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Increasing Patient Adherence to Gestational Weight Gain Goals in Pregnancy

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INCREASING PATIENT ADHERENCE TO GESTATIONAL WEIGHT GAIN GOALS IN PREGNANCY

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by

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Abstract

Problem: The inability to maintain healthy weight gain during pregnancy may contribute to multiple pregnancy-related complications. Nutritional education and support may improve nutrition and vitamin consumption, and recommendations for healthy gestational weight gains have been published. However, pregnant women have reported minimal advice regarding healthy weight gain during pregnancy. A personalized, nutritional counseling program was initiated in a Midwestern, suburban OB-GYN private practice.

Methods: A quality improvement descriptive, correlational design was used. A cohort of pregnant women first trimester through six-weeks postpartum received individual counseling and face-to-face interaction at an office visit each trimester.

Results: Twenty (N=20) participated in this project. Most were white (n=17, 80%), married (n=12, 60%), and had private insurance (n=18, 90%) with no Medicaid patients. With logistic regression analysis, 55% of women who received individual weight counseling gained less than five pounds above recommendations. Subjects were 85.7% more likely to achieve recommended weight gain when nutrition counseling was given (OR=1.857, p = 0.187). Patient enrollment and postpartum weights were compared using a Wilcoxon Matched-Pairs analysis (Z= -1.980, p=0.048).

Implications for practice: Healthcare providers who assist women during pregnancy to achieve a recommended weight gain based on their body mass index (BMI) with counseling and expanded nutritional support may contribute to women being more successful at achieving recommended weight gain goals during pregnancy. Personal nutritional counseling appeared to have benefited women across all weight classes, however, further study is needed with a more diverse population.

Increasing Patient Adherence to Gestational Weight Gain Goals in Pregnancy

Nutrition serves a vital role in pregnancy not only for the growth of the fetus but also for the overall health of the mother during gestation through the postpartum visit. Problems may arise when an excessive amount of weight is gained during pregnancy. Weight gain can lead to an increased prenatal risk for macrosomia, gestational diabetes, risk for cesarean section, and risk for future obesity. Nutritional education and support during pregnancy have been positively associated with an increase in improved nutrition and vitamin consumption (Goodarzi-Khoigani, Moghadam, Nadjarzadeh, Mardanian, Fallahzadeh, &Mazloomy-Mahmoodabad, 2018. However, studies have reported women being encouraged to "eat for two" from family members during pregnancy (Kim, Koleilat, & Whaley, 2016). This advice may contribute to excessive weight gain during some pregnancies. Furthermore, women have reported concern, frustration, and inconsistency with their healthcare providers about appropriate weight gain recommendations and goals. (de Jersey, Nicholson, Callaway, & Daniels, 2013).

The increasing rates of obesity worldwide continue to be a significant health concern, and the childbearing years are often the beginnings of a weight management problem later in life. In 2009, the Institute of Medicine (IOM) revised their practice guidelines for gestational weight gain (GWG) in pregnancy which were specifically related to a woman's body mass index (BMI) in the prepregnant state (American College of Obstetricians and Gynecologists [ACOG], 2013). The IOM's current practice guidelines for pregnancy weight gain are: *underweight* (BMI <18.5) with a recommended weight gain of 28 to 40 pounds; *normal weight* (BMI 18.5 to 24.9) with a recommended weight

gain of 25 to 35 pounds; *overweight* (BMI 25.0 to 29.9) with a recommended weight gain of 15 to 25 pounds; and *obese* (BMI > 30.0) with a recommended weight gain of 11 to 20 pounds (Centers for Disease Control and Prevention [CDC], 2016).

Obesity concerns directly reflect the maternal-child health quality indicators set forth in the *Healthy People 2020* guidelines for *Pregnancy Health and Behaviors.* The *Healthy People 2020* guidelines recommended to increase the proportion of mothers who achieve a recommended weight gain during their pregnancy. (Office of Disease Prevention and Health Promotion [ODPHP], 2020, para.7). The Agency for Healthcare Research and Quality (AHRQ, 2020) has also identified the need for further management of obesity in pregnant patients and cited this as a U.S. Preventive Services Task Force (USPSTF) *grade B* recommendation.

