28-40	1 (1-1.3)
Normal weight	18.5-24.9	25-35	1 (0.8-1)
Overweight	25.0-29.9	15-25	0.6 (0.5-0.7)
Obese (includes all classes)	≥30	11-20	0.5 (0.4-0.6)

^aRecommendations for weight gain differ by pre-pregnancy BMI to increase the percentage of women who have appropriate for gestational age (2.5-4.0 kg) infants (Institute of Medicine and National Research Council, 2009).

^bCalculations assume a 0.5–2 kg (1.1–4.4 lbs) weight gain in the first trimester.

Table 5.2: Patient Characteristics (N=30)

Characteristic	N	%
Marital Status		
Single	21	70.0
Married	9	30.0
Education^b		
< HS graduate	5	16.7
HS graduate or GED	10	33.3
Some college	10	33.3
College graduate	5	16.7
Employment Status		
Employed	14	46.7
Unemployed	16	53.3
Annual household income^c		
< \$15,000	15	50.0
\$15,000-\$24,999	5	17.2
\$25,000-\$49,999	4	13.8
> \$50,000	6	20.7
Parity^d		
0	17	56.7
1	6	20.0
≥ 2	7	23.3
Self-Rated Health^e		
Excellent	2	6.7
Very good	13	43.3
Good	13	43.3
Fair	2	6.7
Smoking		
Before pregnancy	15	50.0
During pregnancy	7	23.3
Physical Activity^f		
Low Active	8	24.2
Moderately Active	6	18.2
Highly Active	19	57.6
Fruit & Vegetable Intake		
< 5 servings/day	12	40.0
≥ 5 servings/day	18	60.0
	Mean (SD)	Range
Age, years	26.6 (5.7)	18.0-41.0
Pre-pregnancy BMI, kg/m ²	28.2 (6.6)	19.0-45.2

Table 5.3: Provider Characteristics (N=11)

Characteristic	N	%
Occupation		
Attending Physician	5	45.5
Nurse Practitioner	1	9.1
Resident	5	45.5
Age		
< 30 years	4	36.4
30-40 years	3	27.3
40-50 years	1	9.1
> 50 years	3	27.3
Years Practicing Medicine		
< 3 years	5	45.5
3-10 years	1	9.1
10-20 years	2	18.2
> 20 years	3	27.3
Race		
Asian	1	9.1
White	10	90.9
Gender		
Female	7	63.6
Male	4	36.4
Self-Rated Health		
Excellent	2	18.2
Very good	3	27.3
Good	6	54.6
Self-reported BMI Category		
Normal weight	6	54.6
Overweight	1	9.1
Obese	4	36.4
Physical Activity		
Low Active	0	0.0
Moderately Active	3	27.3
Highly Active	8	72.7
Fruit and Vegetable Intake		
<5 servings/day	7	63.6
≥5 servings/day	4	36.4
Currently smokes		
	0	0.0
Familiar with IOM Guidelines		
Yes	7	63.6
No	4	36.4
Familiar with ACOG Guidelines		
Yes	9	81.8
No	2	18.2

Table 5.4: Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition Counseling

Topic	Patient Report of Provider Counseling	Patients N=30		Provider Report of Counseling	Providers N=11	
		N	%		N	%
Weight Gain	Discussed	26	87	Discussed	11	100
	Specific recommendations	14	47	Specific recommendations	6	55
	No specific recommendations	12	40	No specific recommendations	5	46
	Not discussed	4	13	Only discussed with overweight or obese women	2	18
PA	Discussed	26	87	Discussed	10	91
	Benefits of exercise	15	50	Continue regular activities	6	55
	Type of exercise	14	47	Type of exercise	6	55
	Continue regular activities	5	17	Frequency, duration, intensity	5	46
	Frequency, duration, intensity	4	13	Activities to avoid	4	36
	Exercises to avoid	3	10	Benefits of exercise	3	27
	Not discussed	4	13	Not discussed	1	9
Nutrition	Discussed	30	100	Discussed	10	91
	Fruits and vegetables	17	57	Fruits and vegetables	8	73
	Food pyramid or MyPlate	14	47	Limit fast food/processed foods	4	36
	Increase water consumption	10	33	Lean meats	3	27
	Foods to avoid	8	27	Complex carbohydrates	3	27
	Limit fried foods	7	23	Limit sugar-sweetened beverages	3	27
	Limit sugar	6	20	Portion control	3	27
	Protein	5	17	Foods to avoid	2	18
	Calorie recommendations	4	13	Increase water consumption	2	18
	Portion control	3	10	Food pyramid or MyPlate	2	18
	Whole grains	3	10	Not Discussed	1	9

PA = Physical Activity

CHAPTER SIX

PREGNANT WOMEN'S PERCEPTIONS OF WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION USING THEORY OF PLANNED BEHAVIOR CONSTRUCTS¹

¹ Whitaker KM, Wilcox S, Liu J, Blair SN, Pate RR. To be submitted to the *Annals of Behavioral Medicine*.

Abstract

Background: The Theory of Planned Behavior (TPB) is an appropriate yet underutilized framework to examine women's weight-related intentions during pregnancy.

Purpose: This study utilized the TPB to elicit women's salient beliefs toward weight gain, physical activity (PA), and nutrition in pregnancy, and to examine whether the TPB constructs explained significant variation in weight gain, PA, and nutrition intentions.

Methods: Women between 20-30 weeks gestation (n=189) were recruited to complete a cross-sectional internet-based survey. Salient beliefs toward weight gain, PA, and nutrition were captured through open-ended responses and content analyzed into themes. TPB constructs (attitude, subjective norm, perceived behavioral control, intentions) were examined using Pearson correlations and hierarchical linear regression models.

Results: Salient beliefs were consistent with the existing literature in non-pregnant populations, with the addition of many pregnancy-specific beliefs. TPB constructs accounted for 23%, 29%, and 39% of the variance in weight gain, nutrition, and PA intentions, respectively, and made varying contributions across outcomes.

Conclusions: The TPB is a useful framework for examining and predicting women's weight-related intentions during pregnancy.

Introduction:

Weight gain, physical activity (PA), and dietary intake all directly influence pregnancy outcomes and the long-term health of mother and child (Institute of Medicine, 2007; Kaiser & Allen, 2008; Pivarnik et al., 2006). Only one-third of women meet the Institute of Medicine (IOM) weight gain guidelines during pregnancy, with up to 50% gaining excessive weight (Institute of Medicine and National Research Council, 2009; National Research Council and Institute of Medicine, 2007). Pregnancy weight gain above recommendations is associated with many adverse health outcomes, including an increased risk of gestational diabetes, preeclampsia, cesarean delivery, macrosomia, and new or persistent overweight or obesity in the mother (Guelinckx et al., 2008; Hernandez, 2012; Nehring et al., 2011). Evidence also suggests an association between excessive gestational weight gain and overweight and obesity in the offspring (Oken et al., 2008; Olson et al., 2009).

PA and dietary intake are two key modifiable behavioral factors that influence pregnancy weight gain. During pregnancy, women are less likely to meet PA guidelines than non-pregnant women (Evenson et al., 2004; Petersen et al., 2005), and activity levels further decline from the second to third trimester (Evenson & Wen, 2011). The majority of women of childbearing age also do not meet federal nutrition guidelines, with less than 20% consuming adequate servings of fruits, vegetables, whole grains and milk, and 97% exceeding the maximum energy allowance for fats and added sugars (Krebs-Smith et al., 2010). Few studies have assessed dietary intake of pregnant women; however, evidence suggests that the majority do not meet dietary guidelines (Fowles, 2002; Siega-Riz et al., 2002; Watts et al., 2007).

Given the high prevalence of excessive gestational weight gain, physical inactivity, and poor diet quality during pregnancy, there is a clear need for behavioral intervention. However, in order to develop effective interventions, it is first critical to better understand women's perceptions of weight gain and related behaviors during pregnancy. Many different theories have been developed in an attempt to understand and predict behavior, including the Theory of Planned Behavior (TPB) (Ajzen, 1985; Ajzen, 1991). Research provides support for the predictive validity of the TPB for a variety of health behaviors, including PA, dietary behaviors, and to a lesser extent, weight control (Armitage & Conner, 2001; Conner et al., 2002; Godin & Kok, 1996; McConnon et al., 2012; McEachan et al., 2011; Symons Downs & Hausenblas, 2005).

According to the TPB, behavioral intention is the primary determinant of behavior. Behavioral intention is in turn directly influenced by three constructs: attitude, subjective norms, and perceived behavioral control. Attitude refers to the overall evaluation of the behavior, subjective norm is the perceived social pressure to engage or not engage in the behavior, and perceived behavioral control is the overall measure of perceived control over the behavior. The primary proposition of this theory is that people will intend to engage in a behavior if they view it positively (attitude), believe that important others want them to participate in certain behaviors (subjective norm), and perceive that the behavior is under their control (perceived behavioral control).

This theory is an appropriate framework to use during pregnancy because it includes factors that may be influenced by aspects of the pregnancy. For example, a woman's attitude about PA may change due to beliefs about the risks or benefits of exercise during pregnancy. Similarly, a woman may excessively increase caloric intake

because her family tells her she needs to eat for two during pregnancy (subjective norm). Likewise, a woman may believe she has no control over her weight gain in pregnancy, therefore impacting her intention to restrict her weight gain within a certain range (perceived behavioral control).

The TPB is most commonly used to predict behavioral intention and behavior, but can also be used to explain behavior by assessing the salient beliefs of a population (Ajzen, 1991). Salient beliefs consist of behavioral, normative, and control beliefs. Behavioral beliefs influence attitude, and reflect the perceived advantages and disadvantages of performing the behavior. Normative beliefs affect subjective norms, and are formed by the belief about whether important others approve or disapprove of the behavior. Finally, control beliefs influence perceived behavioral control, and relate to the presence or absence of barriers and enablers to behavioral performance. Elicitation studies are used to determine the behavioral, normative, and control beliefs of a population (Ajzen & Fishbein, 1980), and are important as they provide valuable information regarding people's thoughts and feelings about a behavior.

To date, the majority of TPB guided research in pregnant women has focused on PA (Downs & Hausenblas, 2003; Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004; Symons Downs & Hausenblas, 2004). Less is known about women's perceptions of weight gain or nutrition in pregnancy (Bassett-Gunter et al., 2013; Wright et al., 2013). Given that weight gain and nutrition are key determinants of health-related outcomes for the mother and child, it is important to examine the utility of the TPB in predicting weight gain and nutrition intentions. An additional limitation of the literature is the near exclusive examination of the direct TPB constructs, while not considering the underlying

salient beliefs. To our knowledge, only one published study has utilized the TPB to assess pregnant women's salient beliefs of PA (Symons Downs & Hausenblas, 2004), and no studies were identified that examined salient beliefs of weight gain or nutrition.

The first purpose of this study is to elicit women's behavioral, normative, and control beliefs toward weight gain, PA, and nutrition in pregnancy. The second purpose of this study is to examine whether the TPB explained significant variation in weight gain, PA, and nutrition intentions. Based on existing research findings (McEachan et al., 2011), we hypothesized that attitude would explain the greatest variation in behavioral intention across the three outcomes, followed by perceived behavioral control, and subjective norm.

Methods:

Study Participants & Procedures

Participants were recruited through pregnancy-related Internet chat forums and social media sites from April-August 2014 to complete a cross-sectional Internet-based survey. Inclusion criteria were: 20-30 weeks pregnant, 18-44 years old, pre-pregnancy body mass index (BMI) between 18.5-45.0 kg/m², singleton pregnancy, and attended first prenatal visit before 16 weeks gestation. If eligible, women were invited to complete an online survey using the commercially available survey software, SurveyGizmo, to assess perceptions of weight gain, PA, and nutrition. At the end of the survey, women had the option to enter a drawing to win one of eight \$50 Amazon gift cards. The University of South Carolina Institutional Review Board approved all study protocols.

Participants were provided with a short description explaining the current weight gain, PA, and nutrition recommendations during pregnancy in order to assess participant

perceptions of these guidelines. Weight gain recommendations were based on the 2009 IOM guidelines and were tailored based on the woman's self-reported pre-pregnancy body mass index (BMI) (Institute of Medicine and National Research Council, 2009). It is recommended that normal weight women (BMI 18.5-24.9 kg/m²) gain 25-35 pounds in pregnancy, overweight women (BMI 25.0-29.9 kg/m²) gain 15-25 pounds, and obese women (BMI ≥ 30.0 kg/m²) gain 11-20 pounds. PA recommendations were based on the 2008 PA Guidelines for Americans, or 150 minutes of moderate to vigorous intensity PA per week (U.S. Department of Health and Human Services, 2008). Nutrition recommendations were based on the 2010 Dietary Guidelines for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Specifically, women were told that a healthy diet includes plenty of fruits and vegetables, low fat dairy products, protein, fiber, and whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta. It also recommended women to watch portion sizes and to avoid eating too much of very sugary or fatty foods.

Measures

Salient beliefs (Indirect TPB Constructs)

Behavioral, normative, and control beliefs were assessed using open-ended questions, with separate questions for weight gain, PA, and nutrition. Behavioral beliefs, the indirect measure of attitude, were assessed by asking women to list up to 5 advantages and 5 disadvantages of meeting the recommendations for weight gain, PA, and nutrition during pregnancy. Normative beliefs, the indirect measure of subjective norm, were examined by asking participants to list up to 5 people who influence their weight gain, PA, and nutrition during pregnancy. Control beliefs, the indirect measure of

perceived behavioral control, were explored by asking women to list up to 5 factors that make it difficult or easier for them to meet recommendations for weight gain, PA, and nutrition during pregnancy.

Direct TPB Constructs

The primary constructs of the TPB (attitude, subjective norm, perceived behavioral control, intentions) were assessed for each outcome of interest, that is, weight gain, PA, and nutrition.

Attitude. Women's attitude toward weight gain, PA, and nutrition recommendations were assessed using the following seven discrepant word pairs commonly used in the existing literature: (1) bad-good, (2) useless-useful, (3) foolish-wise, (4) harmful-beneficial, (5) unpleasant-pleasant, (6) boring-interesting and (7) unenjoyable-enjoyable (Ajzen, 1991, 2002; Downs & Hausenblas, 2003; Hausenblas et al., 2008). The survey was designed to automatically propagate the recommended IOM weight gain range (i.e. 25-35, 15-25, or 11-20 pounds) based on the woman's self-reported pre-pregnancy BMI. Specifically, women read the following statements: 'Gaining between [*recommended weight gain range*] total pounds during my pregnancy will be...'; 'Exercising during my pregnancy for 150 minutes per week at a moderate intensity level (e.g. brisk walking) will be...'; 'Eating a healthy diet during pregnancy will be...'. Participants were asked to respond to the statements by rating each of the word pairs using a seven-point Likert scale ranging from -3 (i.e. bad, useless, foolish, harmful, unpleasant, boring, unenjoyable) to 3 (i.e. good, useful, wise, beneficial, pleasant, interesting, enjoyable). Consistent with the recommended TPB analytical procedures (Ajzen & Fishbein, 1980; Montano & Kasprzyk, 2002), the direct measure of

attitude for weight gain, PA, and nutrition was assessed by summing the scores from the corresponding seven discrepant word pairs. Possible scores for each health behavior range from -21 to 21. Higher scores indicate a more positive attitude toward the corresponding health behavior.

Subjective Norms. Participants were asked what important others think about weight gain, PA, and nutrition in pregnancy. Women read the following statements, ‘Most people who are important to me think I should: gain between [*recommended weight gain range*] total pounds during my pregnancy; exercise regularly during my pregnancy; eat a healthy diet during pregnancy.’ Participants were asked to rate each statement using a seven-point Likert scale ranging from -3 (strongly disagree) to 3 (strongly agree). The direct measure of subjective norms was assessed using the score on the 1-item question with a possible range of -3 to 3 for each behavior. Higher scores indicate greater perceived pressure to engage in the corresponding behavior.

Perceived Behavioral Control. Participants’ perceived behavioral control over meeting the recommendations for weight gain, PA, and nutrition was assessed using three questions for each behavior. First, participants were asked how much control they have over their weight gain, PA, and nutrition during pregnancy using a seven-point Likert scale ranging from -3 (very little control) to 3 (complete control). The ease or difficulty of meeting recommendations was assessed using a seven-point Likert scale ranging from -3 (extremely difficult) to 3 (extremely easy). Finally, women were asked if they could meet the recommendations for each behavior using a seven-point Likert scale ranging from -3 (strongly disagree) to 3 (strongly agree). Summing the scores from the three corresponding survey items assessed the direct measure of perceived behavioral control

for each behavior, with a possible range of -9 to 9. Higher scores indicate higher levels of perceived control to engage in the corresponding health behavior.

Intentions. Weight gain intentions were assessed with the statement “I plan on gaining between [*recommended weight gain range*] total pounds during this pregnancy,” using a seven-point Likert scale ranging from -3 (strongly disagree) to 3 (strongly agree). PA and nutrition intentions were assessed with the statements “I plan on exercising at a moderate intensity for 150 minutes per week (e.g. 30 minutes per day, 5 days per week) during my pregnancy,” and “I plan on eating a healthy diet during my pregnancy,” using the same Likert scale. Intentions were assessed using the score on the 1-item question with a possible range of -3 to 3 for each behavior. Higher scores indicate stronger intentions to meet weight gain, PA, and nutrition recommendations in pregnancy.

Personal history questionnaire.

Self-reported height and pre-pregnancy weight were used to calculate pre-pregnancy BMI. Self-reported weight is the most commonly used measure of pre-pregnancy weight and has shown to be both reliable and valid (Shin et al., 2014; Tomeo et al., 1999). Additional measures included race, age, gestational age, highest grade or years of education, income level, employment status, marital status, parity, smoking status, pregnancy complications, and chronic health conditions.

Qualitative Analyses:

Salient beliefs toward weight gain, PA, and nutrition were assessed using content analysis of open-ended survey questions. Data were organized by outcome and then categorized further by belief type (behavioral, normative, or control beliefs) using a qualitative software system (NVivo 10). As recommended for TPB guided content

analysis, verbatim statements were placed in the following lists: (1) positive and negative behavioral beliefs about outcomes or attributes of the action, (2) people or groups that influence the action, and (3) factors or situations that make it easier or more difficult to perform the action (Ajzen, 1991; Montano & Kasprzyk, 2002). To increase the validity of the analysis, the PI and a second rater independently read and coded the response data. Discussion and consensus between the two raters guided the organization of the statements in each list into major themes. Frequencies and percentages of responses were calculated, and the most frequently discussed beliefs were listed.

Statistical Analyses:

Pearson correlations were used to examine bivariate associations between attitude, subjective norm, perceived behavioral control, and intention for each of the three corresponding outcomes: weight gain, PA, and nutrition. Using recommended TPB analytical procedures, hierarchical regression analyses were used to examine the predictive utility of the TPB on behavioral intentions (Ajzen, 1991). Construct entry order and grouping was based on the theoretical principles of the TPB and previous research (Ajzen, 1991; Downs & Hausenblas, 2003). The first model regressed weight gain intention (dependent variable) on attitude and subjective norm toward weight gain (block 1). The second model regressed weight gain intention on attitude, subjective norm, and perceived behavioral control (block 2). Using this same method, hierarchical regression analyses were repeated for PA and nutrition intentions.

Interactions between race and the TPB constructs were tested individually. None were significant and therefore not retained in final models. For each model, the variance inflation factors were computed as a multicollinearity diagnostic statistic to test the

impact of multicollinearity among the covariates included in the model. The variance inflation factors computed weak dependencies (≤ 1.2) and therefore no modifications were made to the constructs included in the models.

Results:

Sample Characteristics

Of the 724 women who accessed the web-link, 549 completed the screening form and 197 women were excluded for not meeting one or more of the eligibility criteria. Due to the low representation of minority women, the survey was closed to White women at the midpoint of data collection to achieve a more diverse sample. A total of 352 women were deemed eligible to participate (64.1%), and 199 women completed the survey (56.5%). Participants primarily resided in the United States (90.5%) and Canada (7.5%). Those with IP addresses outside the U.S. or Canada ($n=4$), or who later reported values inconsistent with eligibility criteria ($n=6$) were excluded from analyses, resulting in a final sample of 189 women. When examining survey completion rate by U.S. geographical region, 36.9% of women resided in the South, 26.8% in the Midwest, 22.9% in the West, and 13.4% in the Northeast. Characteristics of study participants are shown in Table 6.1. There were significant differences by race in income, employment, marital status, and parity, with African American women being more likely to report a household income less than \$25,000, being unemployed, single, and having more children as compared to White women (not shown in table).

