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THE IMPACTS OF PRECONCEPTION NUTRITION ON PREGNANCY:
An educational module promoting preconception care

A Project presented

by

Alexa Holleran

to

The Faculty of the Graduate College

of

The University of Vermont

**In Partial Fulfillment of the Requirements
For the degree of Master of Science
Specializing in Nursing**

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Abstract

Recent research has shown that maternal overweight and obesity (OW/OB) prior to conception are directly and independently associated with negative outcomes in pregnancy, birth, infancy, childhood, and beyond. The purpose of this project was to create and evaluate educational materials for providers who work with women of childbearing age, in order to encourage and facilitate conversations about the importance of preconception nutrition in family planning. A literature review was conducted, and from it two documents were created: 1) an educational module for providers offering background information, relevant research, and tips for discussing the matter with patients; and 2) an infographic-style handout, written in lay language, for providers to use directly with patients. These materials were presented to 16 practitioners, and the efficacy of the materials was assessed using pre- and post-intervention surveys, in addition to qualitative feedback. Responses indicated that the educational materials were positively received by the participants, and the vast majority of participants planned to increase or enhance their discussions of this important topic as a result of the module. Given the current national overweight and obesity epidemic, such efforts could have wide-reaching impacts on health outcomes. This project, while small, indicates that further such educational efforts for providers are warranted.

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Chapter I: Introduction

Project purpose and objectives

The purpose of this project was to create and evaluate educational materials for providers (NPs, MDs, DOs, and/or PAs) who work with women of childbearing age in order to encourage and facilitate conversations about the importance of preconception nutrition in family planning. The specific aims for this project were:

1. Appraise the literature for the most up-to-date evidence of the impacts of pre- and peri-conceptual nutrition on pregnancy, birth, infancy, and childhood outcomes
2. Develop educational materials for providers who treat women of childbearing age
3. Develop a patient-level educational material for providers' use with patients
4. Develop surveys for providers' evaluation of educational module
5. Implement distribution of educational materials and surveys
6. Evaluate the effectiveness of said materials through analysis of providers' responses

Rationale

Over the past four decades, the average US body mass index (BMI) has risen markedly (Pak, Ferreira, & Colson, 2016). This trend has been present not only in adults, but also in children and adolescents, whose reproductive years lie ahead (Skelton, Cook, Auinger, Klein, & Barlow, 2009). Higher pre-pregnancy maternal BMI is associated with poor perinatal outcomes for both mother and child (Shin & Song, 2015). An unfortunate and counterintuitive response to the obesity epidemic has been that US health care providers have actually *decreased* their weight counseling, though it's needed more than ever (Kraschnewski et al., 2013). In its 2009

reexamination of the guidelines related to weight gain in pregnancy, the Institute of Medicine (IOM) provided bulleted “recommendations for action”. One of the five points under this heading was the following: “...health care providers should inform women of the importance of conceiving at a normal BMI, and those who provide health care or related services to women of childbearing age should include preconceptional counseling in their care” (Rasmussen & Yaktine, 2009). While such discussions are now a clear recommendation, most practicing health care providers received their education before this evidence was available and require continuing education about preconception nutrition counseling.

Relationship to advanced nursing practice

The National Organization of Nurse Practitioner Faculties’ (NONPF) “Nurse Practitioner Core Competencies” include Scientific Foundation Competency #1: Critically analyzes data and evidence for improving advanced nursing practice, and #3: Translates research and other forms of knowledge to improve practice processes and outcomes. This project clearly engages these two goals through development and dissemination of the educational materials, as well as the analysis of the effectiveness of the intervention (NONPF, 2012).

Additionally, in bringing research on an upstream cause of maternal and child morbidity, this project advocates for improved quality and cost effective health care, key components of NONPF Leadership Competency #4. That research was translated in this project into a) a PowerPoint educational module; b) a lay-level infographic handout helpful to both providers and patients in having relevant conversations; c) a written summary in the literature review; and d) an oral defense presentation on March 27th, 2017. As such, this project engages both

NONPF Practice Inquiry Competency #5: Disseminates evidence from inquiry to diverse audiences using multiple modalities, and Leadership Competency #6: Communicates practice knowledge effectively both orally and in writing (NONPF, 2012).

