



Original article

## Pregnant women's knowledge and awareness of nutrition

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### ABSTRACT

The purpose of this study was to investigate effectiveness of an educational intervention on pregnant women's nutritional knowledge. Despite national guidelines, women face personal and healthcare barriers to adequate nutrition education. This quasi-experimental study involved a convenience sample of pregnant women ( $n = 27$ ). The Nutrition Knowledge Questionnaire (NKQ) was utilized for pre and post-tests. Additionally, participants

were asked open-ended questions. Data analysis was performed using paired  $t$ -tests, linear regression, and qualitative thematic analysis. The mean pre-test and post-test scores on the NKQ were 30.0 and 38.96 respectively, representing a statistically significant increase ( $p < 0.00$ ). Six qualitative themes emerged including nutrition as “important” and “a real eye opener.” This study validates the use of an educational intervention based on MyPlate guidelines to increase pregnant women's knowledge of nutrition.

### 1. Introduction

Adequate knowledge and understanding of nutritional intake and dietary recommendations can help women to achieve a healthy weight gain during pregnancy (Wyness, 2014). According to the World Health Organization (2007), nutritional advice was found to hold strong evidence as a mainstay intervention to improve protein intake in pregnancy, reducing the risk of preterm birth by 54% (Darnton-Hill, 2013). A recent meta-analysis validated that nutritional counseling during pregnancy is not only the most effective intervention for improving pregnant women's knowledge and understanding, but also prevents many maternal and fetal complications (Girard & Olude, 2012). More specifically, nutritional counseling is found to improve gestational weight gain by 0.45 kg, increase birth weight in small for gestational age newborns, and lower the risk of maternal anemia by 30% (Darnton-Hill, 2013).

Both deficiencies in maternal nutrition and excessive gestational weight gain are associated with poor maternal and fetal outcomes (Birdsong, Byrd, Holcomb, Ticer, & Weatherspoon, 2014; Kominiarek, Gay, & Peacock, 2015; March of Dimes Foundation, 2017; National WIC Association, 2017). Women with excessive weight gain during pregnancy are at higher risk for complications such as cesarean birth, surgical complications, and gestational diabetes (Birdsong et al., 2014). Furthermore, fetal outcomes such as prematurity, birth defects, mac-rosumia, and increased likelihood for childhood obesity are associated with excessive maternal weight gain and/or inadequate nutrition (Birdsong et al., 2014; March of Dimes Foundation, 2017).

#### 1.1. Background

Over the past few decades, poor maternal nutrition and weight gain have continued to be a rising epidemic addressed by several organizations including the March of Dimes Foundation, Women, Infants, and Children (WIC) Program, Institute of Medicine (IOM), Center for Disease Control and Prevention (CDC), and American Congress of Obstetricians and Gynecologists (ACOG).

In the 1970's, the March of Dimes Foundation developed an education initiative for pregnant women founded on the principle of preventing birth defects linked to low birth weight (March of Dimes Foundation, 2010). The initiative includes a proactive care model with the philosophy of “Be Good to Your Baby before It Is Born” (March of Dimes Foundation, 2017) and later was transformed to reflect the 2009 Institute of Medicine (IOM) categorization of gestational weight gain by BMI to define both inadequacies in maternal weight gain and excessive maternal weight gain. One of the key recommendations for action developed with the IOM guideline revision was to offer nutritional counseling, specifically on dietary intake and physical activity, to pregnant women (IOM, 2009). The March of Dimes (2017) has published multiple nutrition handouts and online resources to address this goal, and also focuses on the prevention of premature births.

Similarly, in 1972 the Federal government established Women, Infants, and Children (WIC) a nutritional food program for pregnant women and mothers as a response to the growing concern of malnutrition in areas of lower socioeconomic status and poverty (National WIC Association, 2017). WIC was established as a supplemental

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nutrition program with a mission to provide nutritional education and support pregnant and lactating women, as well as children up to age five (National WIC Association, 2017). The mission emphasized the relationship between dietary and lifestyle habits to promote positive change (National WIC Association, 2017). Since the 1970's, WIC has continued to grow and provides two nutrition education contacts to women meeting criteria for services. Criteria for WIC includes income-eligibility dependent on state of residence and annual adjustments. In 2009, the United States Department of Agriculture (USDA) aimed to meet the new IOM gestational weight gain recommendations by adjusting the WIC food packages to be consistent with the Dietary Guidelines for Americans (National WIC Association, 2017). The current nutrition recommendations referenced by the March of Dimes and WIC reflect both MyPlate and the Dietary Guidelines for Americans (National WIC Association, 2017; United States Department of Agriculture, 2016). Despite these guidelines, many women continue to face personal, socioeconomic, and healthcare barriers to adequate and effective education on maternal nutrition (Birdsong et al., 2014; Harden et al., 2014; IOM, 2009; Kominiarek et al., 2015; Shub, Huning, Campbell, & McCarthy, 2013; Sullivan, 2014).