Salient Beliefs (Indirect TPB Constructs)

The most frequently cited behavioral, normative, and control beliefs toward weight gain, PA, and nutrition can be found in Tables 6.2-6.4.

Weight Gain Beliefs

Commonly cited advantages of meeting weight gain recommendations in pregnancy were: health benefits to the baby (73%), easier to lose the weight in the postpartum period (28%), and health benefits to the mother (15%). When asked to list the disadvantages of meeting weight gain recommendations, the majority of women discussed disadvantages of general weight gain during pregnancy, while not specifically focusing on the listed weight gain range. Women stated that any weight gain might be challenging to lose in the postpartum period (37%). Other commonly cited disadvantages of pregnancy weight gain included physical discomfort (28%) and negative psychological impact (18%). For example, some women reported struggling with their body image or reduced self-esteem as a result of pregnancy weight gain. The most salient normative influences on weight gain were women's husband or partner (73%), doctor (46%), parents (35%), and friends (23%).

Women discussed barriers and enablers of meeting weight gain recommendations (control beliefs) from three different perspectives. Some listed factors that would make it difficult or easier to avoid excessive pregnancy weight gain (43%); others discussed factors that would make it difficult or easier to meet minimal weight gain recommendations (36%) and some cited barriers and enablers of gaining within the recommended ranges without focusing on either end of the weight gain spectrum (21%).

Women listed cravings (14%), lack of exercise (13%) and eating unhealthy foods (9%) as barriers to limiting their weight gain. Factors that would help them limit weight gain included healthy eating habits (30%) and regular exercise (16%). Women who discussed barriers to gaining enough weight in pregnancy cited nausea (23%), difficulty

eating enough because of feeling full faster (10%), psychological barriers such as body image issues (9%), and having an active lifestyle (7%). For this group of women, factors that would help them gain enough weight included indulging in foods (24%), experiencing an increase in appetite (12%), and limiting exercise (9%). Some women reported a lack of control over their pregnancy weight gain as a barrier (9%), and social support was listed as a factor that would help women gain appropriate weight (10%).

Physical Activity Beliefs

Commonly cited advantages of PA included having an easier labor and delivery (46%), management of weight gain (38%), and health benefits to the mother (31%). Disadvantages of PA were that it increased fatigue (34%), required time (19%), and caused additional aches and pains (18%). Salient normative influences on PA were similar to weight gain (i.e. husband, doctor, parents, friends), with the addition of participants' children (10%). Control beliefs hindering PA include lack of time for exercise (59%), pregnancy-related fatigue (49%) and pregnancy-related pain (20%). Women discussed how social support (32%), additional time (21%), and increased access to fitness facilities or equipment (15%) would facilitate their participation in PA.

Nutrition Beliefs

Advantages of meeting nutrition recommendations included health benefits for the baby (70%), management of weight gain (52%), and health benefits for the mother (37%). Being unable to indulge in cravings was the most commonly cited disadvantage of healthy eating during pregnancy (30%). Other disadvantages were that it requires more time and effort to prepare healthy meals or snacks (19%), and the higher cost of healthy foods (16%). Participants listed the same people influencing healthy eating as PA

(normative influences). Barriers to healthy eating include cravings for unhealthy food (43%), lack of time to prepare food (35%) and the higher cost of healthy food (20%). Women also discussed factors that would help them consume a healthy diet during pregnancy, such as planning meals or snacks ahead of time (23%), having adequate social support (19%) and regular access to healthy foods (14%).

Direct TPB Constructs

Bivariate Correlations

Correlations between TPB constructs can be found in Table 6.5. All correlations were significant and positive with the exception of attitude and perceived behavioral control for weight gain. Subjective norm had the strongest correlation with intentions to meet weight gain recommendations ($r=0.45$), followed by attitude and perceived behavioral control. Perceived behavioral control had the strongest correlation with intentions to meet PA ($r=0.62$) and nutrition recommendations ($r=0.49$), followed by subjective norm and attitude. Effect sizes for TPB constructs were moderate (i.e. $r \geq 0.3$) to large (i.e. $r \geq 0.5$) (Cohen, 1992) across behaviors with the exception of attitude-intention ($r=0.23$) and perceived behavioral control-intention ($r=0.16$) for weight gain.

Linear Regression

Table 6.6 displays results from hierarchical linear regression models. Attitude and subjective norm explained 22% of the variance in weight gain intention (block 1). Subjective norm was significantly associated with weight gain intention ($\beta=0.51$, $p<.01$) while attitude was not ($\beta=0.02$, $p=0.07$). The addition of perceived behavioral control to the model (block 2) only explained an additional 1% of the variance in the model, and was not significant ($\beta=1.35$, $p=0.18$).

In the model examining PA intention, significant associations were observed for both attitude ($\beta=0.05$, $p<0.01$) and subjective norm ($\beta=0.33$, $p<0.01$), explaining 15% of the variation in PA intention (block 1). The addition of perceived behavioral control explained an additional 24% of the variance in the model ($\beta=0.26$, $p<0.01$), with attitude and subjective norm failing to make unique contributions to the final model ($\beta=0.02$, $p=0.14$ and $\beta=0.14$, $p=0.11$, respectively).

Finally, in the nutrition models, both attitude ($\beta=0.03$, $p=0.01$) and subjective norm ($\beta=0.30$, $p<0.01$) were significantly associated with nutrition intentions, explaining 16% of the variance in the model (block 1). The addition of perceived behavioral control (block 2) explained an additional 13% of the model ($\beta=0.16$, $p<0.01$), with both attitude and subjective norm maintaining unique contributions to the model ($\beta=0.02$, $p=0.03$ and $\beta=0.16$, $p=0.03$, respectively).

Discussion:

The purpose of this study was to: (1) elicit the underlying salient beliefs toward weight gain, PA, and nutrition, and (2) examine if TPB constructs explained significant variation in weight gain, PA, and nutrition intentions in a sample of pregnant women. Women described salient beliefs that were largely consistent with the existing literature in non-pregnant population, with the addition of many pregnancy-specific beliefs. TPB constructs made varying contributions in the prediction of women's intentions to meet recommendations. Overall it appears that the TPB is a useful framework for examining and predicting women's weight gain, PA, and nutrition intentions during pregnancy.

Salient Beliefs

Many of the cited behavioral, normative, and control beliefs toward both PA and nutrition (healthy eating) were consistent with the existing literature in non-pregnant populations (Downs & Hausenblas, 2005; Eikenberry & Smith, 2004; White et al., 2007) and pregnant populations (Symons Downs & Hausenblas, 2004). For example, commonly cited advantages of PA and healthy eating are weight control and improvements in health; salient normative referents consistently include family, friends, and healthcare professionals; and commonly perceived barriers include lack of time or lack of social support. Our study uniquely contributes to the literature by using the TPB to examine salient beliefs toward nutrition and weight gain in a pregnant population.

Consistently cited advantages of meeting recommendations for all three behaviors were health benefits for the baby and health benefits for the mom. The percentage of women who discussed health benefits to the baby was greater for weight (73%) and nutrition (70%) as compared to PA (22%). Evidence suggests that PA has many positive health benefits to the fetus that extend into childhood and possibly adulthood via fetal programming (Barker et al., 1989). PA during pregnancy increases placental functional capacity, circulation, and gas exchange, all of which increase nutrient delivery to the fetus (Clapp et al., 2000). Women who are active during pregnancy are at decreased risk of large-for-gestational age infants (Mudd et al., 2013) and these beneficial effects on the child's weight status persist into early childhood (Mattran et al., 2011). Future interventions should seek to increase awareness of the benefits of PA for the fetus.

When assessing salient normative referents, a women's husband or partner exerted the largest influence across behaviors, followed by doctors, parents, friends and other children. Women also stated that social support would help them meet

recommendations across outcomes. Considering these beliefs together, it may be especially important for interventions targeting appropriate weight gain, PA, and/or nutrition during pregnancy to involve close family members (e.g. husband) or friends. This intervention strategy is further supported by the work of Thornton and colleagues, who found social support to be an important determinant of women's beliefs toward weight, diet, and PA in a sample of lower income pregnant and postpartum Latina women (2006). Specifically, Thornton's work indicates that informational and emotional support provided by husbands is the most important and consistent influence on women's health behaviors.

Interestingly, more women cited their doctor as an influencing source of information as compared to the existing pregnancy literature. One study found that only 3% of women discussed their healthcare provider as influencing exercise behaviors during pregnancy (Symons Downs & Hausenblas, 2004), compared to 37% in our study. A high percentage of women also cited their doctor as influencing their weight gain (46%) and nutrition (37%) in our study. The American College of Obstetricians and Gynecologists (ACOG) recommends that healthcare providers discuss weight gain, PA, and nutrition with women during prenatal visits (2013). Given that providers are advised to counsel women on weight gain and related behaviors and women consistently cite their doctor as an influencing source of information, future research is needed to see if providers are aware of the ACOG counseling recommendations and whether they think they are able to effectively counsel women on these topics.

Women discussed barriers and enablers of meeting weight gain recommendations from multiple perspectives. Women who were concerned with excessive weight gain

commonly discussed the importance of healthy lifestyle practices such as regular exercise and healthy eating, while also acknowledging many barriers to these behaviors. For women at risk for excessive weight gain, it may be especially important to focus on strategies to overcome barriers to healthy lifestyle practices in pregnancy. Conversely, women who were focused on gaining enough weight in pregnancy listed unhealthy lifestyle practices, such as reducing exercise and indulging in cravings or unhealthy foods in order to gain adequate weight. Nausea and inability to consume adequate calories were common concerns. For women at risk of inadequate weight gain, it may be helpful to provide strategies to promote weight gain in a healthful manner. For example, women should be encouraged to eat smaller and more frequent meals and provided with meal ideas that are both nutritious and calorically dense.

Some women also stated they lacked control over their weight gain. Pregnancy weight gain is caused by many factors, some of which are not modifiable. However, PA and dietary intake are both modifiable determinants of pregnancy weight gain. Future interventions should seek to empower women by teaching them how to apply behavioral strategies to better control their weight gain in pregnancy through appropriate PA and dietary intake.

TPB Direct Constructs

The overall efficacy of the TPB constructs in predicting behavioral intention was consistent with the existing literature. A meta-analysis describing the efficacy of the TPB across a variety of health behaviors in general populations found that attitude, subjective norm, and perceived behavioral control explained 44% of the variance in behavioral intention (McEachan et al., 2011). This result is comparable to our findings examining

exercise intentions (39%); however the predictive value of the TPB to explain intention was lower for nutrition (29%) and weight gain (23%).

Our hypothesis that attitude would have the strongest relationship with behavior intention across outcomes was not supported. The relationship between attitude and intention was small for weight gain and nutrition and moderate for PA (Cohen, 1992). In final regression models, attitude was not significantly associated with weight gain or PA intentions. These findings are surprising, as attitude has typically shown to have the strongest association with intentions in non-pregnant (Armitage & Conner, 2001; McEachan et al., 2011) and pregnant populations (Bassett-Gunter et al., 2013; Downs & Hausenblas, 2003; Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004) across a variety of behaviors. This implies that women's beliefs or feelings toward weight gain or physical activity in pregnancy have less of an effect on their intention to meet weight gain and PA recommendations as compared to the other TPB constructs. Targeting attitude alone may therefore not be an effective intervention approach for weight management or PA promotion during pregnancy. However, it is important to note that attitude was significantly associated with the other constructs in the model, which may have reduced associations and significance in simultaneous regression models.

Interestingly, the strength of the association between subjective norm and intention was greater than hypothesized. Subjective norm was moderately correlated with intentions across all three behaviors, and was significantly associated with weight gain and nutrition, but not PA intentions in final regression models. Subjective norm is typically the weakest predictor of both intention and behavior in non-pregnant populations (Armitage & Conner, 2001; McEachan et al., 2011). However, studies

examining the utility of subjective norms in pregnant populations have shown more mixed findings (Bassett-Gunter et al., 2013; Downs & Hausenblas, 2003; Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004). Hausenblas and Downs have published three studies examining exercise intentions and behaviors in pregnant women; subjective norm was found to be a significant predictor of exercise intention in one of the three studies (2004). Bassett-Gunter and colleagues found subjective norm to significantly predict healthy eating intentions and behaviors among parents who were expecting their first child (2013). Taken together, it is possible that subjective norm is a stronger predictor of behavioral intention due to our specific population under study. Pregnancy has been referred to as a “teachable moment” where women are more receptive to change for the sake of the baby (Phelan, 2010). This is a particularly vulnerable time where women may be more responsive to the influence of others.

The relationship between perceived behavioral control and intention was smaller than hypothesized for weight gain and larger than hypothesized for PA and nutrition. This construct independently explained a larger proportion of the variance in PA and nutrition intentions (24% and 13%, respectively) as compared to the existing literature, where on average, perceived behavioral control accounts for 6% or less of the variance in intentions in non-pregnant (Armitage & Conner, 2001; McEachan et al., 2011) and pregnant populations (Downs & Hausenblas, 2003; Hausenblas et al., 2008; Hausenblas & Symons Downs, 2004). This illustrates that the perceived ease or difficulty of meeting PA or nutrition recommendations plays an important role in women’s intentions to meet these recommendations. It may be helpful for interventions to target perceived behavioral control by teaching women strategies to overcome commonly cited barriers to PA and

healthy eating (e.g. lack of time and pregnancy-related fatigue). Perceived behavioral control does not appear to be a strong predictor of weight gain intentions, possibly due to the perception that pregnancy weight gain is not under one's control.

Strengths of this study include examination of multiple behaviors, exploration of salient beliefs, and theoretical grounding. While this study contributes novel findings to the existing literature, multiple limitations must be noted. Due to the cross-sectional nature of the study, we did not assess if intentions to meet recommendations translated into women's behaviors. Future studies should prospectively follow women over time to examine the utility of the TPB constructs for predicting weight gain, PA, and dietary behaviors in pregnant women. Additionally, respondents were primarily white with high levels of education and income, which may limit the generalizability of study findings and restrict the range of responses, thus limiting the variance we were able to explain in behavioral intentions. Finally, self-selection bias may be present as participants were volunteers who may have been more interested in weight-related behaviors during pregnancy.

Overall, findings indicate that interventions targeting multiple behaviors require specific attention to each of the behaviors to optimize their efficacy. Interventions targeting nutrition behaviors in pregnancy may be more effective if they seek to improve women's attitudes toward healthy eating, increase perceived pressure to eat a healthy diet during pregnancy, and increase perceived sense of control by teaching women ways to overcome barriers to healthy eating. To increase intentions to engage in PA it may be most effective to target perceived behavioral control. Finally, weight gain interventions

may experience greater success if targeting the construct of subjective norm, possibly through involvement of family, health care providers, and friends.

Acknowledgements:

This work was partially supported by a SPARC Graduate Research Grant from the Office of the Vice President for Research at the University of South Carolina. The participation of KW in this research was supported in part by research training grant T32-GM081740 from the National Institutes of Health, National Institute of General Medical Sciences. The authors would like to thank all women who participated in this study. The authors acknowledge and thank the contributions of Santiago Tovar-Diaz, who assisted with qualitative data coding.

Table 6.1: Participant Characteristics (N=189)

Characteristic	n	Mean (SD) or % (n)	Range
Age	186	30.3 (4.2)	21.2-42.6
Gestational Age	189	25.6 (3.2)	20.0-30.0
Race	188		
White		82.4 (155)	
African American		10.6 (20)	
American Indian		2.7 (5)	
Asian		2.7 (5)	
Other		1.6 (3)	
Education	189		
High School graduate		5.8 (11)	
Some college or technical school		22.2 (42)	
College graduate		72.0 (136)	
Employment	189		
Employed for wages full time		56.1 (106)	
Employed for wages part time		10.6 (20)	
Self-employed		10.0 (19)	
Student		3.2 (6)	
Homemaker		18.5 (35)	
Out of work		1.6 (3)	
Household annual income	189		
Less than \$25,000		11.1 (21)	
\$25,000-\$49,999		15.9 (30)	
\$50,000-\$74,999		18.0 (34)	
\$75,000 or more		55.0 (104)	
Marital Status	188		
Single		4.8 (9)	
Married/member of unmarried couple		94.2 (177)	
Divorced		1.1 (2)	
Parity	189		
0		51.9 (98)	
1		31.8 (60)	
2+		16.4 (31)	
Smoking during pregnancy	189	1.1 (2)	
Prepregnancy BMI	188	25.7 (5.5)	18.6-42.3
Prepregnancy BMI Category	188		
Normal weight		59.3 (112)	
Overweight		19.1 (36)	
Obese		21.2 (40)	
Diagnosed Pregnancy Conditions	189		
Preeclampsia		1.1(2)	
Gestational Diabetes Mellitus		1.6 (3)	
Other pregnancy complications		5.3 (10)	
Diagnosed Chronic Health Conditions	189		
Hypertension		10.1 (19)	
Type 1 Diabetes		3.1 (6)	
Cancer		2.1 (4)	
Other health conditions		5.8 (11)	

Table 6.2: Salient Behavioral, Normative, and Control Beliefs for Meeting Weight Gain Recommendations during Pregnancy (N=189)

Weight Gain Beliefs	N	%	Sample Participant Quotes
Behavioral beliefs – advantages			
Health benefits for baby	138	73.0	<i>Baby will be healthier</i>
Easier to lose weight postpartum	53	28.0	<i>It won't be as hard to get the weight off</i>
Health benefits for mother	28	14.8	<i>Better for my overall health</i>
Prevents health complications	20	10.6	<i>Less risk of diabetes and other complications</i>
Able to eat more food	15	7.9	<i>Allows you to eat healthy but also indulge some</i>
Easier labor and delivery	13	6.9	<i>Likely to have easier labor/delivery than expecting mom who gains more than this amount</i>
Behavioral beliefs – disadvantages			
Hard to lose weight postpartum	69	36.5	<i>It may be hard to get back to pre-pregnancy weight</i>
Discomfort	52	27.5	<i>The extra weight gain in so short a time makes my body uncomfortable</i>
Negative psychological impact	34	18.0	<i>Some women get depression from weight gain</i>
Unappealing physical changes	24	12.7	<i>It may be gained in places I don't want (ex. arms/thighs as opposed to stomach/breasts)</i>
Clothes not fitting	24	12.7	<i>My clothes don't fit me well anymore</i>
Normative beliefs			
Husband or partner	138	73.0	<i>My husband</i>
Doctor	87	46.0	<i>My doctor is really the only one I can see influencing me</i>
Parents	66	34.9	<i>My mother because she is of course concerned the baby is getting everything he needs</i>
Friends	44	23.3	<i>Close friends</i>
Control beliefs – barriers to avoid excessive weight gain			
Cravings	27	14.3	<i>I indulge in cravings too often</i>
Lack of exercise	25	13.2	<i>Difficult to maintain exercise</i>
Eating unhealthy foods	17	9.0	<i>I will probably gain more because I have a sweet tooth</i>
Excessive hunger	13	6.9	<i>Insatiable hunger</i>
Overeating	13	6.9	<i>I love food and have a tendency to overeat if I'm not careful</i>
Control beliefs – enablers to avoid excessive weight gain			
Healthy eating habits	57	30.2	<i>Sticking to a balanced diet with adequate vitamins, protein, and minerals makes it easier</i>
Regular exercise	30	15.9	<i>Daily physical activity</i>

Table 6.2 Continued

Weight Gain Beliefs	N	%	Sample Participant Quotes
Control beliefs – barriers to adequate weight gain	68	36.0	
Nausea	43	22.8	<i>Nausea and heartburn making it difficult to eat</i>
Hard to eat enough	19	10.1	<i>Pregnancy causes you to feel full faster so it's hard to consume a lot of calories at one time</i>
Psychological barriers	18	9.5	<i>Body image issues</i>
Control beliefs – enablers to adequate weight gain			
Indulging in foods	47	24.9	<i>Not focused on dieting</i>
Increased hunger	22	11.6	<i>Sometimes an increase in appetite</i>
Limiting exercise	16	8.5	<i>I quit exercising regularly</i>