In the U.S., CDC (2016), reported only 32% of women who delivered full term, singleton infants gained the appropriate amount of weight during their pregnancy. For comparison, 48% of women who delivered full-term, singleton infants gained more weight than was recommended (CDC, 2016). Weight gain above recommendations was highest among women who were already within the overweight or obese prepregnant categories (61% and 55% respectively) (CDC, 2016). In addition, the Missouri *Pregnancy Risk Assessment Monitoring System* (MOPRAMS) reported approximately one in four women was obese (24.7 %) just before pregnancy (MOPRAMS, 2018, p. 3). In a Mid-Western state with poor maternal mortality rates, 21% of women who gave birth to singleton, term infants gained equal to or > greater than 45 pounds whereas, 12.3% of women who gave birth to singleton, term infants gained equal to or < less than 15

pounds, and was less than what was recommended by the IOM (Missouri Department of Health and Senior Services Office of Epidemiology [MODHSS], 2018). Two counties of a large, mid-western metropolitan area within the state, fared worse than the overall state rates for maternal GWG at 21.2% and 23.77%, respectively (MODHSS, 2018). Hence, over 30% of pregnant women in the state gained too much or not enough weight during their pregnancy.

When examining the effect of adherence to the GWG parameters, normal weight women who were able to maintain their weight within the IOM guidelines, sustained approximately $2,500 less cost per delivery than those who exceeded the weight recommendations (Yanit, Phelon, Pillioid, Volpe, & Caughey, 2012). Likewise, obese women who gained within the recommended IOM parameters also sustained fewer medical costs. Obese women who gained within the recommended IOM parameters exhibited a reduction in delivery costs of approximately $6,500 (Yanit, et al, 2012). Nationally, adherence to GWG guidelines could result in over $12 billion in annual healthcare savings (Yanit, et al, 2012).

The purpose of this project was to evaluate the effects of provider support, i.e., nutritional education at regular intervals, for appropriate GWG during pregnancy. The overall aim was to assist at least 50% of pregnant women, in a private, Mid-western, obstetrical practice to achieve their targeted weight gain during the pregnancy. The primary outcome measure of interest was weight measurements at regular intervals throughout the pregnancy period. The question of study was: What was the effect of nutritional education and patient support on gestational weight gain during pregnancy?

Specific objectives included:

- Patients who were offered nutritional education and support during pregnancy would be able to maintain acceptable weight gain, within established IOM parameters, beginning in the first trimester and ending with the postpartum visit.
- Enhanced nutritional education and support from the provider would decrease maternal morbidities during the pregnancy and at delivery.
- Enhanced nutritional education and support from the provider would influence the amount of weight gained during the pregnancy and the postpartum visit.

Review of the Literature

The search engines used were "Summon" and "CINAHL." The key terms were "gestational weight gain," "self-efficacy with weight gain education in pregnancy", "nutritional education in pregnancy" and "weight gain in pregnancy". Initially 30 publications were retrieved. In addition, an ancestry approach was used for further retrieval of literature. The search was further refined to include publications from 2006 to 2019 and published in the English language. Excluded were publications prior to 2006 and those not published in English. This yielded 40 publications, with 16 selected.

In the United States, childbirth accounts for over 10% of all maternal-related inpatient hospital costs. The estimated cost to Medicaid for prenatal care among program participants that experience an uncomplicated pregnancy and hospital delivery is

$2,200 dollars per delivery (Monea & Thomas, 2011, p. 8), (Moore, Witt, &Elixhauser, 2014). Maternal complications in the state of Missouri led to an increase in delivery costs. Childbirth Connection .org (2012) reported that in 2010, there was a state increase of $3,000 per vaginal delivery $5,000 per cesarean delivery secondary to maternal complications (Childbirth Connection, 2012). Estimated cost analysis for this sample was $32,093.00 per vaginal birth, and $51,125.00 per cesarean birth (Elfieln, 2019).

Excessive GWG is associated with adverse health outcomes. Truong, Yee, Caughey, and Cheng (2015) reported on previous studies examining excessive and its increased risk for macrosomia, gestational diabetes, gestational hypertension, preeclampsia, and cesarean section. Truong et al. (2015) examined a cohort of nulliparous women who delivered from 2011 to 2012. They found women who gained more than the recommended GWG were at a 1.5 to 2.5 greater risk for the development of gestational complications (Truong, et al., 2015). However, Yanit, et al., (2012) found adherence to IOM GWG recommendations was associated with approximately 76,000 fewer complicated deliveries for normal weight women, and 400,000 fewer complications for obese women (Yanit, et al., 2012). Despite these findings, women find it difficult to adhere to the recommended GWG goals (Rogozinska, et al., 2019).