In 2013, ACOG developed two new Committee Opinion recommendations on the management of weight gain during pregnancy, and on obesity in pregnancy (ACOG, 2013a, 2013b). These new recommendations were in line with the IOM revised guidelines, suggesting multiple preventative strategies for maternal obesity such as preconception assessment, routine assessment and documentation of BMI (per the IOM guidelines), discussion of risk factors, and prenatal nutritional consultation (ACOG, 2013a, 2013b). The revised ACOG (2013a, 2013b) recommendations specifically stated nutritional counseling should be offered to all women outside of the normal BMI range throughout each pregnancy and postpartum to reduce risk of complications.

Recent literature demonstrates an overall increase in the number of women's healthcare providers integrating nutritional education materials into clinical practice and therefore following the recommended guidelines for preventing maternal obesity (ACOG, 2013a, 2013b; Foster & Hirst, 2014). Despite this fact, women's perception of appropriate weight gain and knowledge of adequate dietary intake during pregnancy was identified as a barrier to appropriate weight gain (Foster Hirst, 2014; Shub et al., 2013). As the rates of maternal obesity and weight gain continue to remain high, education and prevention strategies focusing on improving maternal nutritional knowledge are necessary for healthcare providers to implement into practice.

## 1.2. Literature review

The literature on pregnant women's knowledge, attitudes and awareness of nutrition supports that women gain a heightened awareness of the importance of nutrition when they are pregnant, but they face barriers to making positive behavior changes and lack reliable sources of information (Bianchi et al., 2016; Bookari, Yeatman, & Williamson, 2016; Downs, Savage, & Rauff, 2014).

In the United States, Downs et al. (2014) conducted focus groups and semi-structured interviews with 30 pregnant women to understand the knowledge and awareness of healthy nutrition behaviors in pregnancy that contribute to gestational weight gain. Of the 30 participants in this study, 65% of participants were of middle to high annual income ranging from \$40,000 to \$100,000 and primarily self-identified as Caucasian, full time employees with a college degree (Downs et al., 2014). Downs et al. (2014) reported many women were aware of what foods to avoid in pregnancy, but lacked knowledge of recommended weight gain. Importantly, 25% of women in the

study felt they did not receive enough information regarding healthy eating and therefore turned to the Internet for more information and often questioned the reliability of what they found online. Women with a previous pregnancy reported feeling as though they did not receive enough education

in subsequent pregnancies, because providers assumed they already knew the information. Downs et al. (2014) identified a need and greater opportunity for provider education on healthy pregnancy recommendations.

In France, Bianchi et al. (2016) conducted focus groups with 40 pregnant women to understand the concerns, attitudes and beliefs related to nutrition. The seven subthemes identified were foods changing from usual to dangerous, physiological changes of pregnancy, weight gain, the empowerment endeavor: building a healthier diet for mothers and their babies, passive absorption of information, active information seeking, and translating information into eating behavior (Bianchi et al., 2016).

Much of the current quantitative literature suggests that the key to maintaining a healthy pregnancy and primary prevention of maternal-fetal complications is to establish healthy dietary habits (Girard & Olude, 2012; Lucas, Charlton, & Yeatman, 2014). In a meta-analysis assessing nutritional advice during pregnancy, nutritional counseling was identified as the intervention most likely to have an overall improvement on maternal knowledge of nutrition and dietary intake during pregnancy (Lucas et al., 2014).

In Australia, De Jersey, Nicholson, Callaway, and Daniels (2013) recruited 582 pregnant women to assess weight, knowledge, and dietary behavior, physical activity and support amongst women during pregnancy. De Jersey et al. (2013) reported that < 50% of women received adequate dietary and physical activity counseling, despite 80% desiring this counseling. The opportunity to provide more education is present and women appear to desire this counseling (De Jersey et al., 2013).

Shub et al. (2013) introduced a questionnaire, “Improving Patient Knowledge and Awareness of Maternal Weight Gain, Nutrition, and Exercise during Pregnancy” in order to assess women’s knowledge and needs regarding education on maternal weight gain and nutrition during pregnancy. Shub et al. (2013) reported that more than half of the 353 pregnant participants

were overweight, and approximately 75% of these overweight women lacked knowledge of appropriate weight gain and nutrition. Further findings reported were that 87% of participants with normal weight gain previous to pregnancy correctly classified their own BMI, whereas only 24% of obese women could (Shub et al., 2013). Only one third of women reported beliefs and knowledge consistent with the idea that healthy nutrition leads to safe weight management during pregnancy (Shub et al., 2013). Additionally, Shub et al. (2013) discovered an overall low awareness of perinatal complications amongst study participants. Only 27.8% of women recognized preeclampsia, and 14.4% recognized postpartum weight retention, as potential complications of excessive weight gain during pregnancy (Shub et al., 2013). Furthermore, only half of the women (51%) recognized gestational diabetes (Shub et al., 2013) as a complication of excessive maternal weight gain. Shub et al. (2013) concluded that increasing awareness on this topic would improve maternal knowledge of best practices for weight gain during pregnancy and therefore have the potential to prevent maternal obesity.