Contribution to intended recipient

The direct recipients of the educational module were providers who work with women of childbearing age; the indirect, ultimate recipients are their patients engaged in family planning. The intended direct impact for providers was an increase in knowledge about the impact of preconception nutritional status on pregnancy, birth, infancy and childhood outcomes. A second intended impact was increased comfort in holding conversations regarding preconception nutritional status with patients of childbearing age. The intended impact for patients is increased awareness and self-empowerment regarding health outcomes of preconception nutritional status, and ultimately healthier pregnancies where preconception lifestyle modifications are enacted.

Anticipated benefits

The main anticipated benefit is to patients of participants in this project, who will be impacted by the increased knowledge and comfort of those providers in having conversations about the impacts of pre-pregnancy BMI on the health of pregnancy. It is hoped that this knowledge will further inform other health care providers known to the participants, as well as contacts of their patients.

The educational materials created for both providers and patients will be reproducible for future use, and will be offered to participants and colleagues of the author. The educational materials will also be available for alterations for further implementation as more research and/or guidelines become available regarding preconception nutrition counseling. The abstract of this project will be submitted to the 2018 Nursing Education Research Conference, the theme for which is, *“Generating and Translating Evidence for Teaching Practice.”* The project may be expanded upon in future projects, and/or presented at future practitioner conferences. Through these avenues, it is hoped that the project’s impacts will continue beyond its direct impact.

Chapter II: Literature Review

Maternal nutritional status at the time of conception has long been known to have profound effects on fetal outcomes, most notably in the reduction of neural tube defects (NTD) with adequate intake of folic acid (Gernand, Schulze, Stewart, West Jr, & Christian, 2016). Yet much of the research into the impact of nutrition on pregnancy has traditionally focused on late pregnancy – second or even third trimester, when fetal organogenesis has already taken place (Ramakrishnan, Grant, Goldenberg, Zongrone, & Martorell, 2012). Recent evidence is clear that the nutritional status of the mother at the time of conception and during the first weeks of pregnancy, before the woman may even know she is pregnant, also plays a significant role in the health of the pregnancy and of the child carried. The aim of this literature review is to examine recent research into the impacts of maternal nutrition in the pre- and peri-conceptual periods on the health of pregnancy, delivery, fetus, and child.

Pre-pregnancy BMI has been shown to be associated with decreased rates of fertility, including sub-fertility and infertility (Mmbaga, 2012). This association extends to both natural conception and assisted reproductive technology (ART) such as in-vitro fertilization (IVF). Much of this association appears to be reversible with weight loss in overweight and obese patients, with estimates of a 10-15% weight loss in overweight patients leading to a 30% increase in spontaneous pregnancy rates, and up to 50% increase in ART pregnancy rates (Papachatzi, 2013).

In a systematic review by Hemond, Robbins, and Young (2016), pre-pregnancy maternal obesity was found to be associated with an increased risk of prematurity, stillbirth, Cesarean section (C-section), Neonatal Intensive Care Unit (NICU) admission, neural tube defects, babies

born large for gestational age (LGA), neonatal and infant mortality, and cleft palate in the infant. Additional associations with these factors that were shown to persist beyond infancy, into childhood and even adulthood, included obesity, metabolic syndrome, and cardiovascular disease (Hemond, Robbins, & Young, 2016).

A cohort study of 85,000 children born between 1999 and 2009 showed an inverse relationship between folic acid supplementation in pre- and early-pregnancy and autism spectrum disorders (ASD), with an adjusted odds ratio for ASD of 0.61 for folic acid supplementation in the period from four weeks before to eight weeks after conception (Suren et al., 2013). This is in line with several studies that have demonstrated an increased risk of ASD in the children of obese mothers, examined by meta-analysis in 2016 (Li et al., 2016), and the inverse association between higher pre-pregnancy BMI and lower serum folate concentrations (Shin, Lee, & Song, 2016). This elevated risk of ASD is associated with BMI independent of gestational weight gain (GWG) (Ling et al., 2015).