Pregnancy is an ideal time for women to begin implementation of healthy behaviors and overall health improvement. However, most pregnancy-related education is offered near-term and primarily includes discussions directed at preparations for labor and childbirth (de Jersey, Nicholson, Callaway, & Daniels, 2013). Women may benefit

from education and guidance on attaining ~~the~~ recommended health requirements for themselves and their fetuses especially with gestational weight gain throughout their pregnancy (International Weight Management in Pregnancy Collaborative Group [i-WIP], 2017). The World Health Organization (WHO, 2016) published recommendations to enhance necessary nutritional education for mother and fetus.

While nutritional education during pregnancy may vary, it can be beneficial. Lucas, Charlton, and Yeaton (2014), evaluated five studies examining supplemental patient nutritional education, of various modalities during pregnancy. Overall, they found maternal nutritional education increased adherence with nutritional recommendations (Lucas, et al., 2014). Patient health was thought to be improved with a health promotion program actively engaging the participants in their education, and when methods of promoting self-efficacy were implemented (Lucas, et al., 2014).

Printed educational material may have limited value. For patient education and self-efficacy to be cultivated, offering written material only may not be adequate (Szwajcer, Hiddink, Koelen, & van Woerkum, 2009). Szwajcer, et al. (2009), found providers who were observed to be supportive of weight gains and losses were unlikely to provide specific recommendations for change. While written information was offered, the addition of verbal counseling was more likely to produce the desired effect (Szwajcer, et al., 2009). Hence active, and engaging education appeared to be most effective.

Since the release of IOM GWG recommendations, research on interventions to

enhance adherence to the guidelines has been sparse, and interventions offered to alleviate this concern have been varied in their approach and success. Althuizen et al. (2006) determined a stepped care behavioral intervention was somewhat effective in reducing the incidence of excessive weight gain in normal-weight women (Althuizen, van Poppel, Seidell, van der Wijden, and van Mechelen, 2006). Althuizen et al., (2006) discovered that initial nutritional counseling improved nutritional intake during pregnancy; however, was not successful in preventing excessive gestational weight gain.

Regarding maternal health and pregnancy weight gain, de Jersey, Nicholson, Callaway, and Daniels (2013) found addressing modifiable indicators, such as nutritional and physical activity behaviors, was key to positive outcomes in pregnancy. In addition to changing overall nutritional and physical activity behaviors, knowledge and self-efficacy assisted ~~the~~ in achieving healthy outcomes. Knowledge included a pregnant woman's understanding of her specific pregnancy health and nutritional importance (de Jersey, et al., 2013). They theorized that the average pregnant woman may have inadequate information about recommended amounts of fruits, vegetable, and protein necessary for optimum maternal-fetal health, therefore the pregnant woman should not be expected to adhere to recommended GWG parameters if she has not been properly educated (de Jersey et al., 2013). While, information alone will not ensure self-efficacy and acceptable weight gain during pregnancy supportive weight gain strategies must be employed obtain real change (de Jersey et al., 2013).

Any significant change can be especially challenging during pregnancy. Bennett, et al. (2018), found real change in nutritional behavior occurred from small, manageable

stages. Diet or physical activity alone was minimally beneficial for the maintenance of GWG but did result in a lower incidence of gestational diabetes (Bennett, et al., 2018). Further, the added benefit of self-efficacy might encourage future positive behavior and lifestyle changes (Bennett, et al., 2018). Conversely, attempting to alter multiple health activities at once may decrease the success the of health changes overall.

Perceived barriers to health might influence the level of patient's self-efficacy. For example, Kim, Koleiat, and Whaley (2016), noted that the encouragement to "eat for two" from significant others and family members placed stress upon the pregnant woman to eat more, not better. This created a form of maternal guilt as pregnant women felt they were not able to adequately "feed their babies" if they did not heed advice from their family members (Kim, et al, 2016).

Kim, et.al. (2016), reported that many patients had a desire to maintain GWG, but were unable to do so due to misperceptions and knowledge gaps. An intervention found to be successful in assisting with patient self-efficacy and maintaining GWG, was use of a tracker tool for GWG promoting self-awareness and conversation with the healthcare provider (Kim, et al., 2016). Thus, meaningful commination in a patient-provider relationship may enhance adherence to recommendations.

In summary, each woman enters pregnancy with their own awareness, perceptions, and motivations to attain and maintain health for herself and the fetus. The evidence supporting the benefits of achieving GWG based-on pre-pregnant BMI not only reduced adverse health outcomes, but also decreased costs associated with too little or too much weight gain. There is some evidence to support individualize nutritional counseling

during pregnancy in small, manageable, and achievable stages, but there is a gap in the literature regarding the most effective strategies to implement and evaluate the effects on a woman's healthy behavior changes during this time.