Jones et al. (2015) developed a questionnaire measuring adults’ general knowledge of nutrition and current dietary recommendations. The framework for Jones et al. (2015) work was Social Cognitive Theory, that inadequate nutrition is one of the largest barriers to maintaining a healthy weight (National Cancer Institute, 2005). Jones et al. (2015) aimed to develop a reliable and valid instrument, the Nutrition Knowledge Questionnaire (NKQ) that could be applicable to the general adult population. The NKQ was developed from several items from other nutrition questionnaires (most notably the General Nutrition Knowledge Questionnaire) and included resources from the Dietary Guidelines for Americans and MyPyramid (Jones et al., 2015). The NKQ was found to have adequate internal consistency with a Cronbach alpha of 0.85, 0.81, and 0.81 for each segment of the questionnaire respectively (Jones et al., 2015). The overall internal consistency reliability was 0.91, the test-retest total reliability was equal to

0.95 ( $p < 0.001$ ) (Jones et al., 2015). The questionnaire focuses on knowledge and suggested for use as pretest and posttest in nutritional education programs and interventions.

In Canada, Da Costa et al. (2015) investigated women's needs and barriers to receiving information on emotional wellness and health during pregnancy, with the goal of developing a website. A resulting sample of 74 pregnant or postpartum women completed the online study survey. 67.6% of the women reported their providers had not discussed weight gain guidelines with them during their pregnancy, and 54.1% did not receive education related to healthy nutrition during pregnancy. The barriers to healthy behaviors identified were lack of resources available in the healthcare system and lack of time to see assistance. 73% of participants identified the Internet as their preferred top source of information related to perinatal health followed closely by 62.2% identifying their healthcare provider. Implications from this study were that evidence-based online educational interventions for pregnant women would be credible, low cost, and easily accessible, as well as augment health-care provider's advice (Da Costa et al., 2015).

In Australia, Bookari et al. (2016) surveyed 326 pregnant women to understand their knowledge of optimal gestational weight gain and dietary approaches. 63.8% of participants were unfamiliar with the Australian Guidelines for Healthy Eating during pregnancy, demonstrating a gap in the knowledge of maternal nutrition education. Further, Bookari et al. (2016) found that more than half of the participants perceived that knowledge of recommended gestational weight gain was "important" and 63.2% of participants were aware of current weight gain recommendations; however, only 27.6% accurately stated their individual recommended weight gain based on BMI. Half of the women in the study were overweight or obese and of this cohort of women, over 50% overestimated their own recommended gestational weight gain. Overall, women in this study lacked knowledge of the IOM weight gain guidelines; however, were aware of general dietary recommendations (Bookari et al., 2016). Bookari et al.'s (2016) findings are in line with Downs et al. (2014) that many women are aware of what foods to avoid in pregnancy, but lack knowledge of recommended weight gain.

Building from the work of the state of the science, this research investigation adds to the literature by evaluating the effectiveness of an educational intervention based on MyPlate guidelines on pregnant women's knowledge of nutrition. This current study aims to evaluate if an education method that guides pregnant women through a healthy dietary intake during pregnancy will increase knowledge and awareness of nutrition. The purpose of this study is therefore to investigate the effect of an educational intervention on the knowledge and awareness of maternal nutrition using the NKQ. In alignment with the work of Jones et al. (2015) developing the NKQ, the theoretical framework for this current study is Social Cognitive Theory (Bandura, 2001). Social Cognitive Theory was founded on the principle that each individual has a belief system that has capacity for self-motivation and positive behavioral change (Bandura, 2001). The external influence of diverse social structures and internal influence of self-perseverance together have a profound effect on the control of an individual in order to establish desired outcomes (Bandura, 2001). The principles of Social Cognitive Theory were used to inform this study through providing education to promote self-efficacy in order to meet desired outcomes of improved dietary knowledge during pregnancy.

## 2. Methods

### 2.1. Procedure

Approval from an institutional review board (IRB) was obtained for this study. Recruitment was performed based each woman's willingness to participate through a convenience sample. Recruitment included study flyers and direct recruitment. Study flyers were hung in a private OB/GYN office at the front desk. On the study days, pregnant women at

any gestational age presenting for prenatal care visits were also asked by the first author if they were willing to participate in this study. Informed consent was obtained from each participant prior to the study beginning. All participants were assigned a code number to be put on all pre-test and post-test material to correlate data and maintain confidentiality.

The inclusion criteria were: pregnant woman who were enrolled in the practice receiving prenatal care, English speaking, and present in the office on recruitment days. There were no exclusions made by race. Exclusion criteria included non-English speaking women as there was no translator present.

## 2.2. Research design

The research design was quasi-experimental with a pre-test, intervention, and a post-test and utilized convenience sampling. The participants were each asked to complete a pre-test including the Participant Demographic Form and the “Nutrition Knowledge Questionnaire” (NKQ) (Jones et al., 2015) focusing on self-knowledge of nutrition. The initial pre-test was performed with the principal investigator inside of the room. The Participant Demographic Form total average time for completion was approximately two to 3 min. The NKQ has a total of 42 questions, six with subscale questions. The total average time to complete the NKQ was approximately seven to 10 min. Although this research instrument has not been used in the pregnant women population, given the strong reliability and validity with the adult population in the past, this tool was utilized during this study. The total average time to perform the pre-test was approximately 10–13 min.