Higher pre-pregnancy BMI is associated with a poorer-quality diet during pregnancy according to the Healthy Eating Index (HEI) (Tsigga et al., 2011); however, pre-pregnancy BMI has been shown to be an *independent* risk factor for several pregnancy and birth outcomes, including gestational hypertension, gestational diabetes (GDM), preterm labor, and small- and large-for-gestational-age infants (Shin & Song, 2015), each of which have sequelae of their own. This trend held true in Rosenberg, Garbers, Chavkin, and Chiasson's (2003) multi-racial study of pre-pregnancy weight and adverse perinatal outcomes, which found that women who were heavier before their pregnancies were more likely to have GDM, preeclampsia, cesarean delivery, macrosomic infants, and infants requiring NICU care.

In a systematic review of the effects of maternal pre-pregnancy and early pregnancy nutrition, Ramakrishnan, Grant, Goldenberg, Zongrone, and Martorell (2012) found positive associations of OW/OB with rates of pregnancy-induced hypertension and preeclampsia; an increased risk preterm delivery; and increased incidence of oro-facial clefts (OFCs). They concluded that “there is evidence supporting the importance of nutritional status before and during early pregnancy to reduce the risk of adverse pregnancy outcomes...the dissemination of messages about the importance of a healthy diet and lifestyle before and during pregnancy along with messages about family planning that address timing and spacing of pregnancies have the potential to optimize maternal, neonatal, and child health outcomes in many settings” (p. 298).

Papachatzi and colleagues (2013) found maternal pre-pregnancy OW/OB to be positively associated with hypertensive disorders of pregnancy, late fetal death, macrosomia, decreased 5-minute APGAR scores in the infant, congenital heart defects, neonatal and infant death, overweight status in childhood, and increased rates of asthma among children born of these pregnancies. Additionally, they found increased rates of C-section delivery, with a severity-linked positive association for obesity and severe obesity. For each unit increase in pre-pregnancy BMI, the odds of a C-section were increased by 7%. In conjunction with this elevated likelihood of C-section, maternal mortality and morbidity was also increased, with an odds ratio (OR) of 1.55 for those with a BMI over 27, and an OR of 2.02 with a BMI above 30.

Thanoon, Gharaibeh, and Mahmood (2015) found similar risks associated with maternal overweight and obesity. These included an increased risk of miscarriage in both spontaneous and IVF pregnancies; increased risk of GDM, with severity-linked ORs of 2.14, 3.56, and 8.56,

respectively, in overweight, obese, and severely obese women. They also found an increased risk of venous thromboembolism among OW/OB pregnant women, citing the combination of the natural hypercoagulability of pregnancy and the effects of obesity on clotting factors, as well as the fact that venous return is worse in obese patients. This study also examined trends in labor dystocia, or “failure to progress”, which was increased in overweight and obese women as a consequence of both fetal macrosomia and maternal pelvic adiposity. The duration of active labor was found to be increased from 6.2 hours in women with normal BMIs, to 7.9 hours in obese women.

This literature review suggests that the nutritional status and BMI of a woman during the pre- and peri-conceptional period can have profound impacts on her pregnancy and the health of her child, well beyond the commonly recognized link of folic acid supplementation leading to decreased risk of NTDs. The myriad pregnancy impacts range from seemingly mild concerns such as babies large- or small for gestational age, to strikingly significant outcomes such as stillbirth and maternal mortality and morbidity. The health impacts on the child, meanwhile, reach well into childhood and adulthood with links to autism spectrum disorders, metabolic syndrome, and cardiovascular disease. This is clearly a subject worthy of further research and particularly of clinical attention, as interventions in preconception and prenatal care could enhance the reduction of these health disparities.

Chapter III: Methods

Identification of Need

Evidence has shown that pre- and peri-conception nutritional status of mothers has wide-ranging effects on the health of the pregnancy as well as the child, from infancy through adulthood. In its 2009 reexamination of the guidelines related to weight gain in pregnancy, the IOM provided bulleted “recommendations for action”. One of these five points under this heading stated, “...health care providers should inform women of the importance of conceiving at a normal BMI, and those who provide health care or related services to women of childbearing age should include preconception counseling in their care” (Rasmussen & Yaktine, 2009). Birth certificates now include a field for maternal pre-pregnancy weight and BMI, which have a direct impact on the recommended gestational weight gain (GWG) in a given pregnancy.