Method

Design

This project utilized a descriptive, correlational design, with a cohort of pregnant patients during their nine-months of pregnancy which was implemented using a Plan-Do-Study-Act (PDSA) methodology. Participants were offered individualized nutritional education and support during their pregnancies at 10-14 weeks, 18-22 weeks, 28-32 weeks, and at the postpartum visit from June 2019 through March 2020.

Setting

The setting included one obstetrical (OB) and gynecological (GYN) hospital-associated suburban practice in a Mid-western, metropolitan area with over three million residents. The suburban county of service has nearly 400,000 residents. The practice was comprised of four physicians, one nurse practitioner, and other ancillary patient care staff who rotate between offices. The practice has approximately 800 patients and approximately 50% is OB. The hospital affiliation for the practice was a 216-bed community hospital, with a 15-bed labor and birth, recovery, postpartum, and a level 2 neonatal intensive care step-down unit.

Sample

Patients were chosen from a convenience sample of OB patients within the one outpatient OB/GYN practice setting. Inclusion criteria were patients who received healthcare provider approval, 18 to 40-years of age, and newly diagnosed as pregnant

within the first trimester. Exclusion criteria were those less than 18- or greater than 40-years of age, entered prenatal care after the first trimester, multiple gestation, or delivery at a hospital other than the practice's hospital affiliation.

Approval Process

Initial approval was obtained from the OB-GYN practice. Approvals from the Doctor of Nursing practice (DNP) committee, organization, and university institutional review board (IRB) were obtained. Finally, approval from pertinent department directors for each outpatient facility was also obtained. Benefits to each patient were improved health and nutritional practices, controlled GWG, and improved perceptions of health. There were no risks associated with this study, however, individual health risks other than nutritional were identified by the investigator and the covering physician at each obstetrical visit. Any additional interventions necessary were implemented.

Data Collection/ Analysis

All patient data was de-identified using alpha-numeric classification and stored on a password-protected computer and removable-portable drive owned by the primary investigator (PI). No control group was used for comparison as this was a descriptive study. Demographic data included age, race/ ethnicity, marital status, zip code, and payer status. The gravid status; prepregnant BMI; weight at first visit for the pregnancy; weights at 10-14 weeks, 18-22 weeks, and 28-32 weeks of pregnancy; gestation at birth; mode of delivery; and weight at the postpartum visit were recorded. Patient weights were obtained from the electronic health record (EHR). Weights were compared with other subjects. The method of delivery was also recorded. Comparisons between

patients were evaluated using SPSS version 26 statistical data software.

The relationship between nutrition counseling and goal weight was measured with logistical regression and calculated as an odds ratio. The occurrence of maternal morbidity at delivery was measured as a percentage. In addition, a comparison of the subject's weight at confirmation of pregnancy and at time of postpartum visit was measured using a Wilcoxon matched-pairs test. Descriptive statistical data was measured using a percentage-based chart, and BMI classification of subjects was illustrated using a run-chart.

Procedures

The Plan-Do-Study-Act model was used to implement this project within the HBM framework. In the Plan phase, research was completed by meeting with key stakeholders: outpatient nutrition department and Vice President of Medicine for associated hospital, as well as the participating healthcare providers and their outpatient office support team. Additionally, decisions were made on the timing and presentation of nutritional education and support provided to each patient during their routine prenatal visits. Approval was also obtained for access to the electronic medical record and use of this project's patient data tool by the Office of Risk Management for the associated hospital.

The Do phase of the project included meeting with each patient at the specified weeks and offering continued nutritional education advice and encouragement during their routine prenatal visits. Immediate communication of the visits was reviewed with each participating healthcare provider after each patient encounter. Determination for the need of dietary interventions, (i.e.: anti-nausea medications, proton-pump inhibitors, or

additional nutritional supplementation) was investigated and implemented prior to the patient leaving the office. Follow-up of any additional nutritional interventions was reviewed by the healthcare provider and project investigator at subsequent visits.

The Study phase began at the initial meeting with the patients in the first trimester of their pregnancies. Documentation of the patients' weights was catalogued at each visit and notes made of any pregnancy losses, transference of care, or declaration of refusal for continued nutritional education and support. Data was collected to reflect variances in many areas such as: race, zip code, weight at enrollment, weight at delivery, and insurance status. In addition, notations were made concerning deliveries, and patient responses to the nutritional counseling and support provided. Data was collected from June 2019 through March 2020.