During the planning stages of this study, permission was obtained to use the questionnaire from the work of Shub et al.’s (2013), which had been previously used with a pregnant population and emphasized lifestyle behaviors and dietary recall. Ultimately, the overall aim of this research led the first author to obtain permission for utilization of the NKQ,

which reflected participants’ nutrition knowledge (Jones et al., 2015). Without a scoring mechanism or focus on knowledge for Shub’s questionnaire, a limitation on how to compare pre-test to post-test after the implementation of an educational intervention was posed. The Jones instrument, the NKQ, was designed for adults, not specifically pregnant women, however, throughout the literature, the MyPlate guidelines have been referenced as the top nutritional education resource for both the March of Dimes and WIC. Given this breakdown of the two instruments, the NKQ was selected for use in this study as it was found to better match the aim of this research investigation most consistently.

Once the pre-test was completed, the first author met with each participant to review the educational trifold handout. The standardized educational handout was presented in a visually engaging format and included MyPlate, ACOG, MyPyramid, and DGA guidelines to address key components of the NKQ. Further, web-based references for these guidelines, as well as relevant websites, were provided on the handout for participants to have as additional resources. The intervention was designed by the 2 authors and then reviewed for feedback by 3 Registered Nurses and 2 Obstetricians who all felt the intervention was comprehensive.

The intervention consisted of material strictly from the handout read one time through to ensure consistent and standardized teaching with each participant. The trifold handout was comprised of visual learning aids to augment the information being spoken. The intervention was designed in line with adult learning principles to target both auditory and visual learners, as well as to convey the importance of the material for them personally, in an effort to promote engagement with the information (Knowles, Holton, & Swanson, 2015). The total time for the educational intervention averaged 5 min.

After reviewing the handout, each participant again completed the NKQ as a post-test and additionally completed the qualitative interview guide, taking about 15 min in total to complete. The qualitative

interview guide contained five semi-structured, open-ended questions focusing on women's perceptions, views, and barriers of nutrition in pregnancy, as well as resources they utilize, and future utilization of the knowledge they received. The first author asked each question in a conversational style, and on average participants took approximately 2 min to answer each question. The first author transcribed detailed notes of participants' answers at the time of the interview.

### 2.3. Data analysis

Data was analyzed in SPSS using paired t-tests comparing pre-test and post-test raw scores of the NKQ through using a significance level of

$p < 0.05$ . During data analysis, scores were categorized as either low or high based on a 65% cut-off score. The scoring mechanism for the NKQ allotted one point for each correct answer in congruence with the scoring mechanism used by Jones et al. (2015). Through email discussion with Dr. Jones, it was identified that there was no cut-off score for the NKQ instrument. In order to compare like groups for this study, a cut-off score was defined as 65% by the researchers of this study. Demographic questions from the original NKQ were omitted because they were duplicative to the separate demographic questionnaire used in this study, making a total of 42 total questions rather than the 50 on the original instrument. The 42 questions were broken down for a total maximum score of 57 points. For questions one through three, one point was awarded only if the participant correctly identified a disease or health problem in the write-in portion. For questions such as "how would you rate the healthfulness of each of the following types of fat?", each correct response received one point per individual row (a, b, c, d, etc.). For data analysis purposes, a low score was calculated as a 65% (37/57) or below and a high score was calculated as  $> 65\%$ . The scores of pre-tests and post-tests were compared using a paired t-test.

Additionally, characteristics and traits of the low scoring versus high scoring groups were correlated with descriptive statistics using linear regression. Qualitative data from the qualitative interview guide was analyzed using thematic qualitative analysis (Polit & Beck, 2017). Both authors independently, and then together, analyzed the qualitative data, enhancing the credibility.

## 3. Results

### 3.1. Sample

The purposeful sample included 27 participants. A total of 30 pregnant women were consented into the study, however, three participants were excluded from data analysis because they were unable to complete the posttest due to time constraints. No adverse event occurred, in all three cases, the participant ran out of time and couldn't stay to finish. Of the 27 participants, one woman was included in the quantitative data analysis only, as she did not complete the qualitative interview guide.

The sample ranged in age from 23 to 39 years (mean 32 years). 20 participants self-identified as white (74.1%), three as Asian (11.1%), one as American Indian (3.7%), one as Black/African American (3.7%), one as Hispanic (3.7%), and one as multiracial (3.7%). The highest self-reported level of education included eleven participants with a bachelor's degree (40.7%), five with a high school diploma (18.5%), five with a master's degree (18.5%), two with an associate's degree (7.4%), two with a doctorate (7.4%), and two with a diploma (7.4%). Data on family household income or utilization of WIC services was not collected; however, in the practice setting utilized for recruitment, all women are offered WIC information and only 10% of utilize these services. Of the participants, 22 stated that they were married (81.5%), four were in a committed relationship (14.8%), and one as single (3.7%).