Table 6.3: Salient Behavioral, Normative, and Control Beliefs for Meeting Physical Activity Recommendations during Pregnancy (N=189)

Physical Activity Beliefs	N	%	Sample Participant Quotes
Behavioral beliefs - Advantages			
Easier labor and delivery	86	45.5	<i>Maintain strength and flexibility, which may make for an easier labor, delivery, and recover</i>
Manages weight gain	72	38.1	<i>It helps to maintain healthy weight gain</i>
Health benefits for mother	58	30.7	<i>Healthier mom</i>
Improves fitness	49	25.9	<i>Stay fit during pregnancy</i>
Psychological benefits	47	24.9	<i>Mood lifted by working out</i>
Health benefits for baby	42	22.2	<i>Has been shown to be beneficial to the baby's growth and intelligence</i>
Faster postpartum recovery	37	19.6	<i>A body in shape before birth is easier to get in shape after birth</i>
Increases energy	23	12.2	<i>Keeps energy levels up</i>
Behavioral beliefs - Disadvantages			
Causes fatigue	64	33.9	<i>I can't do as much without becoming very fatigued</i>
Requires time	35	18.5	<i>Time commitment</i>
Causes aches or pains	33	17.5	<i>Increase in back pain and increase in Braxton hicks during and after exercise</i>
Potential for injury	15	7.9	<i>Feeling nervous about doing something unsafe</i>
Normative beliefs			
Husband or partner	140	74.1	<i>My husband is great at encouraging me to exercise more, regardless of me being pregnant</i>
Doctor	67	35.4	<i>As long as my doctor is supportive of the amount I am working out, I will continue</i>
Parents	48	25.4	<i>My mom and I walk together</i>
Friends	30	15.9	<i>Trusted friends</i>
Children	19	10.1	<i>My toddler – he won't let me sit down</i>
Control beliefs – Barriers			
Lack of time	112	59.3	<i>Time constraints</i>
Fatigue	92	48.7	<i>Being extremely tired</i>
Pain	37	19.6	<i>Back and hip pain</i>
Bad weather	31	16.4	<i>The winter was cold so it was hard to get outside to walk or exercise</i>
Aches/pains	21	11.1	<i>Discomfort and aches related to pregnancy</i>
Nausea	20	10.6	<i>First trimester fatigue and nausea make it difficult</i>
Control beliefs – Enablers			
Social Support	60	31.7	<i>Companionship during exercise outings</i>
More time	39	20.6	<i>If I had more time</i>

Table 6.3 Continued

Physical Activity Beliefs	N	%	Sample Participant Quotes
Control beliefs – Enablers			
Access	29	15.3	<i>Access to a fitness facility</i>
Good weather	20	10.6	<i>Nice weather to encourage me to get outside</i>
Planning ahead	19	10.1	<i>Planning ahead – setting alarm, setting out clothes, etc.</i>
Enjoyment	16	8.5	<i>I enjoy exercising and want to be fit</i>

Table 6.4: Salient Behavioral, Normative, and Control Beliefs for Meeting Nutrition Recommendations during Pregnancy (N=189)

Nutrition Beliefs	N	%	Sample Participant Quotes
Behavioral beliefs - Advantages			
Health benefits for baby	133	70.4	<i>Good start for baby</i>
Manages weight gain	98	51.9	<i>Helps keep weight gain in the optimal range</i>
Health benefits for mother	70	37.0	<i>I feel healthier and have more energy</i>
More energy	30	15.9	<i>Giving me more energy throughout the day</i>
Prevents health complications	27	14.3	<i>Less chance of certain diseases for mom and baby</i>
Feel better	21	11.1	<i>Feel better when you eat better</i>
Psychological advantages	11	5.8	<i>Eating fresh and healthy makes me feel good about myself and what I am providing to baby</i>
Behavioral beliefs - Disadvantages			
Unable to indulge in cravings	56	29.6	<i>Not being able to enjoy cravings</i>
Requires more time & effort	36	19.0	<i>Can be time consuming (trips to store and meal preparation)</i>
Higher cost	30	15.9	<i>It can be a lot more expensive to eat fresh produce and locally sourced foods</i>
Enjoyment of unhealthy foods	14	7.4	<i>Sometimes junk food just sounds better than veggies</i>
Normative beliefs			
Husband	152	80.4	<i>If my husband doesn't eat well, it makes it more difficult for me</i>
Doctor	68	36.0	<i>Midwives and Ob/Gyn involved in my care</i>
Parents	45	23.8	<i>My parents</i>
Friends	30	15.9	<i>My friends</i>
Other Children or baby	26	13.8	<i>My toddler (I don't want him eating junk so I won't eat junk in front of him)</i>
Control beliefs – Barriers			
Cravings	81	42.9	<i>Cravings for unhealthy foods</i>
Lack of time	66	34.9	<i>Sometimes my schedule is hectic and I grab food that is convenient</i>
Cost	37	19.6	<i>Price of healthy foods</i>
Lack of energy	22	11.6	<i>Too tired to prep food and cook</i>
Negative influence of others	19	10.1	<i>Influence of others who think that because you are pregnant it's okay to eat unhealthy foods</i>
Nausea	17	9.0	<i>Morning sickness made it hard to eat most foods during the first trimester</i>
Control beliefs – Enablers			
Planning ahead	43	22.8	<i>Keeping pantry stocked with healthy snacks</i>
Support from others	35	18.5	<i>Having someone else help out and cook healthy meals</i>
Access	27	14.3	<i>More access to healthy food options</i>

Table 6.4 Continued

Nutrition Beliefs	N	%	Sample Participant Quotes
Thinking about benefits to baby	20	10.6	<i>Focusing on how eating healthy is the best thing to do for the baby</i>
More money or cheaper cost	20	10.6	<i>More affordable fresh foods</i>
Enjoyment	20	10.6	<i>I enjoy eating healthy foods</i>

Table 6.5: Correlations, Means (M), and Standard Deviations (SD), and Ranges Among the Theory of Planned Behavior Constructs

Variable	2	3	4	n	M	SD	Range
<i>Weight Gain</i>							
1. Intention	0.235 0.001	0.453 <.001	0.164 0.024	189	0.720	1.941	-3.0-3.0
2. Attitude		0.266 <.001	0.099 0.181	186	6.355	10.015	-21.0-21.0
3. Subjective norm			0.169 0.020	189	0.804	1.597	-3.0-3.0
4. PBC				188	1.500	3.669	-9.0-9.0
<i>Physical Activity</i>							
1. Intention	0.317 <.001	0.331 <.001	0.616 <.001	189	0.503	1.830	-3.0-3.0
2. Attitude		0.284 <.001	0.358 <.001	185	11.973	8.530	-21.0-21.0
3. Subjective norm			0.334 <.001	189	1.339	1.334	-3.0-3.0
4. PBC				189	2.937	3.892	-9.0-9.0
<i>Nutrition</i>							
1. Intention	0.298 <.001	0.376 <.001	0.489 <.001	189	1.841	1.075	-3.0-3.0
2. Attitude		0.363 <.001	0.243 <.001	186	14.618	7.860	-21.0-21.0
3. Subjective norm			0.377 <.001	189	2.048	1.007	-3.0-3.0
4. PBC				189	4.762	2.710	-6.0-9.0

PBC: Perceived Behavioral Control

Table 6.6: Hierarchical Regression Analyses for the Theory of Planned Behavior Constructs and Weight Gain, Physical Activity, and Nutrition Intentions

Variables	β	R²	Model F	ΔF	Model p-value	Variable t	Variable p-value
Weight Gain (n=186)		0.22	26.06		<.001		
Block 1							
Attitude	0.024					1.81	0.072
Subjective Norm	0.512					6.26	< 0.001
Block 2		0.23	18.05	8.01	<.001		
Attitude	0.023					1.73	0.085
Subjective Norm	0.496					6.01	< 0.001
PBC	0.047					1.35	0.180
Physical Activity (n=185)		0.15	16.34		<.001		
Block 1							
Attitude	0.053					3.51	< 0.001
Subjective Norm	0.331					3.33	0.001
Block 2		0.39	39.05	22.71	<.001		
Attitude	0.020					1.48	0.140
Subjective Norm	0.139					1.59	0.113
PBC	0.259					8.47	< 0.001
Nutrition (n=186)		0.16	17.8		<.001		
Block 1							
Attitude	0.025					2.63	0.009
Subjective Norm	0.302					4.03	< 0.001
Block 2		0.29	25.32	7.52	<.001		
Attitude	0.019					2.13	0.034
Subjective Norm	0.164					2.25	0.025
PBC	0.158					5.83	< 0.001

CHAPTER 7

PROVIDER COUNSELING AND WOMEN'S INTENTIONS TO MEET WEIGHT GAIN, PHYSICAL ACTIVITY, AND NUTRITION RECOMMENDATIONS DURING PREGNANCY¹

¹ Whitaker KM, Wilcox S, Liu J, Blair SN, Pate RR. To be submitted to the *American Journal of Obstetrics and Gynecology*.

Abstract

Objectives: To determine the prevalence and accuracy of patient-reported provider counseling on weight gain, physical activity, and nutrition during prenatal visits and to examine the associations of provider counseling with women's weight-related intentions.

Study Design: This was a cross-sectional internet-based survey examining patient-report of provider counseling and health intentions of women between 20-30 weeks gestation (n=188). Separate analyses examined the predictors of patient-reported provider counseling on (1) weight gain, (2) physical activity, and (3) nutrition. Linear and logistic regression models examined associations of provider weight gain recommendations with women's intended weight gain.

Results: Between 52-63% of women reported provider counseling on weight gain, physical activity, or nutrition. Of those who reported weight gain counseling, 79% cited provider recommendations within the Institute of Medicine guidelines, 9% below, and 11% above. Patient-report of provider counseling on physical activity and nutrition were consistent with guidelines, but limited in scope. In bivariate analyses, provider counseling (yes/no) was significantly associated with women's intentions to meet physical activity (p=0.01) and nutrition (p=0.02), but not weight gain guidelines (p=0.86). Provider recommended weight gain in pounds was significantly associated with women's intended weight gain in linear and logistic regression models.

Conclusion: A large percentage of women reported receiving no advice from providers on weight gain, physical activity or nutrition during pregnancy. Of those who received advice, most reported recommendations consistent with current guidelines. Provider advice was associated with women's weight-related intentions in pregnancy.

Introduction:

The Institute of Medicine (IOM) gestational weight gain guidelines were developed to optimize health outcomes for mother and child (Institute of Medicine and National Research Council, 2009). However, the majority of women do not gain appropriate weight in pregnancy, with up to 50% exceeding recommendations (Institute of Medicine, 2007; Simas et al., 2011). Excessive pregnancy weight gain is associated with many adverse health outcomes for both mother and child, including an increased risk of cesarean delivery, postpartum weight retention, and future overweight and obesity in the child (Olson, 2008).

The American College of Obstetricians and Gynecologists (ACOG) recently released a committee opinion report, recommending that providers determine a woman's body mass index (BMI) at the initial prenatal visit, and counsel her on the benefits of appropriate weight gain, physical activity, and nutrition, with emphasis placed on the need to limit excessive weight gain to achieve optimal pregnancy outcomes (2013). The implication of this report is that providers are well positioned to help women gain appropriate weight in pregnancy. However, few studies have examined provider compliance with counseling recommendations, or the extent to which provider counseling influences women's intentions and behaviors during pregnancy.

Evidence suggests that counseling on weight gain, physical activity, and nutrition is inadequate in the prenatal care setting. Approximately 30-50% of women report no advice from a health care provider on weight gain in pregnancy, and accuracy of reported advice widely varies (Cogswell et al., 1999; Ferrari & Siega-Riz, 2013; McDonald et al., 2011; Phelan et al., 2011; Stotland et al., 2005; Taffel et al., 1993). Less is known about provider advice on physical activity or nutrition in prenatal care. Qualitative studies have

found that pregnant women receive limited advice on physical activity and nutrition (Ferrari et al., 2013; Stengel et al., 2012). Women report that advice on physical activity is generally vague and largely limited to being told to walk, while advice on dietary intake is overwhelming, not individualized, and constantly changing (Ferrari et al., 2013). In light of the recent release of the ACOG committee opinion report, it is important to reassess provider counseling on weight gain, physical activity, and nutrition.

It is also important to assess if provider counseling is associated with women's weight gain, physical activity, and nutrition intentions during pregnancy. Behavioral intention has been shown to be the strongest predictor of actual behavior across a variety of populations and behaviors (Armitage & Conner, 2001), and intended pregnancy weight gain is strongly associated with actual weight gain (Cogswell et al., 1999). However, limited research has examined provider weight gain advice with women's intended or actual pregnancy weight gain, with mixed results (Cogswell et al., 1999; Ferrari & Siega-Riz, 2013; Herring et al., 2012; Stotland et al., 2005; Taffel et al., 1993). To our knowledge, no studies have examined associations of provider advice with pregnant women's intentions to meet physical activity or nutrition guidelines.

The current study aims to: (1) determine the proportion of women who report provider counseling on weight gain, physical activity, and nutrition during prenatal care visits, (2) determine the accuracy of patient-reported provider counseling, and (3) examine if patient-reported provider counseling is associated with women's intentions to meet weight-related recommendations during pregnancy. We hypothesized that report of provider counseling on weight gain, physical activity, and nutrition would be associated with more favorable weight-related intentions during pregnancy.

Materials and Methods:

Participants were recruited through pregnancy-related Internet chat forums and social media sites from April-August 2014. Inclusion criteria were: 20-30 weeks pregnant, 18-44 years old, pre-pregnancy body mass index (BMI) between 18.5-45.0 kg/m², singleton pregnancy, and attended first prenatal visit before 16 weeks gestation. If eligible, women were invited to complete a cross-sectional Internet-based survey to assess report of provider counseling on weight gain, physical activity, and nutrition and women's intentions to meet the respective behavioral recommendations. Participants had the option to enter their contact information to enter into a drawing to win one of eight \$50 Amazon gift cards. The University of South Carolina Institutional Review Board approved all study protocols.

Report of Provider Counseling

In three separate questions, women were asked if a health care provider discussed weight gain, exercise, and nutrition with them during their current pregnancy (yes/no for each). If women reported weight gain counseling, they were asked how many pounds their health care provider recommended they gain. If women reported exercise or nutrition counseling, they were asked to report what recommendations were given using an open-ended response for each outcome.

Women's Weight Gain, Physical Activity, and Nutrition Intentions

Weight gain intentions were assessed using two different methods. Women were first asked to report how much total weight they plan on gaining during their pregnancy in pounds. Intentions to meet the 2009 IOM weight gain guidelines were assessed with the statement "I plan on gaining between [*recommended weight gain range*] total pounds

during this pregnancy,” using a seven-point Likert scale ranging from -3 (strongly disagree) to 3 (strongly agree). This scale is a recommended and commonly used method for measuring behavioral intentions (Ajzen, 1991; Montano & Kasprzyk, 2002). The survey was designed to automatically propagate the recommended IOM weight gain range (i.e. 25-35, 15-25, or 11-20 pounds) based on the woman’s self-reported pre-pregnancy BMI.

Intentions to meet the guidelines for physical activity (U.S. Department of Health and Human Services, 2008) and nutrition (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010) were assessed using the statements “I plan on exercising at a moderate intensity for 150 minutes per week (e.g. 30 minutes per day, 5 days per week) during my pregnancy,” and “I plan on eating a healthy diet during my pregnancy,” using the same seven-point Likert scale. Women first read a short description explaining the terms ‘moderate intensity’ and ‘healthy diet’ before answering these questions. Moderate intensity exercise was defined as any activity that noticeably increases heart and breathing rate, like brisk walking. A healthy diet was described as including plenty of fruits and vegetables, low fat dairy products, protein, fiber, and whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta, watching portion sizes, and avoiding eating too much of very sugary and fatty foods. Intentions were assessed using the score on the 1-item question with a possible range of -3 to 3 for each health behavior. Higher scores indicate stronger intentions to meet weight gain, physical activity, and nutrition recommendations in pregnancy.

Personal history questionnaire.

Self-reported height and pre-pregnancy weight were assessed and used to calculate pre-pregnancy BMI. Self-reported weight is the most commonly used measure of pre-pregnancy weight and has shown to be both reliable and valid (Shin et al., 2014; Tomeo et al., 1999). Additional measures included race, age, gestational age, highest grade or years of education, income level, employment status, marital status, parity, smoking status, and perceived health.

Qualitative Analyses

Responses from open-ended questions assessing women's report of provider counseling on physical activity and nutrition were entered into QRS NVivo 10 for computer-assisted qualitative data management. A grounded theory approach was used to identify physical activity and nutrition counseling themes (Strauss & Corbin, 1990). To increase the validity of the analysis, the PI and a second rater independently read and coded the response data. Discussion and consensus between the two raters guided the organization of the statements into major themes. Frequencies and percentages of responses were estimated.

Statistical Analyses

Differences between those who reported counseling and those who did not were examined using t-tests, chi-square or fisher's exact tests, as appropriate. For women who reported provider recommended weight gain or intended weight gain in pounds, associations of recommended/intended weight gain and maternal characteristics were examined using chi-square tests. The 2009 IOM guidelines were used to define whether providers' advice or women's weight gain intentions were below, within, or above these

guidelines based on women's self-reported pre-pregnancy BMI. Due to the small percentage of women who reported weight gain recommendations and weight gain intentions below or above IOM guidelines, we further categorized recommendations and intentions as meeting IOM recommendations and not meeting recommendations.

Associations between women's report of provider counseling on weight gain, physical activity, or nutrition (yes/no for each) with women's intentions (seven-point Likert scale for each) were assessed using Wilcoxon Rank Sum tests. When weight gain recommendations were reported in pounds, Pearson correlations and chi-square tests were used to examine associations of provider recommended weight gain with women's intended weight gain as continuous and categorical variables. Associations between provider recommended weight gain (independent variable) and women's intended weight gain (dependent variable) were assessed using both linear and logistic regression models while controlling for maternal race, age, education, parity, and pre-pregnancy BMI. All analyses were conducted using SAS version 9.3.

Results:

Participant Characteristics

Of the 724 women who accessed the web-link, 549 completed the screening form and 197 women were excluded for not meeting one or more of the eligibility criteria. A total of 352 women were deemed eligible to participate (64.1%), and of which, 199 women completed the survey (56.5%). Participants primarily resided in the U.S. (90.5%) and Canada (7.5%). Those with IP addresses outside the U.S. or Canada (n=4), who did not report a pre-pregnancy weight (n=1), or who later reported values inconsistent with

eligibility criteria (n=6) were excluded from analyses, resulting in a final sample of 188 women. Participant characteristics are located in Table 7.1.

Report of Provider Counseling

Approximately 52% of women reported provider counseling on weight gain during pregnancy, 63% on physical activity, and 56% on nutrition. As seen in Table 7.2, there were differences in parity, race, education, perceived health, and pre-pregnancy BMI among those who reported provider counseling and those who did not. Nulliparous women were more likely to report counseling on weight gain and physical activity than multiparous women. White women were more likely to report counseling on physical activity than non-White women. Physical activity counseling was also positively associated with higher education, income, and rating of perceived health. Obese women were more likely to report provider counseling on nutrition, followed by normal weight and overweight women.

Of those who reported provider advice on weight gain, all but two women listed a weight gain recommendation from their provider in pounds (n=96). When using the 2009 IOM guidelines to categorize provider weight gain advice, 79% of women reported provider recommendations within the guidelines, 9% below guidelines, and 11% above guidelines (see Table 7.3). Accuracy of provider recommendations did not differ across participant characteristics.

Women's report of provider recommendations on physical activity and nutrition are summarized in Table 7.4. For physical activity (n=119), women most commonly reported recommendations to continue their previous exercise routine (36%). Providers also discussed type (32%), intensity (22%), and duration or frequency of activity (21%).