The Act phase began after full data collection and statistical findings were reviewed. These were discussed at length with the participating healthcare providers and with the Vice-President of Medicine for the associated hospital. Current plans for change in practice regarding the addition of nutritional education and support are in discussion at the outpatient level with the healthcare providers and their patient care team.

Results

Thirty-seven (37) pregnant women in the first trimester of their pregnancy were considered for participation. Of this cohort, 30 agreed to participate, but only 20 (N=20) participated fully in the project. The patient's ages ranged from 18-34 years of age. An equal percentage of the patients were 26 years of age (n=3, 15%), and 28 years of age (n=3, 15%). Two of the patients were 18 years of age (10%), two were 27 years of age

(10%), two were 29 years of age (10%), and two were 31 years of age (10%). One patient was 20 years of age (5%), one patient was 23 years of age (5%), one was 25 years of age (5%), one was 32 years of age (5%), one patient was 33 years of age (5%), and one patient was 34 years of age (5%). Patient reported races varied marginally. Most of the patients were white (*n*=17, 80%), one patient identified as African American (5%), one patient identified as Hispanic (5%), and one patient identified as East Indian (5%). The majority of the patients reported they were married (*n*=12, 60%), and eight patients identified as single (*n*=8, 40%). A larger majority of the patients lived in zip codes 63366 (*n*=4, 20%), and 63383 (*n*=4, 20%), respectively. At the time of enrollment, the majority of patients (*n*=18, 90%), had private insurance, with self-pay comprising (*n*=2, 5%). No patients were enrolled in Medicaid.

The primigravids comprised 65% (*n*=13), and multigravidas 35% (*n*=7). Births were classified as *full term,* greater than 39 weeks zero days to 40 weeks six days; *preterm,* less than 37 weeks zero days; *early term,* 37 weeks zero days to 38 weeks; *late* or *post term,* greater than 40 weeks six days. In this sample, 50% were full term births (*n*=10), 30% were early term (*n*=6), 20% were preterm (*n*=4). No births occurred as *late term* (Appendix A). Deliveries were 70% (*n*=14) vaginal births, and the number of cesarean section deliveries was 30% (*n*=6). Healthcare provider rationales for cesarean section included: failure to progress 5% (*n*=1), fetal intolerance of labor 10% (*n*=2), breech position 5% (*n*=1) failure of vaginal birth after previous cesarean section 5% (*n*=1), and medical indication based on maternal presentation of headache with preeclamptic features 5% (*n*=1). All the participants delivered singleton pregnancies

100% (*N*=20). At time of enrollment, the majority of patients were categorized as overweight 45% (*n*=9), obese represented 35% (*n*=7), and normal weight represented 20% (*n*=4). There were no patients enrolled who fell into the under-weight BMI category. At the time of delivery 45% (*n*=9), of the participants were able to maintain recommended GWG within +/- five pounds of their weight gain goal. In addition, 35% (*n*=7) gained more weight than recommended, and 20% (*n*=4) of patients lost weight and fell below the recommended weight range for their BMI (Appendix B).

An analysis of the pregnancy outcomes was examined to determine the rate of maternal morbidity. Eight women (*n*=8) presented at delivery with indicators for high-risk conditions of pregnancy. One of these women (5%) experienced pregnancy induced hypertension at delivery. One woman (5%) experienced preeclampsia and received intravenous (IV) magnesium treatment. Two participants developed gestational diabetes (10%), one who was required to self-administer injectable insulin. One pregnancy developed intrauterine growth restriction (IUGR) of the fetus (5%). Two pregnancies had abnormal amniotic fluid indices (AFI) (10%). Of those, one pregnancy had an AFI that was identified as polyhydramnios (5%), and one pregnancy had an AFI identified as oligohydramnios (5%). One participant experienced premature rupture of membranes (PROM) at 28-weeks with subsequent preterm birth (PTB) at 31-weeks (5%). However, the majority of participants (*n*=12, 60%) did not have any morbidity associated with their pregnancies. Vaginal deliveries were 70% (*n*=14) while the number of cesarean sections

deliveries were 30% (*n*=6). A logistic regression analysis was conducted to determine if there was a relationship between the nutritional education, patient counseling, and their weight gain during pregnancy. Women were 85.7% more likely to maintain the recommended weight gain with nutrition counseling (*OR*=1.857, *p*=0.187) (Appendix C). Patient enrollment weights and postpartum weights were compared using a Wilcoxon Matched-Pairs analysis. All patients gained weight during the pregnancy; however, seven patients demonstrated a decrease in weight from postpartum compared to enrollment. Overall, there appeared to be no statistically significant difference between enrollment weight and postpartum weight (*Z*= -1.980, *p*=0.048) (Appendix D).