The range of previous pregnancies experienced by participants was zero to seven, with an average of two previous pregnancies per participant. In regards to type of births previously experienced, eleven had

prior vaginal births (40.7%), four had cesarean birth (14.8%), and twelve had no previous birthing experience (44.4%). The number of reported living children ranged from zero to three, with an average of one living child per participant. Out of all fifteen participants who had previously had a birthing experience, 73.3% were vaginal and 26.8% were cesarean births. No participant had experienced both vaginal and cesarean birth. Amongst the fifteen women who reported prior pregnancies, the average weight gain during previous pregnancy reported was 38 lbs, with a range of 10 lbs to 90 lbs total weight gain during pregnancy.

Of the participants (N = 26) who self reported pre-pregnancy weight during their current pregnancy, pre-pregnancy weight ranged from 108 lbs to 199 lbs, with an average pre-pregnancy weight of 143 lbs. Pre-pregnancy height ranged from 60 in. to 70 in., with an average pre-pregnancy height of 64 in. BMI calculations based on self-reported pre-pregnancy height and weight ranged from 17.4 to 35.2 (underweight to obese) per IOM pregnancy weight gain recommendation classification guidelines. Fifteen (57.7%) were classified as normal BMI pre-pregnancy, six (23.1%) as overweight, four (15.4%) as obese, and one (3.9%) as underweight. The average reported weekly exercise ranged from zero to five days per week, on average two days per week.

### 3.2. Quantitative results

Maternal nutrition scores improved following the educational intervention (M = 39.0, SD = 7.9) when compared to the pre-test scores (M = 30.0, SD = 9.2). The post-test scores demonstrated an increase in pregnant women's knowledge of nutrition ( $p < 0.0$ ) with an average increase in scores of 16.6% with a range of 0.0% to 31.6% (see Fig. 1 and Fig. 2). Correlations were run between test scores, age, race, and pre-

pregnancy BMI without statistically significant correlations identified.

Of the 15 women who previously had a pregnancy, 40% passed the pre-test NKQ, and of the 12 women who have never had a pregnancy, 16.7% passed. The post-test scores reflected a pass rate of 66.7% (failure rate at 33.3%) for both multiparous and primiparous women. The majority of participants (N = 20) stated “yes” they did change their diet and nutritional intake since they have been pregnant, seven reported “no”. For how they have received information regarding nutrition, 23 participants reported handouts, 20 having discussion, and two having online resources given to them regarding appropriate weight gain during pregnancy. Twenty-two received handouts, 16 discussion, five online resources, and one alternative resources regarding appropriate nutrition during pregnancy. Twenty-six total participants denied any difficulty in understanding information on maternal nutrition or weight gain with one participant unaccounted for due to lack of response.

### 3.3. Qualitative overarching themes

A total of six themes (Table 1) emerged from qualitative data

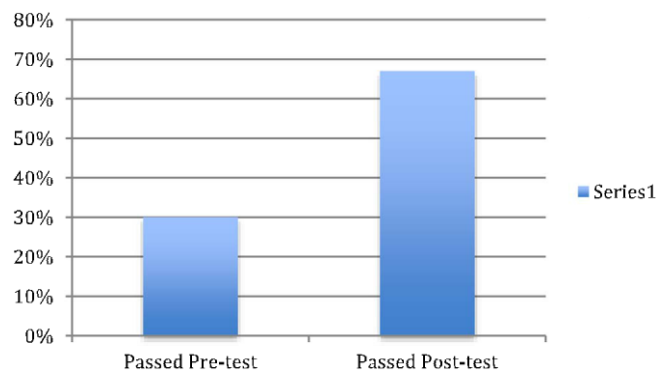


Fig. 1. NKQ pre-test and post-test scores.



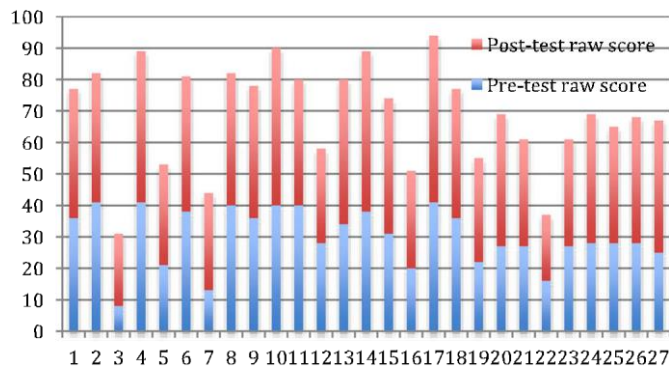


Fig. 2. Changes in test scores after educational intervention.

Table 1  
Overarching themes.

1. Nutrition is just so important for me and my baby, I have to pay attention to be healthy.
2. My eating habits affect the baby before, during, and after my pregnancy.
3. “It has been an eye opener” .
4. Hurdles throughout pregnancy: from morning sickness to cravings and everything in between.
5. Provider, Provider and Google to the rescue, all my pregnancy questions answered in one click.
6. Paying attention to the fine details of diet; knowledge is power.

analysis representing the importance of healthy nutritional habits, knowledge, prevention of harm to baby, and hurdles experienced throughout pregnancy. There were initially a total of 27 themes and over the course of one week, they were collapsed into eight total themes. Approximately 6 weeks later after final review, they were further collapsed into six themes. An example of this process was, Google to the rescue and provider, provider being collapsed into one theme representing how women receive information about nutrition in pregnancy.