According to the FITT principle (i.e. frequency, intensity, time, and type) of exercise, approximately 75% of women reported one physical activity recommendation from their provider, 17% reported two recommendations, and 8% reported three. Overall, providers were encouraging of women to exercise during pregnancy.

Of those reporting provider advice on nutrition, all but four participants provided specific examples of recommendations (n=104). Women reported provider advice to eat plenty of fruits and vegetables (45%), increase protein intake (34%), and to consume a well-balanced diet (33%). Approximately 30% of women reported one dietary recommendation from their provider, 34% reported two recommendations, and 38% reported three or more recommendations. While advice was limited, providers largely encouraged women to eat a diet consistent with the USDA dietary guidelines (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

Women's Intentions

Approximately 51% of women reported an intended weight gain within the IOM guidelines, 29% below, and 20% above (see Table 3). Accuracy of weight gain intentions differed by pre-pregnancy BMI with overweight and obese women being more likely to report intended gains above IOM guidelines, while normal weight women were more likely to report intended weight gain below guidelines, $\chi^2(4, N=188)=21.4, p<0.001$.

Bivariate Analyses of Provider Counseling and Women's Intentions

Women's report of provider counseling on physical activity and nutrition (yes/no) was significantly associated with women's intentions (7-point Likert Scale) to meet the guidelines for physical activity (p=0.007) and nutrition (p=0.025), but not weight gain during pregnancy (p=0.860). When examining the relationship between provider

recommended weight gain and women's intended weight gain in pounds, there was a significant correlation, $r(96)=0.72$, $p<.001$. When examining weight gain recommendations and intentions as categorical variables (within recommendations vs. not) analyses showed women's weight gain intentions significantly differed by provider advice $\chi^2(1, N=96)=6.86$, $p=0.009$. Approximately 58% of women receiving provider advice within recommendations reported appropriate intended weight gain, while only 25% of women receiving provider advice outside of recommendations reported appropriate intended weight gain.

Multivariable Analyses of Provider Counseling and Women's Intentions

Using linear regression, provider recommended weight gain in pounds (independent variable) was significantly associated with women's intended weight gain in pounds (dependent variable) while controlling for race, age, education, parity, and pre-pregnancy BMI ($\beta = 1.10$, $t(85) = 7.17$, $p<.001$). The total model explained 53% of the variance in women's intended weight gain ($F(6, 85) = 16.33$, $p<.001$).

Using logistic regression, we examined the crude and adjusted odds ratios for women's intended weight gain among women who reported weight gain recommendations within or outside of IOM guidelines. Before adjustments, women who reported advice to gain less or more than the IOM guidelines were 4.13 (95% CI 1.36-12.52) times more likely to report an intended weight gain outside guidelines than women who were advised to gain within the recommended ranges. After adjustments noted earlier, the odds of intended weight gain outside IOM guidelines was 6.68 (95% CI 1.87-23.94) times greater for women reporting advice outside of guidelines as compared to those advised to gain within guidelines.

Discussion:

The first objective of this study was to assess the proportion of women reporting provider counseling on weight gain, physical activity, and nutrition during prenatal visits. Approximately 52% reported counseling on weight gain. This is largely consistent with the existing literature (Ferrari & Siega-Riz, 2013; McDonald et al., 2011; Phelan et al., 2011), although some studies have reported counseling rates on pregnancy weight gain closer to 70% (Cogswell et al., 1999; Stotland et al., 2012; Stotland et al., 2005). Nulliparous women were more likely to report counseling than multiparous women. As previously reported in the literature, providers may assume women with previous pregnancies are familiar with weight gain guidelines and therefore choose to spend time discussing other topics (Ferrari & Siega-Riz, 2013; Phelan et al., 2011).

When assessing rates of physical activity and nutrition counseling, we found that 63% and 56% of women reported provider advice, respectively. These findings are consistent with a study conducted in the San Francisco Bay area, where 65% of prenatal patients reported provider counseling on exercise and 69% on nutrition (Stotland et al., 2012). McDonald and colleagues found that 55% of women reported provider discussion on exercise during a prenatal visit; however, only 18% of women reported provider advice on nutrition (McDonald et al., 2011). The lower reported rate for nutrition counseling in their study is likely due to the specific question assessed. Women were asked if their provider had discussed specific caloric recommendations with them, not general nutrition recommendations as in our study.

There were multiple differences found between those who reported physical activity and nutrition counseling and those who did not. Women who were less educated,

lower income, non-White, multiparous, and who reported poorer perceived health were less likely to report physical activity counseling. Lack of provider advice, particularly among less educated and lower income women, may indicate differential counseling practices among providers. Alternately, this may reflect a problem with patient-provider communication, where providers are not counseling these women in a way that is understandable, meaningful, or memorable to them. The lower rate of physical activity counseling in Non-White women is concerning as many ethnic minority populations are less active and experience obesity at greater rates than White women (Carlson et al., 2009; Flegal et al., 2012). In women with poorer perceived health, clinical time may be devoted to discussing issues deemed more urgent than physical activity. Counseling rates on nutrition differed by pre-pregnancy BMI only, with obese women being the most likely to report counseling.

The second objective of this study was to determine the accuracy of provider counseling on weight gain, physical activity, and nutrition. Nearly 80% of women who received counseling on weight gain reported provider advice within IOM guidelines. This is a higher percentage than previously found in the literature (McDonald et al., 2011; Stotland et al., 2005), with the exception of a study published by Phelan and colleagues where 85% of women reported accurate provider counseling (Phelan et al., 2011). A small percentage of women (11.5%) reported provider advice in excess of IOM guidelines. These findings are promising, as it appears the IOM guidelines are becoming more widely known and accepted among prenatal care providers.

When examining specific recommendations for physical activity, providers largely encouraged women to be active during pregnancy. However, few women recalled

provider advice that described the duration, frequency, and intensity needed to meet current physical activity recommendations. A small number of women also reported provider counseling to keep their heart rate below 140 beats per minute. While heart rate recommendations were part of older ACOG guidelines for exercise during pregnancy (1985), this recommendation has not been the standard of practice for 20 years. Taken together, these findings may indicate that some healthcare providers lack knowledge about the current physical activity recommendations for women in pregnancy, or do not counsel women in such a way that they accurately recall recommendations.

Nutrition counseling included advice consistent with the USDA dietary guidelines; however, there was a general lack of detail in participant report of provider counseling. Many women simply reported provider advice to “eat healthy,” while not giving more specific recommendations. It is unclear if women received insufficient information on nutrition from their providers or if detailed advice was provided and simply not reported in this survey. Future studies should compare patient and provider reports of counseling in the prenatal care setting across health behaviors. Study designs should also allow for further probing of patient-report of provider counseling.

While not a primary objective of this study, it is worth noting that only 50% of women reported an intended weight gain within IOM guidelines. Among normal weight women, almost 40% stated an intended weight gain below guidelines. While weight gain below recommendations poses little risk to the mother, moderate to strong evidence suggests an association between inadequate weight gain and preterm delivery, low birth weight, small for gestational age infants, and failure to initiate breastfeeding (Viswanathan et al., 2008). Among overweight and obese women, 28% and 35% reported

an intended weight gain above guidelines, respectively. Excessive pregnancy weight gain is also associated with many adverse health outcomes for both mother and child (Mannan et al., 2013; Oken et al., 2008; Olson et al., 2009). It is critical that women understand the risks of both insufficient and excessive weight gain during pregnancy.

The final objective of this study was to examine if provider counseling on weight gain, physical activity, and nutrition was associated with women's intentions to meet respective recommendations. Supporting our hypothesis, we found significant associations between report of provider counseling and women's intentions to meet physical activity and nutrition recommendations. While report of provider counseling on weight gain was not associated with weight gain intentions in bivariate analyses, the amount of provider recommended weight gain was associated with women's intended weight gain in pounds. Furthermore, provider recommendations to gain below or above the IOM weight gain guidelines were associated with an increased risk of intended weight gain outside of guidelines. Together, these findings illustrate the potential role of the health care provider in guiding women's intentions to meet weight gain, physical activity, and nutrition recommendations.

Although healthcare providers are well positioned to counsel women on weight-related behaviors in pregnancy, there are also many barriers to provider counseling, including: insufficient training, concern about the sensitivity of the topic, and the perception that counseling is ineffective (Stotland et al., 2010). Lack of time has also been cited as a barrier to discussing weight management in the primary care setting (Hebert et al., 2012; Ruelaz et al., 2007). If providers are to consistently and correctly counsel patients, they must be given the appropriate intervention tools. Future studies

should examine the efficacy of provider-based interventions aimed at increasing the rate and accuracy of provider counseling on weight gain, physical activity, and nutrition. Trainings should not only inform providers of the correct guidelines, but also offer strategies for how to quickly and effectively disseminate this information to their patients.

This study contributes to the existing literature in multiple ways. We examined multiple health behaviors that all directly influence pregnancy outcomes. Assessment of women's report of provider counseling on physical activity and nutrition fills an existing gap in the literature, as there is limited data on the content of physical activity and nutrition counseling in the prenatal care setting. Findings provide evidence that healthcare providers influence women's weight-related intentions during pregnancy. However, further education and training for providers is needed to increase the percentage who counsel women on these topics and who do so accurately.

While this study contributes novel findings to the literature, multiple limitations must be noted. We used women's self-report of provider behavior and did not include provider assessments. Recall or confirmation bias may have led women to inaccurately report weight gain, physical activity, and dietary recommendations. Confirmation bias is the tendency to seek out or interpret information in ways that confirm existing beliefs (Nickerson, 1998). For example, women who were sedentary may have been less likely to hear provider recommendations to be more active. Furthermore, the study design did not allow for probing and follow up questions, which may have limited the breadth and depth of responses on physical activity and nutrition recommendations. Pre-pregnancy BMI was also determined through self-report, which may not have been accurate,

resulting in misclassification of BMI category and appropriate weight gain recommendations.

We did not assess women's actual pregnancy weight gain, physical activity, or dietary intake during pregnancy, but rather focused on women's intentions to engage in these behaviors. Future studies should follow women over time to see if provider advice is associated with women's weight-related behaviors during pregnancy. Finally, respondents were primarily white with high levels of education and income, which may limit the generalizability of study findings as these participants may self-select their providers and receive higher quality and greater continuity of care.

Overall rates of patient-reported provider counseling on weight gain, physical activity, and nutrition are less than ideal. However, when advice is reported it is largely consistent with current guidelines. It appears that providers may play an important role in guiding women's weight gain, physical activity, and nutrition intentions in pregnancy. It is imperative that providers are knowledgeable about current guidelines. Interventions are needed to increase the percentage of healthcare providers who counsel women accurately on weight gain and related behaviors during pregnancy.

Acknowledgements:

This work was partially supported by a SPARC Graduate Research Grant from the Office of the Vice President for Research at the University of South Carolina. The participation of KW in this research was supported in part by research training grant T32-GM081740 from the National Institutes of Health, National Institute of General Medical Sciences. The authors would like to thank all women who participated in this study. The

authors acknowledge and thank the contributions of Santiago Tovar-Diaz, who assisted with qualitative data coding.

Table 7.1: Participant Characteristics (N=188)

Characteristic	%	n
Age		
18-25 years	11.2	21
25-29 years	32.5	61
30-34 years	41.0	77
≥35 years	13.8	26
Missing	1.6	3
Race		
White	81.9	154
African American	10.6	20
American Indian	2.7	5
Asian	2.7	5
Other	1.6	3
Missing	0.5	1
Education		
High School graduate	5.9	11
Some college or technical school	22.3	42
College graduate	71.8	135
Employment		
Employed for wages full time	56.4	106
Employed for wages part time	10.6	20
Self-employed	10.1	19
Student	3.2	6
Homemaker	18.1	34
Out of work	1.6	3
Household annual income		
Less than \$25,000	11.2	21
\$25,000-\$49,999	16.0	30
\$50,000-\$74,999	18.1	34
\$75,000 or more	54.8	103
Marital Status		
Single	4.8	9
Married/ unmarried couple	93.6	176
Divorced	1.1	2
Missing	0.5	1
Parity		
0	52.1	98
1	31.4	59
2+	16.5	31
Smoking before pregnancy		
Yes	8.5	16
No	91.0	171
Missing	0.5	1
Prepregnancy BMI Category		
Normal weight	59.6	112
Overweight	19.2	36
Obese	21.3	40

Table 7.1 Continued

Characteristic	%	n
Perceived Health		
Excellent	10.6	20
Very good	44.7	84
Good	35.6	67
Fair	8.5	16
Missing	0.5	1

Table 7.2: Predictors of Patient Report of Being Counseled or Not on Weight Gain, Physical Activity, and Nutrition

Characteristic	Weight Gain			Physical Activity			Nutrition		
	Counseled % (n)	Not counseled % (n)	p-value	Counseled % (n)	Not counseled % (n)	p-value	Counseled % (n)	Not counseled % (n)	p-value
Overall	52.1 (98)	47.9 (90)		63.3 (119)	36.5 (69)		55.8 (105)	44.1 (83)	
Age, years ^a	30.5 ± 4.4	30.1 ± 3.9	0.522	30.6 ± 4.2	29.9 ± 4.1	0.235	30.1 ± 4.3	30.7 ± 3.9	0.368
Race ^b			0.910			0.021			0.093
White	52.6 (81)	47.4 (73)		66.9 (103)	33.1 (51)		58.4 (90)	41.6 (64)	
Non-White	51.5 (17)	48.5 (16)		45.5 (15)	54.6 (18)		42.4 (14)	57.6 (19)	
Education ^b			0.394			0.011			0.648
< College graduate	47.2 (25)	52.8 (28)		49.1 (26)	50.9 (27)		58.5 (31)	41.5 (22)	
College Graduate	54.1 (73)	45.9 (62)		68.9 (93)	31.1 (42)		54.8 (74)	45.2 (61)	
Employment ^b			0.213			0.129			0.722
Not employed	60.5 (26)	39.5 (17)		53.5 (23)	46.5 (20)		53.5 (23)	46.5 (20)	
Employed	49.7 (72)	50.3 (73)		66.2 (96)	33.8 (49)		56.6 (82)	43.5 (63)	
Household income ^b			0.064			0.007			0.652
< \$75,000	44.7 (38)	55.3 (47)		52.9 (45)	47.1 (40)		57.7 (49)	42.4 (36)	
≥ \$75,000 or more	58.3 (60)	41.8 (43)		71.8 (74)	28.2 (29)		54.4 (56)	45.6 (47)	
Marital Status ^c			0.359			0.101			0.912
Single	36.4 (4)	63.6 (7)		36.4 (4)	63.6 (7)		54.6 (6)	45.5 (5)	
Married/Couple	52.8 (93)	47.2 (83)		65.3 (115)	34.7 (61)		56.3 (99)	43.8 (77)	
Parity ^b			0.021			0.001			0.505
0	60.2 (59)	39.8 (39)		74.5 (73)	25.5 (25)		58.2 (57)	41.8 (41)	
≥ 1	43.3 (39)	56.7 (51)		51.1 (46)	48.9 (44)		53.3 (48)	46.7 (42)	
Prepregnancy smoking ^b			0.876			0.093			0.957
Yes	50.0 (8)	50.0 (8)		43.8 (7)	56.3 (9)		56.3 (9)	43.8 (7)	
No	52.1 (89)	48.0 (82)		64.9 (111)	35.1 (60)		55.6 (95)	44.4 (76)	
Prepregnancy BMI ^b			0.376			0.305			0.017
Normal weight	54.5 (61)	45.5 (51)		67.0 (75)	33.0 (37)		58.0 (65)	42.0 (47)	
Overweight	41.7 (15)	58.3 (21)		52.8 (19)	47.2 (17)		36.1 (13)	63.9 (23)	
Obese	55.0 (22)	45.0 (18)		62.5 (25)	37.5 (15)		67.5 (40)	32.5 (13)	

Table 7.2 Continued

Characteristic	Weight Gain			Physical Activity			Nutrition		
	Counseled % (n)	Not counseled % (n)	p-value	Counseled % (n)	Not counseled % (n)	p-value	Counseled % (n)	Not counseled % (n)	p-value
Perceived Health ^b			0.659			0.001			0.634
Excellent/very good	53.9 (56)	46.2 (48)		74.0 (77)	26.0 (27)		57.7 (60)	42.3 (44)	
Good/fair	50.6 (42)	49.4 (41)		50.6 (42)	49.4 (41)		54.2 (45)	45.8 (38)	

^aData are given as presented as mean \pm SD, t-test; ^bChi-square test; ^cFisher's exact test

Table 7.3: Patient Report of Provider Recommended Weight Gain and Patient's Intended Weight Gain

Provider recommended weight gain			
N=96, % (n)			
Pre-pregnancy body mass index category	Within guidelines	Below guidelines	Above guidelines
Normal weight	86.7 (52)	13.3 (8)	0.0 (0)
Overweight	64.3 (9)	0.0 (0)	35.7 (5)
Obese	68.2 (15)	4.6 (1)	27.3 (6)
Total	79.2 (76)	9.4 (9)	11.5 (11)

Patients' intended weight gain			
N=188, % (n)			
Normal weight	48.2 (54)	39.3 (44)	12.5 (14)
Overweight	63.9 (23)	8.3 (3)	27.8 (10)
Obese	47.5 (19)	17.5 (7)	35.0 (14)
Total	51.1 (96)	28.7 (54)	20.2 (38)

Table 7.4: Physical Activity and Nutrition Recommendations, Major Themes

Physical Activity (n=119)	N	%
Maintain previous exercise routine	43	36.1
Recommended types of activities	38	31.9
Walking	31	26.1
Prenatal yoga	18	15.1
Swimming	11	9.2
Recommended intensity level	26	21.8
Moderate	17	14.3
Light	4	3.4
Recommended frequency/duration	25	21.0
Meeting recommendations (30 min, 5+ days/week)	15	12.6
Less than recommendations (<30 min, <5days/week)	5	4.2
Use caution	11	9.2
Do what feels comfortable	9	7.6
Exercises to avoid	8	6.7
Exercise regularly	7	5.9
Keep heart rate below 140 beats per minute	6	5.0
Nutrition (n=104)	N	%
Fruits and vegetables	47	45.2
High protein	35	33.7
Eat healthy, balanced diet	34	32.7
Low carbohydrate or sugar intake	17	16.3
Drink water	15	14.4
Foods to avoid	14	13.5
Whole grains	12	11.5
Small, frequent meals	11	10.6
Unhealthy foods in moderation	8	7.7
Increase iron intake	6	5.8
Dairy	6	5.8
Limit processed foods	5	4.8

CHAPTER EIGHT

OVERALL SUMMARY AND CONCLUSIONS

High pre-pregnancy BMI and excessive gestational weight gain are associated with numerous adverse health outcomes for the mother and child. The American College of Obstetricians and Gynecologists (ACOG) recommend that health care providers determine a woman's body mass index at the initial prenatal visit, and counsel her on the benefits of appropriate weight gain, physical activity, and nutrition, with emphasis placed on the need to limit excessive weight gain to achieve optimal pregnancy outcomes (2013). However, there is a lack of data regarding provider compliance with and perceptions of counseling on weight gain, physical activity, and nutrition in the prenatal care setting. Furthermore, little is known about women's perceptions and intentions related to weight gain, physical activity, and nutrition during pregnancy, or the extent to which women are motivated to comply with provider recommendations. Guided by the Theory of Planned Behavior, the purpose of this dissertation was to use a mixed model design to examine patient and provider perceptions of weight gain, physical activity, and nutrition in pregnancy. This dissertation also examined the role of the health care provider in optimizing pregnancy weight gain. This chapter will summarize the major conclusions from each of the studies.

MANUSCRIPT 1

The first manuscript, titled “African American and White Women’s Perceptions of Weight Gain, Physical Activity, and Nutrition During Pregnancy: A Qualitative Study” addresses aim one: use the Theory of Planned Behavior to examine pregnant women’s attitudes, subjective norms, perceived behavioral control, and intentions towards weight gain, physical activity, and nutrition during pregnancy using qualitative research methods. To address this aim, we recruited 30 pregnant women (15 African American, 15 White) from two Ob/Gyn clinics in Columbia, SC to take part in one-on-one qualitative interviews.