An Excel run chart (Appendix E), was created to examine mean-weights of each BMI class across the pregnancy. The classes were compared at *10-14 weeks*, *18-22 weeks*, *28-32 weeks*, at *Delivery*, and at *Postpartum visit*. During the period between *10-14 weeks* and *18-22 weeks*, the women in the *Normal weight* class and *Overweight* class gained an average of four pounds (*SD*=2.83); however, there was essentially no change in mean weight of the *Obese* class (*SD*=0). Across all classes, the largest weight gain was seen in the period between *18-22 weeks* and *28-32 weeks (M=13 pounds gained, SD=1.73)*. The *Overweight* class had the most significant gain with a mean of 15 pounds (*SD*=10.6). Whereas, *Normal Weight* and *Obese* women gained an average of 12 pounds (*SD*=8.49), respectively. The period from *28-32 weeks* to *Delivery* saw a decrease in the amount of weight gained. During this period, both the *Obese* and *Overweight* classes only gained an average of nine pounds (*SD*=6.36). However, the least amount gained was in the *Normal weight* group at an average of four pounds (*SD*=2.83). *Delivery* to *Postpartum* demonstrated a mean loss of weight among all classes, with the *Overweight*

class losing the most at a mean of 20 pounds (*SD*=14.14). The other classes lost 17 pounds (Obese class) and 13 pounds (Normal weight Class), respectively (*SD*=12.02, *SD*=9.19). Lastly, the mean weights from *10-14 weeks* and *Postpartum* weights were compared to examine amount of weight retained from the pregnancies. The women in the *Overweight* class retained an average gain of eight pounds (*SD*=5.66), while the *Normal weight* class women retained and average of seven pounds (*SD*=4.95) from the pregnancy. However, the *Obese class* women fared the best as they only retained an average of four pounds from the pregnancy (*SD*=2.82).

Discussion

The primary reason pregnant women are unable to gain their optimal weight in a healthy pregnancy is a deficiency in nutritional knowledge and the perception of suboptimal nutritional advice from their healthcare providers. This quality improvement project revealed at the time of delivery, 45% of participants were able to maintain their weight within five pounds of their IOM recommended weight gain goals with nutritional education and support by the investigator. Additionally, this project found pregnant women (85% of the total participants) were more likely to meet their GWG objectives with the implementation of face-to-face nutritional education and patient support from a health care provider. While the intervention was not statistically significant ($p = 0.187$), it was clinically significant for the practice.

Deliveries were all singleton births (100%), with the largest percentage (50%) delivering at full term. The primary medical indication for cesarean section in the six affected patients (30% of the total population) was fetal intolerance to labor

encompassing (10%). These percentages mirrored those reported by the state department of health and human services. There were no specific indications that this intervention decreased the rate of cesarean birth for the practice.

Complications of pregnancy were experienced by eight of the participants. Two women developed pregnancy-induced hypertension with one participant requiring administration of intravenous magnesium sulfate as treatment. Two women developed gestational diabetes, one of which required injectable insulin for blood glucose control. One woman had a fetal diagnosis of IUGR. Two women were diagnosed with abnormal AFI, one with polyhydramnios and one with oligohydramnios. One participant experienced PROM at 28 weeks with subsequent PTB at 31 weeks. While nutritional educational counseling and support did not decrease the likelihood of these complications of pregnancy, no other complications of pregnancy or delivery were reported within the total population of participants.

Weight gain during pregnancy is expected and recommended by IOM. Although 45% of the patient population were able to maintain their weight within the IOM recommendations, 35% of this project's participants did not gain the minimum number of pounds recommended. However, when comparing all participant weights at time of enrollment with weights at postpartum, overall weight gains were statistically significant as all participants gained weight across all weight classification groups ($p = 0.048$).

Upon review of all BMI classes and their mean weight gain from the initial counseling session at 10-14 weeks and at the Postpartum visit, no specific weight class was able to return to their pre-pregnancy weight, however, the *Obese* class of patients

only retained a mean average of four pounds from the pregnancy. The class retaining the most weight from the pregnancy was the *Overweight* class who retained a mean average of eight pounds from the pregnancy. In addition, evaluation of pregnancy weight related incidence of cesarean births was statistically unrelated to GWG and was noted to be comparative to the current state reported average. Furthermore, while correlation was noted between maternal disease states of pregnancy such as gestational diabetes, gestational hypertension, preeclampsia and the implementation of nutritional education and patient counseling; causal relationships could not be established.