3.3.1. Theme 1: nutrition is just so important for me and my baby, I have to pay attention to be healthy

Half (N = 13) of the women described the importance of nutrition for both themselves as the mother, and their baby in response to the semi-structured question “what are your perceptions about nutrition during pregnancy”. This theme emerged by collapsing the following four subthemes: “its important”, awareness and attention to nutrition, focus on “healthy”, and balance.

The word “important” was specifically used by half of the women to describe their feelings about maternal nutrition. One woman shared, “It’s very important, especially if you are in a high range of BMI category”. Six participants (23.1%) stressed the importance of paying attention and

increasing awareness of nutrition during pregnancy using words such as paying attention and being mindful, watchful, aware, and cognizant. Five participants (19.2%) used the term “healthy” to describe the focus of their habits including key phrases, “I need to...”, “I try to...”, and “I should...” to describe their perceptions on healthy eating habits. Overall participants recognize the importance of healthy nutrition for both them and their baby and identify they are, or try to be, mindful and aware about nutrition.

3.3.2. Theme 2: my eating habits affect the baby before, during, and after my pregnancy

Seven participants (26.9%) reflected on the importance of preventing prenatal risks and described the positive effects of nutrition on both maternal and fetal health. These participants felt passionately about nutrition and diet behavior changes to promote a more safe and healthy pregnancy. One participant shared, you must “watch what you

eat to ensure no harm to the baby.” Participants also discussed that their nutrition can directly affect their baby. One woman shared, healthy nutrition is important in “decreasing the risk of preterm [delivery] and pregnancy complications.” Another participant offered, “watching weight gain helps with cardiovascular health for the mom and baby.” The fact that their baby is affected by their nutrition was acknowledged by women and largely fueled their eating habits throughout pregnancy, in order to prevent potential complications.

### 3.3.3. Theme 3: “It has been an eye opener”

Nineteen women (73.1%) felt strongly that their view of nutrition changed during their pregnancy and that the pregnancy itself was an eye opener to the benefits of nutrition. Four subthemes emerged including: increase in awareness and consciousness, increased in knowledge and research, trying to eat healthier, and vegetarian change. Participants reported an overall increase in and awareness of areas of healthy eating that they wanted to know more about. A few of the participants associated these perceptions with changes in biometric or laboratory changes, such as the glucose tolerance test for gestational diabetes. One participant describes the eye opening experience of receiving the news on her new diagnosis: “Now that I am diagnosed with gestational diabetes, it has changed. You think you can eat anything, and then you fail the glucose tolerance test and everything changes.”

### 3.3.4. Theme 4: hurdles throughout pregnancy: from morning sickness to cravings and everything in between

Participants largely felt there were a multitude of hurdles experienced throughout pregnancy that barricaded their success with healthy nutrition at times. The following eight subthemes were collapsed to form this theme: morning sickness, cravings, work schedules, no real barriers, meal prep challenges, dietary restrictions, picky eaters, and holidays. Of the eight subthemes, seven participants (26.9%) identified morning sickness and food aversions as

the biggest hurdle to achieving and incorporating a healthier diet into their lifestyle. One woman shared, “in the beginning it was harder because of nausea and weakness during my first trimester, since then I have been able to cope”. Six participants (23.1%) reported difficulty dealing with cravings during pregnancy and that giving into these cravings impeded achieving healthy nutrition.

Additionally, six participants (23.1%) described challenges with work schedules that conflicted with meeting nutrition goals during pregnancy, three participants (11.5%) describing challenges with meal prep. Barriers varied on workplace setting, access to food, and responsibilities at home. One participant stated, “I work at a fast food restaurant” and shared that she has challenges not only with cravings, but access to healthy options. Another participant reflects on challenges with balancing meal prep for themselves and younger children in the house: “I have a toddler, so meal prep has changed dramatically. We tried to use Blue Apron® and making meals that everyone can eat. I have to try and sneak veggies in.”

Two women with pre-existing medical conditions also identified meal prep challenges as a barrier due to specific dietary restrictions associated with their conditions (e.g. irritable bowel disease, and anemia). Five participants (19.2%) felt they had minimal or no barriers to meeting pregnancy nutritional goals.

### 3.3.5. Theme 5: provider, provider and Google to the rescue, all my pregnancy questions answered in one click

Eight participants (30.8%) primarily sought their providers (e.g. doctor, midwife, or nurse) for information on nutrition during pregnancy. Five of the eight participants used the word “doctor”, stating “I call the doctor’s office” and “I find out information at doctor’s visits and checking in”. Some women described receiving initial packets or information from their providers directly regarding nutrition and weight gain guidelines.

The majority of participants however (88.5%) expressed how they

use the internet to find information on maternal nutrition. Google was the primary source for information. The next most common source was Ovia, an online application described by one of the participants as a “food safety look up feature.” Participants shared how all of their questions could be answered in one click using online resources.