Overall, we identified several gaps in knowledge as well as race differences in women’s perceptions and intentions toward weight gain, physical activity, and nutrition during pregnancy. Few women identified risks of excessive weight gain or benefits of physical activity as it related to the health of the baby. White women were more likely to express intentions to meet the weight gain, physical activity, and nutrition guidelines during pregnancy as compared to African American women. White women also appeared to be more concerned with excessive weight gain while African American women seemed more concerned with inadequate weight gain during pregnancy.

These findings have important intervention implications. First, interventions should seek to correct misperceptions about weight gain and related behaviors during pregnancy. For example, it is important to increase women’s awareness of how weight gain and physical activity directly impact the short and long term health of the fetus. Second, it may be necessary to culturally tailor interventions to better meet the specific needs of women to improve health outcomes.

MANUSCRIPT 2

The second manuscript, titled “Patient and Provider Perceptions of Weight Gain, Physical Activity, and Nutrition Counseling During Pregnancy: A Qualitative Study” addresses aim two: use the Theory of Planned Behavior to examine patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy using qualitative research methods. To address this aim, we recruited 30 pregnant women (15 African American, 15 White) and 11 prenatal care providers (5 Attending Physicians, 5 Residents, 1 Nurse Practitioner) from two Ob/Gyn clinics in Columbia, SC to take part in qualitative interviews. The women that were recruited for this study were the same women as described for manuscript one.

Overall we found that the majority of women and providers reported counseling on weight gain, physical activity, and nutrition during prenatal care visits (87-100%). Discussion of counseling content was largely consistent between patients and providers. However, counseling was limited and not fully consistent with current guidelines. The majority of women responded positively to provider counseling, although some stated they wanted additional information. Providers discussed many barriers to lifestyle counseling but they also said they wanted to receive additional training to better prepare them to counsel women on weight gain, physical activity, and nutrition.

In light of the obesity epidemic and high prevalence of women with excessive pregnancy weight gain, providers should be better equipped to discuss weight gain, physical activity, and nutrition with their patients. It may be helpful to integrate a standard nutrition and physical activity curriculum into the existing medical school curriculum. Additional training opportunities and continuing education programs should

be available for current residents and attending physicians. It may also be helpful for prenatal care settings to integrate other health professionals, such as nutritionists, health educators, and physical activity specialists into the existing healthcare system through a referral system or a model of integrated care. Future research is needed to determine the efficacy of different intervention approaches to increase the percentage of women who are counseled accurately and effectively on weight gain, physical activity, and nutrition during pregnancy.

MANUSCRIPT 3

The third manuscript, titled “Pregnant Women’s Perceptions of Weight Gain, Physical Activity, and Nutrition Using Theory of Planned Behavior Constructs” addresses aim three: use the Theory of Planned Behavior to explore women’s beliefs regarding weight gain, physical activity, and nutrition in pregnancy and to examine if attitudes, subjective norms, and perceived behavioral control predict weight gain, physical activity, and nutrition intentions during pregnancy. To address this aim, we recruited women between 20-30 weeks gestation from the United States and Canada to complete a cross-sectional Internet-based survey (N=189).

Salient beliefs toward weight gain, physical activity, and nutrition were consistent with the existing literature in non-pregnant populations, with the addition of many pregnancy-specific beliefs. For example, women discussed how appropriate weight gain, regular physical activity, and healthy eating during pregnancy would benefit the health of their baby. A commonly discussed advantage of physical activity was that it would lead to an easier and shorter labor and delivery. Nausea was cited as a barrier across topics,

and pregnancy-related cravings were discussed as a barrier to appropriate weight gain and healthy eating.

The Theory of Planned Behavior constructs made varying contributions in the prediction of women's intentions to meet weight gain, physical activity, and nutrition recommendations. Specifically, subjective norm was the only variable significantly associated with weight gain intentions in final regression models. For physical activity, a significant association was found for perceived behavioral control only. Finally, for nutrition, we found that attitude, subjective norm, and perceived behavioral control all explained significant variation in the final model.

Overall, findings indicate that interventions targeting multiple behaviors require specific attention to each of the behaviors to optimize their efficacy. Interventions targeting nutrition behaviors in pregnancy may be more effective if they seek to improve women's attitudes toward healthy eating, increase perceived pressure to eat a healthy diet during pregnancy, and increase perceived sense of control by teaching women ways to overcome barriers to healthy eating. To increase intentions to engage in physical activity it may be most effective to target perceived behavioral control. Finally, weight gain interventions may experience greater success if targeting the construct of subjective norm, possibly through involvement of family, health care providers, and friends.

MANUSCRIPT 4

The fourth manuscript, titled "Provider Counseling and Women's Intentions to Meet Weight Gain, Physical Activity, and Nutrition Recommendations During Pregnancy" addresses aim four: to examine women's report of provider counseling on

weight gain, physical activity, and nutrition during pregnancy and to determine if provider counseling is associated with weight gain, physical activity, and nutrition intentions during pregnancy. To address this aim, we recruited women between 20-30 weeks gestation from the United States and Canada to complete a cross-sectional Internet-based survey (N=189). These participants were the same as described for manuscript three.

Overall rates of patient-reported provider counseling on weight gain, physical activity, and nutrition were less than ideal (52-63%). However, when advice was reported it was largely consistent with current guidelines, although limited in scope. Analyses supported our hypothesis that providers play an important role in guiding women's weight gain, physical activity, and nutrition intentions in pregnancy.

It is critical that providers are knowledgeable about current weight gain, physical activity, and nutrition guidelines during pregnancy and discuss these recommendations with their patients. Future studies should examine the efficacy of provider-based interventions aimed at increasing the rate and accuracy of provider counseling on weight gain and related topics. Trainings should not only inform providers of the correct guidelines, but also offer strategies for how to quickly and effectively disseminate this information to their patients.

LIMITATIONS AND STRENGTHS

This dissertation has limitations that should be noted. For manuscripts one and two we recruited women and health care providers from two clinics in Columbia, South Carolina, therefore the findings have limited generalizability. The sample that took part in

qualitative interviews was relatively small (30 patients and 11 providers). However, major themes in qualitative research have been identified in as few as 6 interviews (Guest et al., 2006). Furthermore, it appears data saturation was reached as no new themes emerged in the final interviews.

For manuscripts three and four, the participants who completed the Internet-based survey were primarily White with high levels of education and income. This may limit the generalizability of study findings. Furthermore, this may restrict the range of responses, thus limiting the variance we were able to explain in behavioral intentions.

Due to the cross-sectional nature of the studies, we did not assess if women's intentions to meet recommendations translated into women's behaviors. However, behavioral intention has shown to be the strongest predictor of actual behavior across a variety of populations and behaviors (Armitage & Conner, 2001), and intended pregnancy weight gain is strongly associated with actual weight gain (Cogswell et al., 1999). Given the study design, we were also unable to assess if provider recommendations prospectively predict women's behaviors. However, findings provide initial evidence that provider counseling is associated with women's behavioral intentions.

Across studies, self-selection bias may be present as participants were volunteers who may have been more interested in weight gain, physical activity, or nutrition. Furthermore, all information was self-reported and therefore subject to recall and social desirability bias.

Despite these limitations, this dissertation also has notable strengths. For manuscripts one and two, we used qualitative methods which provide rich data that could

not be readily captured through a quantitative survey. We examined race differences in women's perceptions, something that is notably absent from the existing literature. Furthermore, assessment of both patient and provider perceptions of counseling on weight gain and related behaviors adds to the literature as existing studies have commonly only assessed patient or provider perceptions, not both.

Across studies, we explored women's perceptions of three distinct topics: weight gain, physical activity, and nutrition. This breadth contributes to the literature as few studies have examined women's perceptions toward all three of these importantly related topics. This dissertation also examined women's report of provider counseling on these topics. This fills an existing gap in the literature, as there is limited data on the content of provider counseling in the prenatal care setting, particularly for physical activity and nutrition. A final and important strength of this dissertation is the use of theoretical grounding (i.e., Theory of Planned Behavior) in all the studies.

CONCLUSION

Results indicate that the Theory of Planned Behavior is a useful framework to assess women's and health care providers' perceptions of weight gain, physical activity, and nutrition during pregnancy. Furthermore, the theory constructs explained significant variance in women's weight gain, physical activity, and nutrition *intentions* during pregnancy. Future studies should follow women over time to examine the utility of the theory for predicting weight gain, physical activity, and dietary *behaviors* in pregnant women. Findings from this study can help guide the development of future interventions

to help women gain an appropriate amount of weight in pregnancy and meet physical activity and nutrition guidelines.

Findings also suggest that provider counseling on weight gain, physical activity, and nutrition in the prenatal care setting is limited in scope. However, women responded positively to provider counseling in qualitative interviews, and quantitative analyses revealed that provider counseling is associated with women's weight-related intentions. Future studies are needed to determine if provider counseling prospectively influences women's behaviors during pregnancy. It is also necessary to increase the percentage of providers who are knowledgeable about current weight gain, physical activity, and dietary guidelines during pregnancy and who discuss these recommendations with their patients. Future studies should examine the efficacy of provider-based interventions aimed at increasing the rate and accuracy of provider counseling on weight gain and related behaviors. Trainings should offer strategies for how to overcome the perceived barriers to counseling identified in this dissertation and to quickly and effectively disseminate information to their patients.

REFERENCES

- Abrams, B., Altman, S. L., & Pickett, K. E. (2000). Pregnancy weight gain: still controversial. *Am J Clin Nutr*, *71*, 1233S-1241S.
- Adams, K. M., Kohlmeier, M., & Zeisel, S. H. (2010). Nutrition education in U.S. medical schools: latest update of a national survey. *Acad Med*, *85*(9), 1537-1542.
- Aittasalo, M., Pasanen, M., Fogelholm, M., & Ojala, K. (2010). Validity and repeatability of a short pregnancy leisure time physical activity questionnaire. *J Phys Act Health*, *7*(1), 109-118.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: from cognition to behavior* (pp. 11-39): Springer Berlin Heidelberg.
- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.
- Ajzen, I. (2002, January, 2006). Constructing a TpB Questionnaire: Conceptual and Methodological Considerations. Retrieved December 5, 2013, from http://chuang.epage.au.edu.tw/ezfiles/168/1168/attach/20/pta_41176_7688352_57138.pdf
- Ajzen, I. (2004). Frequently Asked Questions. Retrieved December 5, 2013, from <http://people.umass.edu/aizen/faq.html>
- Ajzen, I., & Fishbein, M. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. MA: Addison-Wesley.

- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Althuisen, E., van Poppel, M. N., Seidell, J. C., & van Mechelen, W. (2009). Correlates of absolute and excessive weight gain during pregnancy. *J Womens Health (Larchmt)*, 18(10), 1559-1566.
- American College of Obstetricians and Gynecologists. (1985). Exercise during pregnancy and the postnatal period *ACOG Technical Bulletin: Women and exercise* (Vol. 87). Washington, DC: ACOG.
- American College of Obstetricians and Gynecologists. (2002). ACOG committee opinion no 267: exercise during pregnancy and the postpartum period. *Int J Gynaecol Obstet*, 77(1), 79-81.
- American College of Obstetricians and Gynecologists. (2013). ACOG Committee opinion no. 548: weight gain during pregnancy. *Obstet Gynecol*, 121(1), 210-212.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *Br J Soc Psychol*, 40(Pt 4), 471-499.
- Artal, R., Catanzaro, R. B., Gavard, J. A., Mostello, D. J., & Friganza, J. C. (2007). A lifestyle intervention of weight-gain restriction: diet and exercise in obese women with gestational diabetes mellitus. *Applied Physiology, Nutrition, and Metabolism*, 32, 596-601.
- Asbee, S. M., Jenkins, T. R., Butler, J. R., White, J., Elliot, M., & Rutledge, A. (2009). Preventing excessive weight gain during pregnancy through dietary and lifestyle counseling: a randomized controlled trial. *Obstet Gynecol*, 113(2), 305-311.

- Barker, D. J., Osmond, C., Golding, J., Kuh, D., & Wadsworth, M. E. (1989). Growth in utero, blood pressure in childhood and adult life, and mortality from cardiovascular disease. *BMJ*, *298*(6673), 564-567.
- Bassett-Gunter, R. L., Levy-Milne, R., Naylor, P. J., Symons Downs, D., Benoit, C., Warburton, D. E., . . . Rhodes, R. E. (2013). Oh baby! Motivation for healthy eating during parenthood transitions: a longitudinal examination with a theory of planned behavior perspective. *Int J Behav Nutr Phys Act*, *10*(1), 88.
- Bertolotto, A., Volpe, L., Calianno, A., Pugliese, M. C., Lencioni, C., Resi, V., . . . Di Cianni, G. (2010). Physical activity and dietary habits during pregnancy: effects on glucose tolerance. *J Matern Fetal Neonatal Med*, *23*(11), 1310-1314.
- Bipartisan Policy Center, American College of Sports Medicine, & Alliance for a Healthier Generation. (2014). Teaching nutrition and physical activity in medical school: training doctors for prevention-oriented care Washington DC.
- Blue, C. L. (1995). The predictive capacity of the theory of reasoned action and the theory of planned behavior in exercise research: an integrated literature review. *Res Nurs Health*, *18*(2), 105-121.
- Borodulin, K. M., Evenson, K. R., Wen, F., Herring, A. H., & Benson, A. M. (2008). Physical activity patterns during pregnancy. *Med Sci Sports Exerc*, *40*(11), 1901-1908.
- Bowman, S. A., & Vinyard, B. T. (2004). Fast food consumption of U.S. adults: impact on energy and nutrient intakes and overweight status. *J Am Coll Nutr*, *23*(2), 163-168.

- Brooten, D., Youngblut, J. M., Golembeski, S., Magnus, M. H., & Hannan, J. (2012). Perceived weight gain, risk, and nutrition in pregnancy in five racial groups. *J Am Acad Nurse Pract*, *24*(1), 32-42.
- California Department of Public Health. (2013). California MyPlate for Moms. Retrieved Nov 1, 2013, from <http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforMoms.pdf>.
- Carlson, S. A., Densmore, D., Fulton, J. E., Yore, M. M., & Kohl, H. W., 3rd. (2009). Differences in physical activity prevalence and trends from 3 U.S. surveillance systems: NHIS, NHANES, and BRFSS. *J Phys Act Health*, *6 Suppl 1*, S18-27.
- Carreno, C. A., Clifton, R. G., Hauth, J. C., Myatt, L., Roberts, J. M., Spong, C. Y., . . . Human Development Maternal-Fetal Medicine Units, N. (2012). Excessive early gestational weight gain and risk of gestational diabetes mellitus in nulliparous women. *Obstet Gynecol*, *119*(6), 1227-1233.
- Chang, T., Llanes, M., Gold, K. J., & Fetters, M. D. (2013). Perspectives about and approaches to weight gain in pregnancy: a qualitative study of physicians and nurse midwives. *BMC Pregnancy Childbirth*, *13*, 47.
- Cioffi, J., Schmied, V., Dahlen, H., Mills, A., Thornton, C., Duff, M., . . . Kolt, G. S. (2010). Physical activity in pregnancy: women's perceptions, practices, and influencing factors. *J Midwifery Womens Health*, *55*(5), 455-461.
- Claesson, I.-M., Sydsjo, G., Brynhildsen, J., Cedergren, M., Jeppsson, A., Nystrom, F., . . . Josefsson, A. (2008). Weight gain restriction for obese pregnant women: a case-control intervention study. *BJOG*, *115*, 44-50.

- Clapp, J. F., 3rd. (2000). Exercise during pregnancy. A clinical update. *Clin Sports Med*, 19(2), 273-286.
- Clapp, J. F., 3rd, Kim, H., Burciu, B., & Lopez, B. (2000). Beginning regular exercise in early pregnancy: effect on fetoplacental growth. *Am J Obstet Gynecol*, 183(6), 1484-1488.
- Clarke, P. E., & Gross, H. (2004). Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery*, 20(2), 133-141.
- Cogswell, M. E., Scanlon, K. S., Beck Fein, S., & Schieve, L. A. (1999). Medically advised, mother's personal target, and actual weight gain during pregnancy. *Obstet Gynecol*, 94(4), 616-622.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155–159.
- Conner, M., Norman, P., & Bell, R. (2002). The theory of planned behavior and healthy eating. *Health Psychol*, 21(2), 194-201.
- Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., . . . Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*, 35(8), 1381-1395.
- Da Costa, D., Rippen, N., Dritsa, M., & Ring, A. (2003). Self-reported leisure-time physical activity during pregnancy and relationship to psychological well-being. *J Psychosom Obstet Gynaecol*, 24(2), 111-119.
- Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? *Am J Clin Nutr*, 87(5), 1107-1117.
- de la Torre, L., Flick, A. A., Istwan, N., Rhea, D., Cordova, Y., Dieguez, C., . . . Gonzalez-Quintero, V. H. (2011). The effect of new antepartum weight gain

- guidelines and prepregnancy body mass index on the development of pregnancy-related hypertension. *Am J Perinatol*, 28(4), 285-292.
- Deierlein, A. L., Siega-Riz, A. M., Herring, A. H., Adair, L. S., & Daniels, J. L. (2012). Gestational weight gain and predicted changes in offspring anthropometrics between early infancy and 3 years. *Pediatr Obes*, 7, 134-142.
- DeVader, S. R., Neeley, H. L., Myles, T. D., & Leet, T. L. (2007). Evaluation of Gestational Weight Gain Guidelines for Women with Normal Prepregnancy Body Mass Index. *Obstet Gynecol*, 110(4), 745-751.
- Doran, F., & O'Brien, A. P. (2007). A brief report of attitudes towards physical activity during pregnancy. *Health Promot J Austr*, 18(2), 155-158.
- Downs, D. S., & Hausenblas, H. A. (2003). Exercising for two: examining pregnant women's second trimester exercise intention and behavior using the framework of the theory of planned behavior. *Womens Health Issues*, 13(6), 222-228.
- Downs, D. S., & Hausenblas, H. A. (2005). Elicitation studies and the theory of planned behavior: a systematic review of exercise beliefs. *Psychology of Sport and Exercise*, 6(1), 1-31.
- Dunlop, A. L., Kramer, M. R., Hogue, C. J., Menon, R., & Ramakrishan, U. (2011). Racial disparities in preterm birth: an overview of the potential role of nutrient deficiencies. *Acta Obstet Gynecol Scand*, 90(12), 1332-1341.
- Duthie, E. A., Drew, E. M., & Flynn, K. E. (2013). Patient-provider communication about gestational weight gain among nulliparous women: a qualitative study of the views of obstetricians and first-time pregnant women. *BMC Pregnancy Childbirth*, 13, 231.

- Dyer, J. S., & Rosenfeld, C. R. (2011). Metabolic imprinting by prenatal, perinatal, and postnatal overnutrition: a review. *Semin Reprod Med*, 29(3), 266-276.
- Eastman, N., & Helman, L. (1966). *Williams Obstetrics* (13th ed. Vol. 326). New York: Appleton-Century-Crofts.
- Eikenberry, N., & Smith, C. (2004). Healthful eating: perceptions, motivations, barriers, and promoters in low-income Minnesota communities. *J Am Diet Assoc*, 104(7), 1158-1161.
- Ekelund, U., Sepp, H., Brage, S., Becker, W., Jakes, R., Hennings, M., & Wareham, N. J. (2006). Criterion-related validity of the last 7-day, short form of the International Physical Activity Questionnaire in Swedish adults. *Public Health Nutr*, 9(2), 258-265.
- Evenson, K. R., & Bradley, C. B. (2010). Beliefs about exercise and physical activity among pregnant women. *Patient Educ Couns*, 79(1), 124-129.
- Evenson, K. R., Buchner, D. M., & Morland, K. B. (2012). Objective measurement of physical activity and sedentary behavior among US adults aged 60 years or older. *Prev Chronic Dis*, 9, E26.
- Evenson, K. R., Moos, M. K., Carrier, K., & Siega-Riz, A. M. (2009). Perceived barriers to physical activity among pregnant women. *Matern Child Health J*, 13(3), 364-375.
- Evenson, K. R., Savitz, D. A., & Huston, S. L. (2004). Leisure-time physical activity among pregnant women in the US. *Paediatr Perinat Epidemiol*, 18(6), 400-407.