In this project, women who participated anecdotally reported being open to receiving enhanced nutritional education and patient support throughout the pregnancy because they were motivated to have healthy pregnancies. Multiparous patients participating in this project, reported frustration in previous pregnancies related to the inconsistent and vague information provided. They also reported a perceived decrease in pregnancy nutrition often compelled them to complete self-research for nutritional answers. This led to gaps in pregnancy nutritional knowledge and inaccurate perceptions of health expectations during pregnancy. These reports mirrored those in a previous study (i-WHP, 2017). The desire for additional nutritional information and support was demonstrated most often in women who were primigravida who represented 65% of the cohort. Anecdotal, verbal responses from multigravidas was overwhelmingly positive and seen as “a welcome addition” to their prenatal care. Both patient populations of primigravida and multigravida reported an increased sense of accountability to themselves and to their fetus to maintain a high level of nutrition during their

participation in this project.

Implications for practice call for a reassessment of the current approach to the pregnant woman and her ability to maintain her GWG. Currently the nutritional counseling and information shared with women during pregnancy is limited and varies widely among obstetrical providers. These inconsistencies and deficiencies in counseling lead to a feeling of frustration and confusion for the patient. Advance practice providers who adopt a practice of offering additional nutritional education and support to their obstetric patients, will likely see an increase in patient adherence to GWG recommended guidelines. In addition, the supplementation of this intervention into practice will strengthen the pregnant woman's self-efficacy and enhance her overall approach to optimum health during current and future pregnancies. Recommendations for further study within this area of obstetric care are re-creating the study with a larger, more racially and economically diverse population sample to include Medicaid and Women, Infants, and Children (WIC) participants. Secondly, a longitudinal study to observe if the strategies and nutritional habits gained by these patients through their participation in this project will continue to be utilized through the first year post-delivery. Furthermore, examining newborns of the participating women to determine if there is a relationship between the mother's participation in nutritional counseling during pregnancy effects the newborn's growth and development is recommended.

Conclusion

The addition of nutritional education and support during obstetric visits assisted the pregnant woman not only in maintaining her recommended GWG, but also positively

impacted her perception of health during pregnancy. Pregnant women who received nutritional education and counseling were 85.7% more likely to achieve their weight gain goals during pregnancy in this private, Midwestern OB-GYN practice. Based on pre-pregnancy BMI, those within the highest weight classes were more likely to return to their pre-pregnancy weight and were less likely to retain weight coming out of pregnancy at least at six-weeks postpartum in this study. Overall this project found the implementation of a personalized nutrition education and support program at each visit during pregnancy not only helped to maintain GWG goals but may have improved perceptions of nutritional health during pregnancy.

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Appendix A

Table 1. Deliveries Defined by Term

Delivery by Term

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Preterm	4	20.0	20.0	20.0
	Early Term	6	30.0	30.0	50.0
	Full Term	10	50.0	50.0	100.0
	Total	20	100.0	100.0	

Note: Births were classified as *full term,* greater than 39 weeks zero days to 40 weeks six days; *preterm,* less than 37 weeks zero days; *early term,* 37 weeks zero days to 38 weeks; *late* or *post term,* greater than 40 weeks six days. In this sample, 50% were full term births (n=10), 30% were early term (n=6), 20% were preterm (n=4).

Appendix B

Table 2. Frequency and Percentage of Total Weight Gained from Enrollment to Postpartum

Total Weight Gained from Enrollment to Postpartum					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Gained 6+lbs less than IOM recommendation	4	20.0	20.0	20.0
	Gained within or 5lbs +/- of IOM recommendation	9	45.0	45.0	65.0
	Gained more than 6lbs over IOM recommendation	7	35.0	35.0	100.0
	Total	20	100.0	100.0	

Note: 45% (n=9) of this patient population gained within 5lbs +/- of their IOM recommended weight gain goal. 35% (n=7) gained more than 5lbs over recommended weight gain, and 20% (n=4) gained 6lbs or less of their IOM recommended weight gain goal.

Appendix C

Table 3. Logistic Regression: Impact of Nutrition Education on Meeting Provider Parameters

Nutritional Education and Meeting Provider Parameters							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.619	.469	1.744	1	.187	1.857

Note: Logistic Regression was used to determine the likelihood ratio of women meeting their determined gestational weight gain goals based on their prepregnant BMI. The Exp(B) indicates that women were 85.7% more likely to meet their gestational weight gain goals.