At the same time as evidence is growing of the importance of pre- and peri-conception nutritional status, providers’ time with patients is ever more squeezed. Ironically, just as the American obesity epidemic soars, weight counseling is receiving decreasing air time in medical visits. Additionally, evidence of the myriad associations between preconception nutrition and outcomes is relatively new; as such, many providers have not received education directly on the subject. In such a landscape, many providers who work with women of childbearing age could benefit from a summary of the recent evidence supporting preconceptional nutrition counseling, as well as a supporting document for briefly summarizing these recommendations with patients.

Development of Project Materials

A literature search was conducted using the databases Ovid Medline, PubMed, and Clinical Key, to find studies published within the past 10 years (2007-2016) that addressed the impact of women's nutritional status at the time of conception on pregnancy outcomes, maternal and/or child mortality and morbidity. Search terms used included "preconception/pre-conception/preconceptional/pre-conceptional, periconception/periconceptional/peri-conceptional/periconceptual/peri-conceptual, prepregnancy/pre-pregnancy, BMI, overweight, obese/obesity, nutrition/nutritional status, fertility, in-vitro fertilization/IVF, assisted reproductive technology/ART, pregnancy, pregnancy outcomes, miscarriage, stillbirth, preterm labor, delivery, birth, birth outcomes, cesarean section/c-section, pre-eclampsia, gestational diabetes/GDM, neonate/neonatal, infants/infancy, congenital defects, autism, and childhood."

Drawing upon the literature review, a PowerPoint presentation was created as an educational module for practitioners who work with women of childbearing age (appendix F). Understanding that providers' time is limited, this presentation was kept succinct. The presentation first covered a brief overview of the background of the problem; second, it offered a summary of evidence of connections between preconception nutrition/BMI and health outcomes in pregnancy, birth, infancy, and childhood; and finally, it encouraged providers directly to speak with patients about this issue, particularly when discontinuing long-acting reversible contraception (LARC).

Pre- and post-intervention surveys, developed and hosted through the University of Vermont's Lime Survey software, were linked in the presentation. The pre-survey included

three demographic questions about participants, followed by four subjective questions on participants' current understanding of the subject matter (appendix B). The post-survey included four questions reflecting on the value of the module to providers, and an opportunity for qualitative feedback (appendix C).

An infographic was also created, and imbedded within the PowerPoint presentation (appendix A). This infographic was intended for direct use by the providers with patients. It covered the health disparities in pregnancy, birth, infancy, and childhood outcomes as related to BMI prior to conception, in bullet points written in lay language. The tone of the infographic was positive, focusing on the benefits of healthy BMI at the time of conception rather than the risks associated with conceiving at a higher BMI. The infographic also emphasized the benefits of lifestyle modification prior to pregnancy, and encouraged patients to approach their primary care provider for preconception care.

Enhancements and Inhibitors of Project Objectives

Enhancements included the IOM's 2009 report on gestational weight gain, and associated recommendation of increased preconception counseling in this regard; increasing numbers of studies indicating health disparities of pregnancies based on preconception BMI of the mother; and increasing use of LARC methods of contraception, allowing for a key intervention time-point at removal. Inhibitors included providers' increasingly tight time constraints regarding patient visits; to this end, the materials produced for this project emphasized succinctness. Additionally, the optional patient-level pamphlet included for

providers was designed to help facilitate efficient sharing of information with patients regarding the benefits of a healthy BMI at the time of conception.

Persons involved

The intended direct audience of this educational module was providers (NPs, CNM's, MDs, DO's, and PAs) who work with women of childbearing age. These providers were solicited through direct contacts of the author (former preceptors, educators, former students known to the author, etc.), indirect contacts of the author (preceptors' colleagues, professors' colleagues, classmates' preceptors, etc.), and public posting via online primary care and nurse practitioner networks.

The University of Vermont's Institutional Review Board (IRB) designated this project "not research", and granted the author permission to proceed with the intended educational module in October of 2016.