- Evenson, K. R., & Wen, F. (2010). National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. *Prev Med*, 50(3), 123-128.
- Evenson, K. R., & Wen, F. (2011). Prevalence and correlates of objectively measured physical activity and sedentary behavior among US pregnant women. *Prev Med*, 53(1-2), 39-43.
- Faulkner, G., & Biddle, S. (2001). Predicting physical activity promotion in health care settings. *Am J Health Promot*, 16(2), 98-106.
- Ferrari, R. M., & Siega-Riz, A. M. (2013). Provider advice about pregnancy weight gain and adequacy of weight gain. *Matern Child Health J*, 17(2), 256-264.
- Ferrari, R. M., Siega-Riz, A. M., Evenson, K. R., Moos, M. K., & Carrier, K. S. (2013). A qualitative study of women's perceptions of provider advice about diet and physical activity during pregnancy. *Patient Educ Couns*, 91(3), 372-377.
- Ferraro, Z. M., Gaudet, L., & Adamo, K. B. (2012). The Potential Impact of Physical Activity During Pregnancy on Maternal and Neonatal Outcomes. *Obstet Gynecol Surv*, 67(2), 99-110.
- Fisher, S. C., Kim, S. Y., Sharma, A. J., Rochat, R., & Morrow, B. (2013). Is obesity still increasing among pregnant women? Prepregnancy obesity trends in 20 states, 2003-2009. *Prev Med*, 56(6), 372-378.
- Flegal, K. M., Carroll, M. D., Kit, B. K., & Ogden, C. L. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA*, 307(5), 491-497.

- Fowles, E. R. (2002). Comparing pregnant women's nutritional knowledge to their actual dietary intake. *MCN Am J Matern Child Nurs*, 27(3), 171-177.
- Fraser, A., Tilling, K., Macdonald-Wallis, C., Sattar, N., Brion, M. J., Benfield, L., . . . Lawlor, D. A. (2010). Association of maternal weight gain in pregnancy with offspring obesity and metabolic and vascular traits in childhood. *Circulation*, 121(23), 2557-2564.
- Fryar, C. D., & Ervin, R. B. (2013). *Caloric intake from fast food among adults: United States, 2007-2010. NCHS data brief, no 114*. Hyattsville, MD: National Center for Health Statistics.
- Gibson, K. S., Waters, T. P., & Catalano, P. M. (2012). Maternal weight gain in women who develop gestational diabetes mellitus. *Obstet Gynecol*, 119, 560-565.
- Godin, G., Belanger-Gravel, A., Eccles, M., & Grimshaw, J. (2008). Healthcare professionals' intentions and behaviours: a systematic review of studies based on social cognitive theories. *Implement Sci*, 3, 36.
- Godin, G., & Kok, G. (1996). The theory of planned behavior: a review of its applications to health-related behaviors. *Am J Health Promot*, 11(2), 87-98.
- Goodrich, K., Cregger, M., Wilcox, S., & Liu, J. (2013). A qualitative study of factors affecting pregnancy weight gain in African American women. *Matern Child Health J*, 17(3), 432-440.
- Green, S. B. (1991). How many subjects does it take to do a regression analysis? . *Multivariate Behav Res*, 26(3), 499-510.
- Gross, H., & Bee, P. E. (2004). Perceptions of effective advice in pregnancy – The case of activity. *Clinical Effectiveness in Nursing*, 8, 161-169.

- Groth, S. W., & Kearney, M. H. (2009). Diverse women's beliefs about weight gain in pregnancy. *J Midwifery Womens Health, 54*(6), 452-457.
- Groth, S. W., Morrison-Beedy, D., & Meng, Y. (2012). How pregnant African American women view pregnancy weight gain. *J Obstet Gynecol Neonatal Nurs, 41*(6), 798-808.
- Guelinckx, I., Devlieger, R., Beckers, K., & Vansant, G. (2008). Maternal obesity: pregnancy complications, gestational weight gain and nutrition. *Obes Rev, 9*(2), 140-150.
- Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. *Field Methods, 18*(59), 59-82.
- Hagger, M. S., Chatzisarantis, N. L., & Biddle, S. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *J Sport Exerc Psychol, 24*, 3-32.
- Hales, D., Evenson, K. R., Wen, F., & Wilcox, S. (2010). Postpartum physical activity: measuring theory of planned behavior constructs. *Am J Health Behav, 34*(4), 387-401.
- Hardeman, W., Johnston, M., Johnston, D. W., Bonnetti, D., Wareham, N. J., & Kinmonth, A. L. (2002). Application of the theory of planned behaviour in behaviour change interventions: a systematic review. *Psychology and Health, 17*(2), 123-158.

- Harris, S. T., Liu, J., Wilcox, S., Moran, R., & Gallagher, A. (2014). Exercise During Pregnancy and its Association with Gestational Weight Gain. *Matern Child Health J.*
- Hausenblas, H., Downs, D. S., Giacobbi, P., Tuccitto, D., & Cook, B. (2008). A multilevel examination of exercise intention and behavior during pregnancy. *Soc Sci Med*, 66(12), 2555-2561.
- Hausenblas, H., & Symons Downs, D. (2004). Prospective examination of the theory of planned behavior applied to exercise behavior during women's first trimester of pregnancy. *J Reprod Infant Psychol*, 22(3), 199-210.
- Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the Theories of Reasoned Action and Planned Behavior to Exercise Behavior: A Meta-Analysis. *J Sport Exerc Psychol*, 19, 36-51.
- Headen, I. E., Davis, E. M., Mujahid, M. S., & Abrams, B. (2012). Racial-ethnic differences in pregnancy-related weight. *Adv Nutr*, 3(1), 83-94.
- Hebert, E. T., Caughy, M. O., & Shuval, K. (2012). Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *Br J Sports Med*, 46(9), 625-631.
- Hedderson, M. M., Gunderson, E. P., & Ferrara, A. (2010). Gestational weight gain and risk of gestational diabetes mellitus *Obstet Gynecol*, 115, 597-604.
- Herbert, K. E., Urmie, J. M., Newland, B. A., & Farris, K. B. (2006). Prediction of pharmacist intention to provide Medicare medication therapy management services using the theory of planned behavior. *Res Social Adm Pharm*, 2(3), 299-314.

- Hernandez, D. C. (2012). Gestational weight gain as a predictor of longitudinal body mass index transitions among socioeconomically disadvantaged women. *J Womens Health (Larchmt)*, 21(10), 1082-1090.
- Herring, S. J., Henry, T. Q., Klotz, A. A., Foster, G. D., & Whitaker, R. C. (2012). Perceptions of low-income African-American mothers about excessive gestational weight gain. *Matern Child Health J*, 16(9), 1837-1843.
- Herring, S. J., Nelson, D. B., Davey, A., Klotz, A. A., Dibble, L. V., Oken, E., & Foster, G. D. (2012). Determinants of excessive gestational weight gain in urban, low-income women. *Womens Health Issues*, 22(5), e439-446.
- Hesse, B. W., Nelson, D. E., Kreps, G. L., Croyle, R. T., Arora, N. K., Rimer, B. K., & Viswanath, K. (2005). Trust and sources of health information: the impact of the Internet and its implications for health care providers: findings from the first Health Information National Trends Survey. *Arch Intern Med*, 165(22), 2618-2624.
- Institute of Medicine. (2007). Influence of Pregnancy Weight on Maternal and Child Health: Workshop Report. Washington DC.
- Institute of Medicine and National Research Council. (2009). Weight Gain During Pregnancy: Reexamining the Guidelines. Washington DC.
- Institute of Medicine: Committee on Nutritional Status During Pregnancy and Lactation. (1990). Nutrition During Pregnancy: Part I: Weight Gain, Part II: Nutrient Supplements. Washington, DC.

- Jiang, H., Qian, X., Li, M., Lynn, H., Fan, Y., He, F., & He, G. (2012). Can physical activity reduce excessive gestational weight gain? Findings from a Chinese urban pregnant women cohort study. *Int J Behav Nutr Phys Act*, *9*, 12.
- Kaiser, L., & Allen, L. H. (2008). Position of the American Dietetic Association: nutrition and lifestyle for a healthy pregnancy outcome. *J Am Diet Assoc*, *108*(3), 553-561.
- Kasawara, K. T., do Nascimento, S. L., Costa, M. L., Surita, F. G., & e Silva, J. L. (2012). Exercise and physical activity in the prevention of pre-eclampsia: systematic review. *Acta Obstet Gynecol Scand*, *91*(10), 1147-1157.
- Kiel, D. W., Dodson, E. A., Artal, R., Boehmer, T. K., & Leet, T. L. (2007). Gestational weight gain and pregnancy outcomes in obese women: how much is enough? *Obstet Gynecol*, *110*(4), 752-758.
- Kramer, M. S., & McDonald, S. W. (2006). Aerobic exercise for women during pregnancy. *Cochrane Database Syst Rev*(3), CD000180.
- Krebs-Smith, S. M., Guenther, P. M., Subar, A. F., Kirkpatrick, S. I., & Dodd, K. W. (2010). Americans do not meet federal dietary recommendations. *J Nutr*, *140*(10), 1832-1838.
- Lawlor, D. A., Fraser, A., Lindsay, R. S., Ness, A., Dabelea, D., Catalano, P., . . . Nelson, S. M. (2010). Association of existing diabetes, gestational diabetes and glycosuria in pregnancy with macrosomia and offspring body mass index, waist and fat mass in later childhood: findings from a prospective pregnancy cohort. *Diabetologia*, *53*(1), 89-97.

- Leppanen, M., Aittasalo, M., Raitanen, J., Kinnunen, T. I., Kujala, U. M., & Luoto, R. (2014). Physical Activity During Pregnancy: Predictors of Change, Perceived Support and Barriers Among Women at Increased Risk of Gestational Diabetes. *Matern Child Health J.*
- Lin, J. S., O'Connor, E., Whitlock, E. P., Beil, T. L., Zuber, S. P., Perdue, L. A., . . . Lutz, K. (2010). Behavioral Counseling to Promote Physical Activity and a Healthful Diet to Prevent Cardiovascular Disease in Adults: Update of the Evidence for the U.S. Preventive Services Task Force. *Ann Intern Med.*
- Liu, J., Gallagher, A., Carta, C. M., Torres, M. E., Moran, R., & Wilcox, S. (2012). An examination of the association between excessive gestational weight gain and pregnancy-induced hypertension in women from South Carolina. *Am. J. Epidemiol., 175*(suppl 11), 538.
- Liu, J., Wilcox, S., Whitaker, K., Blake, C., & Addy, C. (2014). Preventing Excessive Weight Gain During Pregnancy and Promoting Postpartum Weight Loss: A Pilot Lifestyle Intervention for Overweight and Obese African American Women. *Matern Child Health J.*
- Lokey, E. A., Tran, Z. V., Wells, C. L., Myers, B. C., & Tran, A. C. (1991). Effects of physical exercise on pregnancy outcomes: a meta-analytic review. *Med Sci Sports Exerc, 23*(11), 1234-1239.
- Loprinzi, P. D., Fitzgerald, E. M., & Cardinal, B. J. (2012). Physical activity and depression symptoms among pregnant women from the National Health and Nutrition Examination Survey 2005-2006. *J Obstet Gynecol Neonatal Nurs, 41*(2), 227-235.

- Mannan, M., Doi, S. A., & Mamun, A. A. (2013). Association between weight gain during pregnancy and postpartum weight retention and obesity: a bias-adjusted meta-analysis. *Nutr Rev*, *71*(6), 343-352.
- Martin-Gronert, M. S., & Ozanne, S. E. (2006). Maternal nutrition during pregnancy and health of the offspring. *Biochem Soc Trans*, *34*(Pt 5), 779-782.
- Mattran, K., Mudd, L. M., Rudey, R. A., & Kelly, J. S. (2011). Leisure-time physical activity during pregnancy and offspring size at 18 to 24 months. *J Phys Act Health*, *8*(5), 655-662.
- McBride, C. M., Emmons, K. M., & Lipkus, I. M. (2003). Understanding the potential of teachable moments: the case of smoking cessation. *Health Educ Res*, *18*(2), 156-170.
- McConnon, A., Raats, M., Astrup, A., Bajzova, M., Handjieva-Darlenska, T., Lindroos, A. K., . . . Shepherd, R. (2012). Application of the Theory of Planned Behaviour to weight control in an overweight cohort. Results from a pan-European dietary intervention trial (DiOGenes). *Appetite*, *58*(1), 313-318.
- McDonald, S. D., Pullenayegum, E., Taylor, V. H., Lutsiv, O., Bracken, K., Good, C., . . . Sword, W. (2011). Despite 2009 guidelines, few women report being counseled correctly about weight gain during pregnancy. *Am J Obstet Gynecol*, *205*(4), 333 e331-336.
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: a meta-analysis. *Health Psychology Review*, *5*(2), 97-144.

- Melzer, K., Schutz, Y., Boulvain, M., & Kayser, B. (2010). Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. *Sports Med*, 40(6), 493-507.
- Millstein, S. G. (1996). Utility of the theories of reasoned action and planned behavior for predicting physician behavior: a prospective analysis. *Health Psychol*, 15(5), 398-402.
- Montano, D. E., & Kasprzyk, D. (2002). The Theory of Reasoned Action and The Theory of Planned Behavior. In K. Glanz, B. K. Rimer & M. C. Lewis (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice* (3rd ed., pp. 67-97). San Francisco, CA: Jossey-Bass.
- Moore Simas, T. A., Waring, M. E., Sullivan, G. M., Liao, X., Rosal, M. C., Hardy, J. R., & Berry, R. E., Jr. (2013). Institute of medicine 2009 gestational weight gain guideline knowledge: survey of obstetrics/gynecology and family medicine residents of the United States. *Birth*, 40(4), 237-246.
- Morris, S. N., & Johnson, N. R. (2005). Exercise during pregnancy: a critical appraisal of the literature. *J Reprod Med*, 50(3), 181-188.
- Mudd, L. M., Owe, K. M., Mottola, M. F., & Pivarnik, J. M. (2013). Health benefits of physical activity during pregnancy: an international perspective. *Med Sci Sports Exerc*, 45(2), 268-277.
- Muktabhant, B., Lumbiganon, P., Ngamjarus, C., & Dowswell, T. (2012). Interventions for preventing excessive weight gain during pregnancy. *Cochrane Database Syst Rev*, 4, CD007145.

- National Research Council. (1970). *Maternal Nutrition and the Course of Pregnancy*.
Report of the Committee on Maternal Nutrition, Food and Nutrition Board.
Washington, DC: National Academy of Sciences
- National Research Council. (2011). *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: National Academies Press.
- National Research Council and Institute of Medicine. (2007). *Influences of Pregnancy Weight on Maternal and Child Health: Workshop Report*. Washington DC: the National Academies Press.
- Nehring, I., Schmoll, S., Beyerlein, A., Hauner, H., & von Kries, R. (2011). Gestational weight gain and long-term postpartum weight retention: a meta-analysis. *Am J Clin Nutr*, *94*(5), 1225-1231.
- Nickerson, R. S. (1998). Confirmation Bias: A Ubiquitous Phenomenon in Many Guises. *Review of General Psychology*, *2*(2), 175-220.
- Oken, E., Rifas-Shiman, S. L., Field, A. E., Frazier, A. L., & Gillman, M. W. (2008). Maternal gestational weight gain and offspring weight in adolescence. *Obstet Gynecol*, *112*(5), 999-1006.
- Oken, E., Taveras, E. M., Kleinman, K. P., Rich-Edwards, J. W., & Gillman, M. W. (2007). Gestational weight gain and child adiposity at age 3 years. *Am J Obstet Gynecol*, *196*(4), 322 e321-328.
- Olson, C. M. (2008). Achieving a healthy weight gain during pregnancy. *Annu Rev Nutr*, *28*, 411-423.

- Olson, C. M., & Strawderman, M. S. (2003). Modifiable behavioral factors in a biopsychosocial model predict inadequate and excessive gestational weight gain. *J Am Diet Assoc, 103*(1), 48-54.
- Olson, C. M., Strawderman, M. S., & Dennison, B. A. (2009). Maternal weight gain during pregnancy and child weight at age 3 years. *Matern Child Health J, 13*(6), 839-846.
- Orow, G., Kinmonth, A. L., Sanderson, S., & Sutton, S. (2012). Effectiveness of physical activity promotion based in primary care: systematic review and meta-analysis of randomised controlled trials. *BMJ, 344*, e1389.
- Ostlund, I., Haglund, B., & Hanson, U. (2004). Gestational diabetes and preeclampsia. *Eur J Obstet Gynecol Reprod Biol, 113*(1), 12-16.
- Oteng-Ntim, E., Varma, R., Croker, H., Poston, L., & Doyle, P. (2012). Lifestyle interventions for overweight and obese pregnant women to improve pregnancy outcome: systematic review and meta-analysis. *BMC Med, 10*, 47.
- Paeratakul, S., Ferdinand, D. P., Champagne, C. M., Ryan, D. H., & Bray, G. A. (2003). Fast-food consumption among US adults and children: dietary and nutrient intake profile. *J Am Diet Assoc, 103*(10), 1332-1338.
- Parker, J. D., & Abrams, B. (1993). Differences in postpartum weight retention between black and white mothers. *Obstet Gynecol, 81*(5 (Pt 1)), 768-774.
- Patton, M. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks, CA: Sage Publications

- Pereira, M. A., Rifas-Shiman, S. L., Kleinman, K. P., Rich-Edwards, J. W., Peterson, K. E., & Gillman, M. W. (2007). Predictors of change in physical activity during and after pregnancy: Project Viva. *Am J Prev Med*, 32(4), 312-319.
- Petersen, A. M., Leet, T. L., & Brownson, R. C. (2005). Correlates of physical activity among pregnant women in the United States. *Med Sci Sports Exerc*, 37(10), 1748-1753.
- Pew Research Center. (2013). Smartphone Ownership: 2013 Update. Retrieved January 10, 2014, from <http://www.pewinternet.org/2013/06/05/smartphone-ownership-2013/>
- Phelan, S. (2010). Pregnancy: a "teachable moment" for weight control and obesity prevention. *Am J Obstet Gynecol*, 202(2), 135 e131-138.
- Phelan, S., Phipps, M. G., Abrams, B., Darroch, F., Schaffner, A., & Wing, R. R. (2011). Practitioner advice and gestational weight gain. *J Womens Health*, 20(4), 585-591.
- Pivarnik, J. M., Chambliss, H. O., Clapp, J. F., Dugan, S. A., Hatch, M. C., Lovelady, C. A., . . . Williams, M. A. (2006). Impact of physical activity during pregnancy and postpartum on chronic disease risk. *Med Sci Sports Exerc*, 38(5), 989-1006.
- Polley, B. A., Wing, R. R., & Sims, C. J. (2002). Randomized controlled trial to prevent excessive weight gain in pregnant women. *Int J Obes Relat Metab Disord*, 26(11), 1494-1502.
- Power, M. L., Cogswell, M. E., & Schulkin, J. (2006). Obesity prevention and treatment practices of U.S. obstetrician-gynecologists. *Obstet Gynecol*, 108(4), 961-968.

- Rose, S. A., Poynter, P. S., Anderson, J. W., Noar, S. M., & Conigliaro, J. (2012). Physician weight loss advice and patient weight loss behavior change: a literature review and meta-analysis of survey data. *Int J Obes (Lond)*.
- Ruelaz, A. R., Diefenbach, P., Simon, B., Lanto, A., Arterburn, D., & Shekelle, P. G. (2007). Perceived barriers to weight management in primary care--perspectives of patients and providers. *J Gen Intern Med*, 22(4), 518-522.
- Schmidt, M. D., Pekow, P., Freedson, P. S., Markenson, G., & Chasan-Taber, L. (2006). Physical activity patterns during pregnancy in a diverse population of women. *J Womens Health (Larchmt)*, 15(8), 909-918.
- Scholl, T. O., & Johnson, W. G. (2000). Folic acid: influence on the outcome of pregnancy. *Am J Clin Nutr*, 71(5 Suppl), 1295S-1303S.
- Sciamanna, C. N., Tate, D. F., Lang, W., & Wing, R. R. (2000). Who reports receiving advice to lose weight? Results from a multistate survey. *Arch Intern Med*, 160(15), 2334-2339.
- Shin, D., Chung, H., Weatherspoon, L., & Song, W. O. (2014). Validity of Prepregnancy Weight Status Estimated from Self-reported Height and Weight. *Matern Child Health J*, 18(7), 1667-1674.
- Shirazian, T., Monteith, S., Friedman, F., & Rebarber, A. (2010). Lifestyle modification program decreases pregnancy weight gain in obese women. *Am J Perinatol*, 27(5), 411-414.
- Siega-Riz, A. M., Bodnar, L. M., & Savitz, D. A. (2002). What are pregnant women eating? Nutrient and food group differences by race. *Am J Obstet Gynecol*, 186(3), 480-486.