### 3.3.6. Theme 6: paying attention to the fine details of diet; knowledge is power

Participants felt they would incorporate the knowledge gleaned from the intervention in a multitude of ways. Largely, they felt that knowledge is power. They expressed they would change the specifics of their diet (61.5%), be more motivated in their approach to nutrition (26.9%), review nutrition material at home (26.9%), continue to gain knowledge and to be more mindful (26.9%). A few participants stated that the information on the risks associated with being unhealthy during pregnancy and that the desire to have a healthy baby would be motivating factors. One participant reflected, “I will be more cognizant of types of fats and watching caloric intake”, “I will be mindful of the fat content versus sugars. The calories per gram are quite impressive”.

## 4. Discussion

The March of Dimes and the Women Infant, and Children Association stand out as two of the leading organizations providing nutrition education to women and providers alike, and each base their recommendations on the Dietary Guidelines for Americans and MyPlate as this intervention did (March of Dimes Foundation, 2017; National WIC Association, 2017). This current study demonstrates an overall increase in nutrition knowledge and awareness following an educational intervention based on MyPlate guidelines and evidence-based practice. On average, participants’ scores increased by 16.6%, supporting the use of this nutritional counseling intervention in the pre-natal care setting to improve knowledge. The knowledge gained can in turn help women to make improved food choices and to follow more positive health related behaviors. It is important to note that improving knowledge is in fact a first step that aims to help pregnant women make healthier food choices and/or to change their current eating habits. These choices and changes in behavior that result from the knowledge gained can ultimately prevent maternal-fetal complications that may arise from poor nutrition during pregnancy (Darnton-Hill, 2013; Girard & Olude, 2012).

The first theme identified in this study “Nutrition is just so important for me and my baby, I have to pay attention to be healthy” validates the subtheme of “the empowerment endeavor: building a healthier diet for mothers and their babies” from Bianchi et al.’s (2016) research. Both in this current study, and Bianchi et al.’s (2016) work, women felt it was important to be healthy for their babies and to prevent complications, they were mindful of their choices, and they contributed to their own health and well-being because they were pregnancy and starting their motherhood journey.

The current state of the science validates that inadequate maternal nutrition can lead to poor maternal-fetal outcomes, such as gestational diabetes, preeclampsia, and childhood obesity (Girard & Olude, 2012; Kominiarek et al., 2015). Shub’s prior research (2013) in this area revealed that pregnant women have an overall low awareness of the perinatal complications such preeclampsia (27.8% are aware), gestational diabetes (51% are aware), and postpartum weight retention (14.4% are aware) as potential complications of excessive weight gain during pregnancy. In this current study, qualitative data analysis, specifically theme two, “my eating habits affect the baby before, during, and after my pregnancy” validates Shub’s (2013) findings, as approximately 25% of participants spoke about complications arising from poor nutrition. For this current study, women were not directly asked about the complications arising, but instead were asked about their perceptions of why nutrition is important in pregnancy, a noted difference between the two studies.

Multiparous and primiparous women may be provided different nutrition education based on the assumption that multiparous women have likely already received this information. In this current study, women 60% of multiparous and 83.3% of primiparous women failed the pre-test on nutritional knowledge. It may be presumed that primi-parous women would have failed at a much higher rate than multiparous counterparts, due to their likely previous exposure to nutrition information. A participant from previous qualitative literature summarizes a likely rationale for these results, “At the physician’s office they thought I wouldn’t need a lot of information because it wasn’t my first pregnancy so they thought I knew a lot of the stuff, but I didn’t remember” (Downs et al., 2014, p. 6). Healthcare providers are reminded to provide education to all pregnant women regardless of parity.

During the qualitative portion of this study, women described challenges that they have experienced throughout pregnancy around achieving nutritional goals. They also describe how they access knowledge and education about nutrition. Many women provided detailed examples of specific online websites and services utilized to overcome some of the barriers such as time, work schedules, and meal prep challenges.

It is imperative to note that for the current study’s population, financial constraints were not mentioned as a barrier or a challenge to achieving their nutritional goal and on average in the practice setting utilized for recruitment, only 10% utilize WIC services. Overall, however, many women do in fact face financial obstacles to healthy nutrition and in 2012, 983,192 pregnant women were enrolled in WIC (Johnson et al., 2013).

Another common barrier identified in the literature are family and friends influencing food choices often in a negative way (Bianchi et al., 2016). Women in this current study did not feel as though their family members were influencing their food choices, and just one participant stated that cooking healthy meals was challenging because she had a toddler at home and was trying to make a meal everyone would eat.

The qualitative portion of this study revealed, that the Internet, specifically Google, was identified by almost all of the women (88.5%) as what they utilize for obtaining information about nutrition during their pregnancy. This theme validates Downs et al.’s (2014) findings that 25% of women turn to the Internet for more nutrition information during pregnancy. Importantly, the participant demographics reported in Downs et al. (2014) are close to this current study demographics. The fact that pregnant women are turning to the Internet for information demonstrates a need for a multimodal approach in promoting nutritional counseling in the prenatal care setting, as in this study where a handout was provided with clear information about recommended websites. For healthcare providers, the addition of trusted and recommended websites specific to nutrition would be a valuable resource for pregnant women who are clearly seeking this information. Previous research has also demonstrated that women have an overall interest in web-based strategies to improve dietary, weight gain and lifestyle behaviors during pregnancy (Da Costa et al., 2015).