Appendix D

Table 4. Wilcoxon Signed Ranks Test: Enrollment Weights versus Post-Partum Weights

Enrollment Weight vs. Postpartum Weight		N	Mean Rank	Sum of Ranks
PPWt - EnrollmentWt	Negative Ranks	7[a]	7.43	52.00
	Positive Ranks	13[b]	12.15	158.00
	Ties	0[c]		
	Total	20		

a. PPWt < EnrollmentWt

b. PPWt > EnrollmentWt

c. PPWt = EnrollmentWt

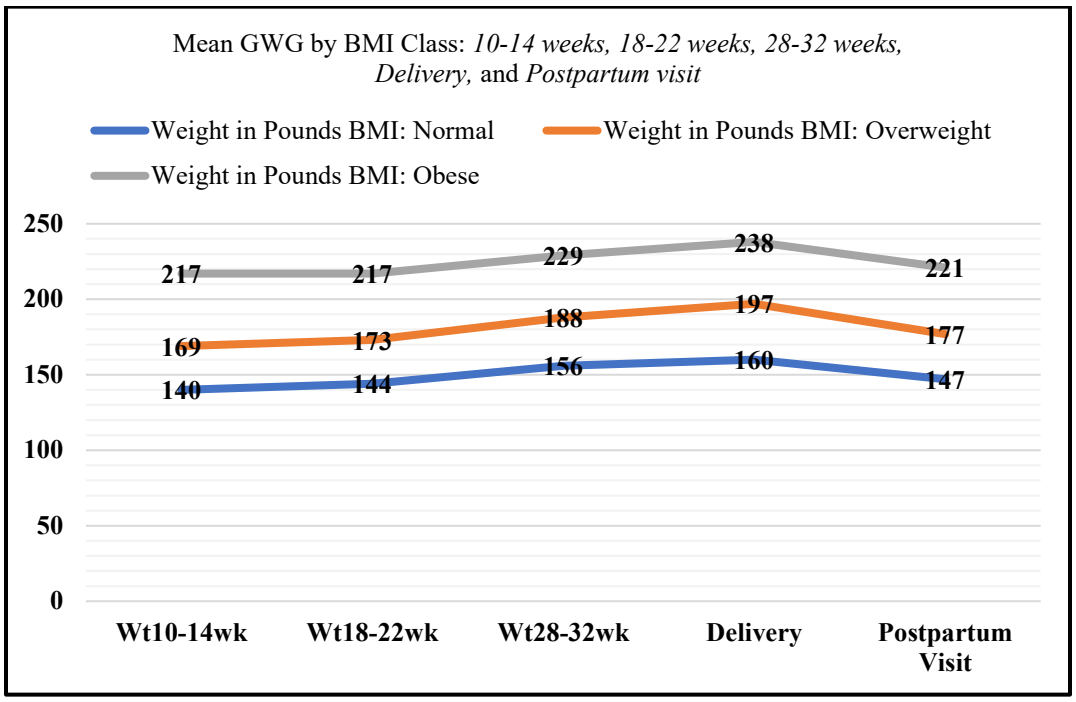
	PPWt - EnrollmentWt
Z	-1.980[a]
Asymp. Sig. (2-tailed)	.048

a. Based on negative ranks.

Note: Analysis revealed 13 of the women had not returned to their pre-pregnancy weight by Postpartum. Seven of the women had either returned to their pre-pregnancy weight or weighed less than their pre-pregnancy weight at Postpartum. This was revealed as 1.98 standard deviations below the mean for both groups ($Z = -1.980$, $p = 0.048$).

Appendix E

Figure 1. Run Chart: Mean Gestational Weight Gain by BMI Class from First Trimester to Postpartum



Note: Mean weights of each BMI class were compared at *10-14 weeks*, *18-22 weeks*, *28-32 weeks*, at *Delivery*, and at *Postpartum visit*. Across all classes, the largest weight gain was seen in the period between *18-22 weeks* and *28-32 weeks*. The *Overweight* class had the most significant gain with a mean of 15 pounds. The period from *28-32 weeks* to *Delivery* saw a decrease in the amount of weight gained. *Delivery* to *Postpartum* demonstrated a mean loss of weight among all classes, with the *Overweight* class losing the most at a mean of 20 pounds. Lastly, the mean weights from *10-14 weeks* and *Postpartum* were compared to examine amount of weight retained from the pregnancies. The *Obese class* women fared the best as they only retained four pounds from the pregnancy.