- Siega-Riz, A. M., Herring, A. H., Carrier, K., Evenson, K. R., Dole, N., & Deierlein, A. (2010). Sociodemographic, perinatal, behavioral, and psychosocial predictors of weight retention at 3 and 12 months postpartum. *Obesity (Silver Spring)*, *18*(10), 1996-2003.
- Simas, T. A., Liao, X., Garrison, A., Sullivan, G. M., Howard, A. E., & Hardy, J. R. (2011). Impact of updated Institute of Medicine guidelines on prepregnancy body mass index categorization, gestational weight gain recommendations, and needed counseling. *J Womens Health*, *20*(6), 837-844.
- South Carolina Department of Health and Environmental Control. (2008). Healthy People Living in Healthy Communities. 2008 Report on the Health of South Carolina's People and Environment. Retrieved February 25, 2013, from <http://www.scdhec.net/administration/library/ML-006048.pdf>.
- South Carolina Department of Health and Environmental Control. (2008). South Carolina Community Assessment Network. Retrieved February 25, 2013, from <http://scangis.dhec.sc.gov/scan/>.
- Stengel, M. R., Kraschnewski, J. L., Hwang, S. W., Kjerulff, K. H., & Chuang, C. H. (2012). "What my doctor didn't tell me": examining health care provider advice to overweight and obese pregnant women on gestational weight gain and physical activity. *Womens Health Issues*, *22*(6), e535-540.
- Stotland, N., Tsoh, J. Y., & Gerbert, B. (2012). Prenatal weight gain: who is counseled? *J Womens Health*, *21*(6), 695-701.

- Stotland, N. E., Cheng, Y. W., Hopkins, L. M., & Caughey, A. B. (2006). Gestational weight gain and adverse neonatal outcome among term infants. *Obstet Gynecol*, *108*(3 Pt 1), 635-643.
- Stotland, N. E., Gilbert, P., Bogetz, A., Harper, C. C., Abrams, B., & Gerbert, B. (2010). Preventing excessive weight gain in pregnancy: how do prenatal care providers approach counseling? *J Womens Health*, *19*(4), 807-814.
- Stotland, N. E., Haas, J. S., Brawarsky, P., Jackson, R. A., Fuentes-Afflick, E., & Escobar, G. J. (2005). Body mass index, provider advice, and target gestational weight gain. *Obstet Gynecol*, *105*(3), 633-638.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.
- Strauss, A. L., & Corbin, J. (1990). *Basics of qualitative research*. Thousand Oaks, CA: SAGE.
- Streuling, I., Beyerlein, A., Rosenfeld, E., Hofmann, H., Schulz, T., & von Kries, R. (2011). Physical activity and gestational weight gain: a meta-analysis of intervention trials. *BJOG*, *118*(3), 278-284.
- Streuling, I., Beyerlein, A., & von Kries, R. (2010). Can gestational weight gain be modified by increasing physical activity and diet counseling? A meta-analysis of interventional trials. *Am J Clin Nutr*, *92*(4), 678-687.
- Stuebe, A. M., Oken, E., & Gillman, M. W. (2009). Associations of diet and physical activity during pregnancy with risk for excessive gestational weight gain. *Am J Obstet Gynecol*, *201*(1), 58 e51-58.

- Sui, Z., & Dodd, J. M. (2013). Exercise in obese pregnant women: positive impacts and current perceptions. *Int J Womens Health, 5*, 389-398.
- Sui, Z., Turnbull, D. A., & Dodd, J. M. (2012). Overweight and Obese Women's Perceptions About Making Healthy Change During Pregnancy: A Mixed Method Study. *Matern Child Health J.*
- Sword, W., Heaman, M. I., Brooks, S., Tough, S., Janssen, P. A., Young, D., . . . Hutton, E. (2012). Women's and care providers' perspectives of quality prenatal care: a qualitative descriptive study. *BMC Pregnancy Childbirth, 12*, 29.
- Symons Downs, D., & Hausenblas, H. (2005). The theories of reasoned action and planned behavior applied to exercise: a meta-analytic update. *J Phys Act Health, 2*, 76-97.
- Symons Downs, D., & Hausenblas, H. A. (2004). Women's exercise beliefs and behaviors during their pregnancy and postpartum. *J Midwifery Womens Health, 49*(2), 138-144.
- Taffel, S. M., Keppel, K. G., & Jones, G. K. (1993). Medical advice on maternal weight gain and actual weight gain. Results from the 1988 National Maternal and Infant Health Survey. *Ann N Y Acad Sci, 678*, 293-305.
- Takahasi, E. H., Alves, M. T., Alves, G. S., Silva, A. A., Batista, R. F., Simoes, V. M., . . . Barbieri, M. A. (2013). Mental health and physical inactivity during pregnancy: a cross-sectional study nested in the BRISA cohort study. *Cad Saude Publica, 29*(8), 1583-1594.

- Thangaratinam, S., Rogozinska, E., Jolly, K., Glinkowski, S., Duda, W., Borowiack, E., . . . Khan, K. S. (2012). Interventions to reduce or prevent obesity in pregnant women: a systematic review. *Health Technol Assess*, *16*(31), iii-iv, 1-191.
- Thompson, J. M., Wall, C., Becroft, D. M., Robinson, E., Wild, C. J., & Mitchell, E. A. (2010). Maternal dietary patterns in pregnancy and the association with small-for-gestational-age infants. *Br J Nutr*, *103*(11), 1665-1673.
- Thornton, P. L., Kieffer, E. C., Salabarria-Pena, Y., Odoms-Young, A., Willis, S. K., Kim, H., & Salinas, M. A. (2006). Weight, diet, and physical activity-related beliefs and practices among pregnant and postpartum Latino women: the role of social support. *Matern Child Health J*, *10*(1), 95-104.
- Thornton, Y. S., Smarkola, C., Kopacz, S. M., & Ishaof, S. B. (2009). Perinatal outcomes in nutritionally monitored obese pregnant women: a randomized clinical trial. *J Natl Med Assoc*, *101*(6), 569-577.
- Tobias, D. K., Zhang, C., van Dam, R. M., Bowers, K., & Hu, F. B. (2011). Physical activity before and during pregnancy and risk of gestational diabetes mellitus: a meta-analysis. *Diabetes Care*, *34*(1), 223-229.
- Tomeo, C. A., Rich-Edwards, J. W., Michels, K. B., Berkey, C. S., Hunter, D. J., Frazier, A. L., . . . Buka, S. L. (1999). Reproducibility and validity of maternal recall of pregnancy-related events. *Epidemiology*, *10*(6), 774-777.
- U.S. Census Bureau. (2013). Computer and Internet Use in the United States: Current Population Survey Reports. Retrieved January 10, 2014, from <http://www.census.gov/prod/2013pubs/p20-569.pdf>

- U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2010). *Dietary Guidelines for Americans, 2010 (7th ed.)*. Washington, DC: U.S. Government Printing Office.
- U.S. Department of Health and Human Services. (2008). *2008 Physical Activity Guidelines for Americans*. Washington, DC: .
- van Poppel, M. N., Chinapaw, M. J., Mokkink, L. B., van Mechelen, W., & Terwee, C. B. (2010). Physical activity questionnaires for adults: a systematic review of measurement properties. *Sports Med, 40*(7), 565-600.
- Vesco, K. K., Sharma, A. J., Dietz, P. M., Rizzo, J. H., Callaghan, W. M., England, L., . . . Hornbrook, M. C. (2011). Newborn size among obese women with weight gain outside the 2009 Institute of Medicine recommendation. *Obstet Gynecol, 117*(4), 812-818.
- Viswanathan, M., Siega-Riz, A. M., Moos, M. K., Deierlein, A., Mumford, S., Knaack, J., . . . Lohr, K. N. (2008). Outcomes of maternal weight gain. *Evid Rep Technol Assess*(168), 1-223.
- Watts, V., Rockett, H., Baer, H., Leppert, J., & Colditz, G. (2007). Assessing diet quality in a population of low-income pregnant women: a comparison between Native Americans and whites. *Matern Child Health J, 11*(2), 127-136.
- Weir, Z., Bush, J., Robson, S. C., McParlin, C., Rankin, J., & Bell, R. (2010). Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. *BMC Pregnancy Childbirth, 10*, 18.

- Wells, C. S., Schwalberg, R., Noonan, G., & Gabor, V. (2006). Factors influencing inadequate and excessive weight gain in pregnancy: Colorado, 2000-2002. *Matern Child Health J, 10*(1), 55-62.
- White, K. M., Terry, D. J., Troup, C., & Rempel, L. A. (2007). Behavioral, normative and control beliefs underlying low-fat dietary and regular physical activity behaviors for adults diagnosed with type 2 diabetes and/or cardiovascular disease. *Psychol Health Med, 12*(4), 485-494.
- Wright, C., Bilder, D., DeBlasis, T., Mogul, M., Rubin, D., & Shea, J. A. (2013). Psychosocial factors associated with gestational weight gain in a low-income cohort. *J Health Care Poor Underserved, 24*(1), 332-343.
- Yarnall, K. S., Pollak, K. I., Ostbye, T., Krause, K. M., & Michener, J. L. (2003). Primary care: is there enough time for prevention? *Am J Public Health, 93*(4), 635-641.
- Yaroch, A. L., Tooze, J., Thompson, F. E., Blanck, H. M., Thompson, O. M., Colon-Ramos, U., . . . Nebeling, L. C. (2012). Evaluation of three short dietary instruments to assess fruit and vegetable intake: the National Cancer Institute's food attitudes and behaviors survey. *J Acad Nutr Diet, 112*(10), 1570-1577.

APPENDIX A
PATIENT INTERVIEW GUIDE

Interview Guide

Pregnant Women

I. Welcome and Introduction

Moderator introduces self.

Thank you for taking the time to talk with me today. I would like to learn what you think about weight gain, exercise, and nutrition during pregnancy. I will be holding a total of 30 interviews like this. I will be looking at my notes to make sure I don't forget to ask you anything.

II. Order of Business

Our discussion will last about 40 minutes. After the discussion, I'll ask you to answer some questions about your pregnancy, health, and family, and then you'll receive \$30 for your participation.

We won't be taking a formal break. Please feel free to let me know if you need to use the restroom or if you need a break.

III. Guidelines for Interview

First, I'm interested in hearing what you think. There are no right or wrong answers to my questions. I am interested in hearing about your point of view even if it's different from what others around you might think.

Second, I will be audiotaping the discussion because I don't want to miss any comments.

Please share any thoughts you have. I am interested in both positive and negative comments.

Please be specific when you are discussing topics. Use examples whenever you can.

IV. Confidentiality

We will be on a first name basis today, but there will not be any names attached to the comments in the final reports. Your responses will never be associated with your name.

Do you have any questions about the interview or anything I've described?

V. Informed Consent

If not, then I'd like to go through this informed consent document with you.
Go through major points in the consent process.

Now that I have explained this form, please take your time to review the document. If you are comfortable participating in this study, I'll ask you to sign after you have read everything and acknowledge your understanding of the study. Please feel free to ask me any questions you have about the study.

(AFTER INFORMED CONSENT FORM IS SIGNED)

I'd like to start to audio record this session. Are you OK with me doing that?

(If yes, begin audio recording)

VI. Interview Questions

Throughout the interview I will be asking some questions about your health care provider. When I say provider, I am referring to any nurse or doctor that you met with during a prenatal visit for this pregnancy.

Okay, let's get started. I'm going to first ask you about some of your plans during this pregnancy.

1. How much total weight do you plan on gaining during this pregnancy?

Now I'd like to ask you some questions about exercise. I will be using the word "exercise" throughout our interview. I want to make sure we are on the same page in terms of what I mean. When I use the word exercise, I mean activities that increase your heart rate and breathing – things like walking, jogging, dancing, or cycling.

2. Please tell me about any plans you have to exercise during the rest of your pregnancy.

Probes:

- What types of exercise do you plan on doing during your pregnancy?
- How often do you plan on exercising?
- About how many minutes do you plan on exercising each time?
- How hard do you plan on exercising?

Now I'd like to ask you some questions about nutrition.

3. Please tell me about the type of diet you plan on eating during this pregnancy.

Probes:

- What types of foods will you eat?
- Will you avoid or eat less of certain types of foods?
- How much will you eat?
- How often will you eat?

Weight Gain

Now I'm going to ask you a few questions about your weight gain during pregnancy.

4. What are some good things that could happen if you gain a healthy amount of weight during pregnancy – so not too little and not too much?
 - Which of these outcomes are most important to you and why?
5. What are some bad things that could happen if you gain too much weight during pregnancy?
 - Which of these outcomes are most important to you and why?
6. Who influences how you think about your pregnancy weight gain?

Probes:

 - What does your spouse or significant other think about your pregnancy weight gain? What about your family? Friends? Health care provider?
7. Whose advice or opinion about pregnancy weight gain do you most value and trust?

Probes:

 - Can you tell me a little more about why you value the advice of that person?
8. What has your provider told you about weight gain during pregnancy?

If participant reports nothing skip question 9
9. What do you think about the advice your provider gave you on pregnancy weight gain?

Probes:

 - How does the advice your provider gave you on weight gain fit in with your personal weight gain goal?
 - How motivated are you to follow your provider's advice on weight gain?
 - Can you tell me a little bit more about why you want (or don't want) to follow your provider's advice on weight gain?

Now I would like to talk to you about the recently released recommendations for weight gain in pregnancy. Here is a print out for you to look over as I go through these recommendations.

Based on your weight before you became pregnant, it is recommended that you gain between ___ and ___ pounds during this pregnancy.

Modify weight gain range (25-35/15-25/11-20 pounds) based on calculated BMI from screening form

10. What do you think about these recommendations?
11. What could make it hard for you to gain between ___ and ___ pounds during this pregnancy?
12. What could help you to gain between ___ and ___ pounds during this pregnancy?

Exercise:

Once again I'd like to shift the focus of our discussion to exercise. As a reminder, when I use the term exercise I mean activities that increase your heart rate and breathing – like walking, jogging, dancing, or cycling.

13. What exercise are you currently doing in this pregnancy, if any?
Probes:
 - Type? How often? How long? Intensity?
14. What are some good things that could happen if you exercise during your pregnancy?
Probes:
 - Good things that would happen to you
 - Good things that would happen to the baby
 - Which of these outcomes are most important to you and why?
15. What are some risks or bad things that could happen if you exercise during your pregnancy?
 - Bad things that would happen to you
 - Bad things that would happen to the baby
 - Which of these outcomes are most important to you and why?

16. Who influences your exercise behaviors during pregnancy?

Probes:

- What does your spouse or significant other think about you exercising during pregnancy? What about your family? Friends? Health care provider?

17. Whose advice or opinion regarding exercise during pregnancy do you most value and trust?

- Can you tell me a little more about why you value and trust the advice of that person?

18. What has your health care provider told you about exercise during pregnancy?

If participant reports nothing skip question 19

19. What do you think about the advice your provider gave you on exercise?

Probes:

- How does the advice your provider gave you fit in with your personal exercise goals?
- How has advice from your doctor changed your exercise habits?
- How motivated are you to follow your provider's advice on exercise?
- Can you tell me a little bit more about why you want (or don't want) to follow your provider's advice on exercise?

Now I would like to talk to you about the recently released recommendations for exercise during pregnancy. Here is a print out for you to look over as I go through these recommendations. It is recommended that all women get 150 minutes of moderate intensity physical activity per week during a healthy pregnancy. This is about 30 minutes per day, 5 times per week of an activity like brisk walking.

20. What do you think about these recommendations?

21. What could make it hard for you to meet the exercise recommendations during this pregnancy?

22. What could make it easier for you to meet the exercise recommendations during this pregnancy?

Nutrition:

Now I'd like to shift the focus of our discussion to nutrition.

23. What are some good things that could happen if you eat a healthy diet during pregnancy?
- Good things that would happen to you
 - Good things that would happen to the baby
 - Which of these outcomes are most important to you and why?
24. What are some bad things that could happen if you eat an unhealthy diet during pregnancy?
- Good things that would happen to you
 - Good things that would happen to the baby
 - Which of these are most important to you and why?
25. Who influences your nutrition behaviors during pregnancy? In other words, who influences what you eat or what you don't eat during pregnancy?
- Probe:
- What does your spouse or significant other think about your nutrition behaviors during pregnancy? What about your family? Friends? Health care provider?
26. Whose advice or opinion regarding nutrition during pregnancy do you most value and trust?
- Can you tell me a little more about why you value the advice of that person?
27. What has your health care provider told you about nutrition during pregnancy?
- If participant reports nothing, skip question 28*
28. What do you think about the nutrition advice your provider gave you?
- How does the advice your provider gave you on nutrition fit in with your personal nutrition goals during pregnancy?
 - How has advice from your doctor changed your eating habits?
 - How motivated are you to follow your provider's nutrition advice?
 - Can you tell me a little bit more about why you want (or don't want) to follow your provider's nutrition advice?

Now I would like to talk to you about the recently released nutrition recommendations during pregnancy. Here is a print out for you to look over as I go through these recommendations. Pregnant women are encouraged to eat healthy in many ways. They are encouraged to eat plenty of fruits and vegetables, to eat more low fat dairy products, to get plenty of protein, and to choose whole grains like whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta. They are often told to eat

plenty of fiber, to watch their portion sizes, and to avoid eating too much of very sugary and fatty foods. All of these things help to make up a healthy diet during pregnancy.

29. What do you think about these recommendations?
30. What could make it hard for you to eat a healthy diet during this pregnancy?
31. What would make it easier for you to eat a healthy diet during this pregnancy?

Intervention Development:

32. What do you think about your provider discussing weight gain, exercise, or healthy eating with you during prenatal visits?
33. If your health care provider was going to talk with you about weight gain, exercise, or healthy eating in pregnancy, what types of things would you want to learn?

Probes:

- How would you want your provider to bring these topics up with you?
- How often would you like your provider to discuss these topics with you?
- When in your pregnancy should they start talking with you about these topics?

VII. Conclusions

Those are all of the questions I have. Is there anything else you would like to add?

Thank you very much for participating in our discussion today. I'd just like you to take a few moments to answer a few additional questions.

Administer survey with response options notebook.

Distribute incentive and give photocopy of signed and dated consent form to participant.

If photocopier is not available, have participant sign and date an identical consent form for their records.

APPENDIX B
PROVIDER INTERVIEW GUIDE

Interview Guide

Providers

I. Welcome and Introduction

Thank you for taking the time to speak with me today. The purpose of our conversation is to better understand what you think about counseling pregnant women on weight gain, exercise, and nutrition during prenatal care visits. I will be holding a total of 12 interviews like this. I will be looking at my notes to make sure I don't forget to ask you anything.

II. Order of Business

I would first like you to fill out a survey about your background, personal health, and current recommendations in your field. Once that is complete we will begin our discussion, which should last about 30 minutes. After the discussion you'll receive \$30 for your participation.

III. Guidelines for Interview

First, I'm interested in hearing what you think. There are no right or wrong answers to my questions. I am interested in hearing about your point of view even if it's different from what others around you might think.

Second, I will be audiotaping the discussion because I don't want to miss any comments.

Please share any thoughts you have. I am interested in both positive and negative comments.

Please be specific when you are discussing topics. Use examples whenever you can.

IV. Confidentiality

There will not be any names attached to the comments in the final reports. Your responses will never be associated with your name. Do you have any questions about the interview or anything I've described?