#### 4.1. Limitations and strengths

The major strength of this study is the manner in which the qualitative analysis was conducted by both authors who then met several times to discuss theme identification. The limitations of this study include the lack of generalizability for this intervention given the small sample size. The sample size was limited by the size of the practice and time for recruitment. Due to these limiting factors, inclusion criteria was broad, including women of any gestational age and even those with gestational diabetes. Further work would aim to recruit women in the second and third trimesters of pregnancy only and separate women diagnosed with gestational diabetes from those not diagnosed, given the additional nutrition education these women receive inherent to their diagnosis.

Additionally, the delivery of education was equally effective regardless of parity, age, race, or pre-pregnancy BMI as demonstrated by no change in scores with linear regression comparing demographical data with test scores. Shub et al. (2013) also reported no association between parity, age, of BMI and pregnant women's knowledge of complications or beliefs about diet. However, these variables may be significant with a larger sample. The results from the study demonstrated statistical significance of the intervention's effectiveness across the sample of pregnant women; however, due to the small sample size, the study was underpowered and therefore would warrant additional research investigation with a larger sample.

Lastly, two notable limitations are that household income demographic data was not obtained during this study and that there were no follow up posttests included to determine the long-term effects of this nutrition education intervention.

#### 4.2. Clinical practice implications

The findings of this study support the use of an educational handout intervention in improving women's knowledge and awareness of nutrition during pregnancy. Based on the qualitative data, most women in the study defined nutrition during pregnancy as "important" and feel they want to be healthy for themselves and their baby. Therefore, the findings support the presence and implementation of nutritional education in the prenatal care setting by having the provider or a registered nurse review the trifold one-on-one with patients, allowing time for questions, which would take approximately 5 min per patient during their initial prenatal visit, which is a longer visit to allow time for pregnancy education.

By including a provider-led discussion of weight gain in correspondence with each prenatal office visit, this will allow women to be active participants in their care. Based on previous research regarding nutrition education in pregnancy, we hypothesize that this intervention will promote healthy nutrition in pregnant women, thereby decreasing maternal-fetal weight gain and associated complications. Previous work has also identified the need for an educational and weight gain focused study on improving maternal awareness of BMI targets and appropriate weight management strategies during pregnancy (Shub et al., 2013).

#### 4.3. Implications for policy

In 2012, the Joint Commission set national goals toward improved outcomes for maternal and child health (National Quality Forum, 2012). Specifically, the goals were for a minimum gestational age for elective inductions, for a reduction of cesarean sections, and to decrease infection rates, each of which can be impacted by maternal weight gain and obesity (National Quality Forum, 2012). HealthyPeople 2020 (2014) defined an explicit goal of increasing the number of women with healthy pre-pregnancy BMI who deliver a live infant. In order to close gaps between perinatal health care disparities, a more standardized approach, such as the one implemented in this study, could be put in place to provide education on nutrition and to pregnant women. Having this education as a reimbursable service and tied to the electronic medical record systems, may increase the number of healthcare providers offering this education. Increasing reimbursement for

nutrition education to pregnant women will ultimately prevent potential complications stemming from poor nutrition and improper weight gain that can lead to increased healthcare spending.

#### 4.4. Suggestions for future research

The majority of nutritional education studies performed to date have evaluated group interventions. Few studies, such as this current one, have performed a one on one intervention to assess maternal nutrition knowledge. Since diet and pregnancy are both individualized and personal aspects of women's lives, additional studies including one

on one education with women will be beneficial, specially separating women with and without gestational diabetes in future studies. A mixed methods study aimed at assessing perceptions of knowledge and barriers would assist providers in giving a multimodal and comprehensive approach to caring for this population of women.

Additionally, repeating this current study with a socioeconomically diverse group of women and measuring the impact of the intervention longitudinally will add to the literature. Future research should also follow participants' behaviors after the intervention and throughout the entire pregnancy course through dietary journaling, collection of data on maternal weight gain and information about the pregnancy course. Adding this information to the data collection will help to determine if nutrition behaviors are positively changed as a result of the intervention.

## 5. Conclusion

The research findings validate the use of educational intervention based on MyPlate and current evidence-based guidelines on informing and improving nutrition education in pregnant women. The delivery of education was equally effective regardless of age, race, parity, or pre-pregnancy BMI, supporting the use of this tool with diverse populations of pregnant women. This study also supports that women in subsequent pregnancies should not be overlooked when providing nutritional education. The implementation of this educational intervention has a high yield in improving maternal nutrition knowledge. The minimal cost for each handout and the 5–10 min of time spent with each woman to review the information, is a step toward decreasing the financial burden and poor health outcomes associated with inadequate nutrition and maternal obesity. Continuing to improve maternal knowledge of nutrition will lead to healthier food behavior choices, which can increase maternal and fetal health, thereby decreasing long-term complications.

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