V. Informed Consent

If not, then I'd like to go through this informed consent document with you.

Go through major points in the consent process.

Now that I have explained this form, please take your time to review the document. If

you are comfortable participating in this study, I'll ask you to sign after you have read everything and acknowledge your understanding of the study. Please feel free to ask me any questions you have about the study.

(AFTER INFORMED CONSENT FORM IS SIGNED)

Distribute survey.

I'd like to start to audio record this session. Are you OK with me doing that?

(If yes, begin audio recording)

VI. Interview Questions

Throughout this interview I will use the word "patient." When I say "patient" I am referring to pregnant women you see during prenatal care visits. I'm going to start off by asking you some questions about weight gain during pregnancy.

Weight Gain:

1. What is your philosophy about discussing pregnancy weight gain with your patients?
Probes:
 - What recommendations do you give?
2. Can you discuss what makes you more or less likely to talk with a given patient about pregnancy weight gain?
3. What are some potential positive outcomes of talking with patients about pregnancy weight gain?
4. What are some potential negative outcomes of talking to patients about pregnancy weight gain?
5. To what extent do you believe your counseling will impact women's pregnancy weight gain?
6. Describe factors or situations that make it harder to talk to women about pregnancy weight gain.

7. What factors or situations make it easier to talk to women about pregnancy weight gain?

Exercise:

Now I'd like to turn our focus to exercise during pregnancy.

8. What is your philosophy about discussing exercise with your pregnant patients?
Probes:
 - What recommendations do you give?
9. Can you discuss what makes you more or less likely to talk with a given patient about exercise during pregnancy?
10. What are some potential positive outcomes of talking to patients about exercise during pregnancy?
11. What are some potential negative outcomes of talking to patients about exercise during pregnancy?
12. To what extent do you believe your counseling will impact women's exercise behavior during pregnancy?
13. Describe factors or situations that make it harder to talk to patients about exercise during pregnancy.
14. What factors or situations make it easier to talk to patients about exercise during pregnancy?

Nutrition:

Now I would like to shift our focus again to talk about nutrition, specifically healthy eating during pregnancy.

15. What is your philosophy about discussing healthy eating with your pregnant patients?
Probes:
 - What recommendations do you give?

16. Can you discuss what makes you more or less likely to talk with a given patient about healthy eating recommendations during pregnancy?
17. What are some potential positive outcomes of talking to patients about healthy eating during pregnancy?
18. What are some potential negative outcomes of talking to patients about healthy eating during pregnancy?
19. To what extent do you believe your counseling will impact women's eating behaviors during pregnancy?
20. Describe factors or situations that make it harder to talk to pregnant patients about healthy eating.
21. What factors or situations make it easier to talk to pregnant patients about healthy eating?

Current Guidelines:

Now I would like to shift topics to talk more about some of the current recommendations in your field.

The Institute of Medicine recommends that women gain a certain amount of weight based on their pre-pregnancy BMI.

Hand participant a print out with the IOM recommendations.

22. What do you think about these recommendations?

Probes:

-Are these recommendations something that you use in your practice?

You may be aware that the American College of Obstetricians and Gynecologists recently released a committee opinion report stating that health care providers who care for pregnant women should determine a woman's body mass index at the initial prenatal visit and counsel her regarding the benefits of appropriate weight gain, nutrition and exercise, and, especially, the need to limit excessive weight gain to achieve best pregnancy outcomes.

Hand participant a print out of the ACOG committee opinion report.

23. What do you think about these recommendations?
Probes:
- How motivated are you to follow these recommendations?
24. Please describe any other people, groups, or organizations that support or discourage you from counseling women on weight gain, exercise, or healthy eating during pregnancy.
25. How did your medical training prepare or not prepare you to counsel women on weight gain, exercise, or nutrition during pregnancy?
Probes:
- Would you like to receive any additional training on these topics?
- (if yes)What type of information would you want to be part of this training?
26. How comfortable are you initiating discussions on weight gain, exercise, or nutrition during prenatal care visits?
27. How likely are you to discuss pregnancy weight gain, exercise, and nutrition with your pregnant patients in future prenatal sessions?
28. How will you counsel women on these health topics?
Probes:
- How will you initiate these discussions?
- Would it be similar or different with (topic not mentioned)

VII. Conclusions

Those are all of the questions I have. Is there anything else that you would like to add?
Thank you very much for participating in our discussion today.

Distribute incentive and give photocopy of signed and dated consent form to participant.

If photocopier is not available, have participant sign and date an identical consent form for their records.

APPENDIX C

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ)

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

- G1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities



Skip to question 3

- G2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

- G3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

No moderate physical activities



Skip to question 5

G4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

No walking → **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

APPENDIX D

INTERNET-BASED PARTICIPANT SURVEY

Internet Survey

Consent Process:

Thank you for your interest in this study! You are being invited to take part in a research study titled "Women's perceptions of weight gain, physical activity, and nutrition in pregnancy." The purpose of this study is to better understand what women think about weight gain, exercise, and nutrition during pregnancy, as well as the role of the prenatal care provider in promoting these health behaviors.

If you are interested in taking part in this study, you will be asked to complete an online survey. This survey will ask about some of your health related habits during pregnancy. The survey should take approximately 30-45 minutes for you to complete. At the end of the survey, you will have the opportunity to enter your name and contact information to enter a drawing to win 1 of 8 \$50 Amazon gift cards. You may also enter your contact information if you would like to receive the study results. You will only be contacted if you are selected to receive a gift card and/or to receive the study results.

There are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by storing all data on password protected servers.

You may not directly benefit from this research; however, your participation in the study will help develop better programs and interventions for pregnant women like you.

All information gathered will remain anonymous and therefore confidential. Your name will not be recorded in this study unless you enter your contact information to be entered into a drawing to win an Amazon gift card. After completion of this study, all data stored on surveygizmo.com will be destroyed. Once the Amazon gift cards are distributed, the participant names and contact information will be removed from the surveys.

Participation in this study is completely voluntary and you can withdraw at any time. You are free to skip any question that you choose. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential matter.

This study is being conducted by Kara Whitaker, a PhD Candidate from the University of South Carolina. This study is being conducted as part of her dissertation work. If you have any questions about this project or if you have a research-related problem, you may contact Kara Whitaker by telephone at (803) 777-9916 or by e-mail at goodricm@email.sc.edu. If you have questions about your rights as a research subject, you may contact: Thomas Coggins, Director, Office of Research Compliance, University of South Carolina, Columbia, SC 29208, by telephone at (803) 777-7095, by fax at (803) 576-5589, or by e-mail at tcoggins@mailbox.edu.

If you are still interested in this research study, please select next to see if you are eligible to participate.

Eligibility Screening Form:

1. Are you currently pregnant?
 Yes
 No
2. How many weeks pregnant are you?
 Less than 20 weeks pregnant
 20-30 weeks pregnant
 31 weeks pregnant or more
3. Are you pregnant with more than one baby (e.g. twins)?
 Yes
 No
4. When did you attend your first prenatal session?
 Before I was 16 weeks pregnant
 When I was 16 weeks pregnant or later
5. How old are you?
 Younger than 18 years
 18-44 years
 Older than 45 years

The link below will take you to a new webpage sponsored by the National Heart, Lung, and Blood Institute to calculate your Body Mass Index (BMI). BMI is a measure of body fat based on height and weight that applies to adult men and women. After clicking the link below, please enter your height and weight just BEFORE you became pregnant (before gaining any pregnancy weight) and press enter. Your BMI will be automatically calculated. Please remember this value and return to the survey.

Take me to the BMI Calculator!

[http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm]

6. After using the BMI calculator, what was your BMI just BEFORE you became pregnant?
 Less than 18.5
 Between 18.5-24.9
 Between 25.0-29.9
 Between 30.0-44.9
 More than 45.0

Survey:

Section A. This section will ask you questions about your current pregnancy.

1. What is your due date? _____ / _____ / _____
2. How many weeks along are you in your pregnancy? _____ weeks
3. Did a doctor tell you that you had preeclampsia during this pregnancy (high blood pressure and protein in the urine)?
 Yes No Don't Know
4. Did a doctor tell you that you had gestational diabetes during this pregnancy (high blood sugar that developed during pregnancy)?
 Yes No Don't Know
5. Have you had any other complications during this pregnancy?
 Yes No Don't Know
a) If yes, please list these complications.

Section B: This section will ask you about some of your plans during this pregnancy.

- B1. How much total weight do you plan on gaining during this pregnancy?
_____ pounds

The next question will ask you about your plans to gain a specific amount of weight during pregnancy.

- B2. I plan on gaining between 25-35 / 15-25 / 11-20 total pounds in this pregnancy.

Strongly	-3	-2	-1	0	1	2	3	Strongly
Disagree								Agree

The appropriate IOM weight gain recommended ranges was displayed for question B2, as determined from participant pre-pregnancy BMI that was reported during screening (BMI 18.5-24.9 = 25-35 pounds; BMI 25.0-29.9 = 15-25 pounds; BMI 30.0 or more = 11-20 pounds).

Please read the following statement before answering the following question.

Moderate intensity exercise is any activity that noticeably increases your heart and breathing rate, like brisk walking.

B3. With this definition in mind, I plan on exercising at a moderate intensity for 150 minutes per week (e.g. 30 minutes per day, 5 days per week) during my pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

Please read the following statement before answering the following question.

A healthy diet includes plenty of fruits and vegetables, low fat dairy products, protein, fiber, and whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta. A healthy diet includes watching portion sizes and avoiding eating too much of very sugary and fatty foods.

B4. With this definition in mind, I plan on eating a healthy diet during my pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

Section C. This section asks questions about the health care provider(s) you have seen during this pregnancy. Only count discussions at prenatal care visits.

C1. Has a health care provider discussed with you how much weight you should gain during this pregnancy?

Yes No Don't Know

C2. If yes, how many pounds did your health care provider recommend that you gain during this pregnancy?

C3. Has a health care provider discussed exercise with you during this pregnancy?

Yes No Don't Know

C4. If yes, what did your health care provider recommend?

C5. Has a health care provider discussed healthy eating with you during this pregnancy?

Yes No Don't Know

C6. If yes, what did your health care provider recommend?

Section D. This section will ask you questions about weight gain during pregnancy.

For all questions in Section D, the appropriate IOM weight gain recommended ranges were displayed as determined by the participants' pre-pregnancy BMI (BMI 18.5-24.9 = 25-35 pounds; BMI 25.0-29.9 = 15-25 pounds; BMI 30.0 or more = 11-20 pounds).

Based on your weight before you became pregnant, it is recommended that you gain between 25-35 / 15-25 / 11-20 total pounds during your pregnancy.

Please select one number between -3 and +3 for every item.

Gaining 25-35 / 15-25 / 11-20 total pounds during my pregnancy will be...

D1.	Bad	-3	-2	-1	0	1	2	3	Good
D2.	Useless	-3	-2	-1	0	1	2	3	Useful
D3.	Foolish	-3	-2	-1	0	1	2	3	Wise
D4.	Harmful	-3	-2	-1	0	1	2	3	Beneficial
D5.	Unpleasant	-3	-2	-1	0	1	2	3	Pleasant
D6.	Boring	-3	-2	-1	0	1	2	3	Interesting
D7.	Unenjoyable	-3	-2	-1	0	1	2	3	Enjoyable

D8. Please list some of the advantages of gaining 25-35 / 15-25 / 11-20 pounds during pregnancy.

D9. Please list some of the disadvantages of gaining 25-35 / 15-25 / 11-20 pounds during pregnancy.

D10. Most people who are important to me think I should gain 25-35 / 15-25 / 11-20 pounds during pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

D11. Please list the individuals who might influence how much weight you gain during your pregnancy.

D12. How much control do you have over your weight gain during pregnancy?

Very Little Control -3 -2 -1 0 1 2 3 Complete Control

D13. For you to gain between 25-35 / 15-25 / 11-20 total pounds during pregnancy will be...

Extremely -3 -2 -1 0 1 2 3 Extremely
Difficult Easy

D14. If you wanted to, you can easily control how much weight you gain during this pregnancy.

Strongly -3 -2 -1 0 1 2 3 Strongly
Disagree Agree

D15. Please list some things that might make it difficult for you to gain between 25-35 / 15-25 / 11-20 total pounds during pregnancy.

D16. Please list some things that might make it easier for you to gain between 25-35 / 15-25 / 11-20 total pounds during pregnancy.

Section E: This section will ask you questions about your exercise during pregnancy.

It is recommended that all women get 150 minutes of moderate intensity physical activity per week during a healthy pregnancy. This is about 30 minutes per day, 5 times per week of an activity like brisk walking. Moderate intensity exercise is any activity that noticeably increases your heart and breathing rate.

Please select one number between -3 and +3 for every item.

Keeping this definition in mind, exercising during my pregnancy for 150 minutes per week at a moderate intensity level (e.g. brisk walking) will be...

E1.	Bad	-3	-2	-1	0	1	2	3	Good
E2.	Useless	-3	-2	-1	0	1	2	3	Useful
E3.	Foolish	-3	-2	-1	0	1	2	3	Wise
E4.	Harmful	-3	-2	-1	0	1	2	3	Beneficial
E5.	Unpleasant	-3	-2	-1	0	1	2	3	Pleasant
E6.	Boring	-3	-2	-1	0	1	2	3	Interesting
E7.	Unenjoyable	-3	-2	-1	0	1	2	3	Enjoyable

- E8. Please list some of the advantages of exercising regularly during pregnancy.
- E9. Please list some of the disadvantages of exercising regularly during pregnancy.
- E10. Most people who are important to me think I should exercise regularly during my pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

- E11. Please list the individuals in your life who influence whether you exercise or not during pregnancy.

- E12. How much control do you have over whether or not you exercise during your pregnancy?

Very Little Control -3 -2 -1 0 1 2 3 Complete Control

- E13. For you to regularly exercise during pregnancy will be ...

Extremely Difficult -3 -2 -1 0 1 2 3 Extremely Easy

- E14. If you wanted to, you could easily exercise during pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

- E16. Please list some things that might make it difficult for you to exercise regularly during pregnancy.

- E17. Please list some things that might make it easier for you to exercise regularly during pregnancy.

Section F: This next section will ask you about your eating habits during pregnancy.

It is recommended that all pregnant women eat a healthy diet that includes plenty of fruits and vegetables, low fat dairy products, protein, fiber, and whole wheat breads and pastas instead of refined grains like white bread, rice, and pasta. Pregnant women are often told to watch their portion sizes, and to avoid eating too much of very sugary and fatty foods.

Please select one number between -3 and +3 for every item.

Keeping these dietary recommendations in mind, eating a healthy diet during my pregnancy will be...

F1.	Bad	-3	-2	-1	0	1	2	3	Good
F2.	Useless	-3	-2	-1	0	1	2	3	Useful
F3.	Foolish	-3	-2	-1	0	1	2	3	Wise
F4.	Harmful	-3	-2	-1	0	1	2	3	Beneficial
F5.	Unpleasant	-3	-2	-1	0	1	2	3	Pleasant
F6.	Boring	-3	-2	-1	0	1	2	3	Interesting
F7.	Unenjoyable	-3	-2	-1	0	1	2	3	Enjoyable

F8. Please list some of the advantages of eating a healthy diet during pregnancy.

F9. Please list some of the disadvantages of eating a healthy diet during pregnancy.

F10. Most people who are important to me think I should eat a healthy diet during my pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

F11. Please list the individuals in your life who influence your eating behaviors during pregnancy.

F12. How much control do you have over whether or not you eat a healthy diet during your pregnancy?

Very Little Control -3 -2 -1 0 1 2 3 Complete Control

F13. For you to eat a healthy diet during pregnancy will be...

Extremely Difficult -3 -2 -1 0 1 2 3 Extremely Easy

F14. If you wanted to, you could easily eat a healthy diet during pregnancy.

Strongly Disagree -3 -2 -1 0 1 2 3 Strongly Agree

F16. Please list some things that might make it difficult for you to eat a healthy diet during pregnancy.

F17. Please list some things that might make it easier for you to eat a healthy diet during pregnancy.

Section G: This next group of questions will ask you about your physical activity during the past week.

The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

G1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

G2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

G3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

G4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

G5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

G6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

G7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Section H: This next group of questions about your fruit and vegetable intake during this pregnancy.

H1. About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day?

H2. About how many cups of vegetables (including 100% pure vegetable juice) do you eat or drink each day?

Section I: This section will ask you questions related to your health.

- I1. Would you say that in general your health is:
- Excellent
 - Very good
 - Good
 - Fair
 - Poor
- I2. During the past month, how would you rate your sleep quality overall?
- I3. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed).
- I4. Do you plan to breastfeed your baby ever?
- Yes
 - No
 - Don't Know
- I5. *Before* you became pregnant, did you smoke cigarettes every day, some days, or not at all?
- Every day
 - Some days
 - Not at all
 - Don't know/Not sure
- I6. Do you *now* smoke cigarettes every day, some days, or not at all?
- Every day
 - Some days
 - Not at all
 - Don't know/Not sure
- I7. How many alcoholic drinks did you have in an average week *before* you became pregnant?
- I didn't drink
 - Less than 1 drink a week
 - 1 to 3 drinks a week
 - 4 to 6 drinks a week
 - 7 to 13 drinks a week
 - 14 drinks or more a week
- I8. How many alcoholic drinks did you have in an average week now?
- I don't drink now
 - Less than 1 drink a week
 - 1 to 3 drinks a week
 - 4 to 6 drinks a week

- 7 to 13 drinks a week
- 14 drinks or more a week

- I9. Has a doctor, nurse, or other health professional EVER told you that you had any of the following?
- Hypertension or high blood pressure
 - Heart attack (also called myocardial infarction)
 - Stroke
 - Diabetes – insulin dependent
 - Diabetes – type 2 or non-insulin dependent
 - Cancer
 - Other serious conditions
- I10. How much do you currently weigh in pounds?
- I11. How much did you weigh in pounds just BEFORE you became pregnant?
- I12. How tall are you without shoes?

Section J: This last section will ask you questions related to you and your family.

- J1. What month and year were you born? _____ / _____
- J2. What is your marital status?
- Never been married
 - Married or member of an unmarried couple
 - Divorced
 - Separated
 - Widowed
- J3. What is the highest grade or year of school that you attended?
- Never attended school or only attended kindergarten
 - Grades 1 through 8 (Elementary)
 - Grades 9 through 11 (Some high school)
 - Grade 12 or GED (High school graduate)
 - College 1 year to 3 years (Some college or technical school)
 - College 4 years or more (College graduate)
- J4. How many adults (over age 18) including yourself live in your household?
- _____ adults

- J5. How many children under the age of 18 live in your household?
_____ children
- J6. How many children have you given birth to?
_____ children
- J7. Which of the following apply to you regarding your current working status?
- Employed for wages full time
 - Employed for wages part time
 - Self-employed
 - Out of work
 - Homemaker
 - Student
 - Disabled and unable to work
- J8. During the past 12 months, what was your total household income before taxes? Include your income, your husband or partner's income, and any other income you may have used. All information will be kept private and will not affect any services you are now getting.
- Less than \$10,000
 - \$10,000 to \$14,999
 - \$15,000 to \$19,999
 - \$20,000 to \$24,999
 - \$25,000 to \$34,999
 - \$35,000 to \$49,999
 - \$50,000 to \$74,000
 - \$75,000 or more
- J9. During the past 12 months, how many people, including yourself depend on this income?
_____ people
- J10. Are you Hispanic or Latino?
- Yes No
- J11. Which one or more of the following would you say is your race?
- White
 - Black or African American
 - American Indian or Alaska Native

- Asian
- Pacific Islander
- Other

Thank you for taking the time to complete this survey.

If you have any further questions please feel free to contact the primary investigator of this research study, Kara Whitaker, at goodricm@email.sc.edu.

Please enter your name and e-mail address if you would like to be entered into a drawing to win 1 of 8 \$50 Amazon Gift Cards. You may also enter your contact information if you would like to receive the results of this study.

You will only be contacted by e-mail if you win the Amazon Gift Card and/or to receive the study results. You will not be contacted for any other reason.

I hope you have a healthy and happy pregnancy and wish the best for you and your baby!
Thank you again for your input!