Procedure

Providers were approached through the above mentioned avenues in early 2017. Those agreeing to participate were provided with educational materials via PowerPoint file by the author in February and March of 2017. In the course of the module, participants were asked to complete the pre-survey defining relevant demographics and exploring their knowledge base; participants then reviewed the educational module and patient-oriented infographic; and finally, participants were directed to the post-survey examining the impacts of the educational module. Participants had between a week and two weeks to complete this process, which was

generally accomplished in approximately 15 minutes in total. Participants were given access to the email address of this author to address technical difficulties with any of these pieces.

Following collection of survey responses, frequency-count tables and corresponding histograms were generated to analyze the perceived benefits to providers. Qualitative responses of feedback on the module were also collected and assessed for trends.

Chapter IV: Evaluation and Discussion

Achievement of Project Objectives

The objectives of this project were to appraise the literature for evidence of the impacts of preconception nutrition on pregnancy, birth, infancy, and childhood outcomes and then to develop and distribute materials for providers who work with women of childbearing age, in order to encourage and facilitate conversations about the importance of preconception nutrition in family planning. The final objective was to evaluate the success of the educational module.

The literature review was conducted in the spring and summer of 2016, and is summarized above. The educational module was developed in the fall of 2016, and distributed during the winter of 2017. The overall reaction to the module was positive, with detailed analysis below. Based on participants' responses, the educational module may be considered a success, with all participants feeling it offered a valuable contribution to their practice of preconception care.

Evaluation of Educational Module

Sixteen providers completed the module. Of these, eight (50%) were Nurse Practitioners (NPs), five (31%) were Medical Doctors or Doctors of Osteopathy (MDs/DOs), one (6%) was a Physician's Assistant (PA), and one (6%) was a doctoral psychotherapist (appendix D, figure 3). Nine (56%) worked in primary care, three (19%) worked in obstetrics & gynecology or women's health, one (6%) worked in urgent care, and three (19%) worked in psych-related

fields (figure 4). All 16 participants responded to both the pre- and post-survey, giving a response rate of 100%.

Entering the module, the participants felt that they were fairly well-informed about women's health issues generally, with an average response of 3.81 on a Likert-scale rating of one to five, where one represented "poorly informed" and five represented "extremely well-informed" (appendix D, figure 5). They felt slightly less well-informed about standards in preconception care, with an average response of 3.06, also on a Likert-scale rating of one to five, where one represented "poorly informed" and five represented "extremely well-informed." Prior to reviewing the educational module, 16 out of 16 participants (100%) reported that they already understood preconception nutrition to have impacts on both pregnancy outcomes and on infancy and childhood, with three out of 16 (19%) reporting that they understood such nutrition to be "extremely impactful", 12 of 16 (75%) reporting that they understood it to "have significant impacts", and one of 16 (6%) reporting that they understood it to be "moderately impactful" (appendix D, figure 6).

Following the educational module, 15 out of 16 participants (94%) either "agreed" or "strongly agreed" (four and five, respectively, on a one to five Likert scale) that participation in the module had led them to feel better informed about the impacts of perinutritional status on pregnancy, while one (6%) felt neutral about this (appendix E, figure 7). Fifteen out of 16 participants (94%) also "agreed" or "strongly agreed" that the educational module was useful in encouraging them to discuss nutritional issues with patients prior to conception, while one (6%) felt its contribution was neutral. Sixteen out of 16 participants (100%) "agreed" or "strongly agreed" that the patient infographic would be useful for offering information to patients of

childbearing age. Twelve out of 16 participants (75%) reported that they would be making changes to their family planning or preconceptional care as a result of the module; of the four respondents that did not report intent to change their care, two implied that the question was non-applicable, one citing as a reason that s/he had just retired, and another citing the fact that, in OB/GYN, s/he rarely saw patients prior to conception.

Qualitative feedback on the module was offered by 10 out of 16 participants (63%). Eight of these offered a positive analysis of the module as a whole, with comments such as, “Professional, handy info graphic. Awareness is a first step!”, “I think it is a great module. I particularly liked the last couple of slides with concrete phrases and images to use in the office,” and “Very helpful. We all know it’s important to be a healthy weight when one attempts to conceive, but the module, by discussing the studies reflecting the effects of obesity on the infant, will be most important to discuss with women desiring to conceive.”

Criticism or edits were offered by a few participants. One participant commented on the use of the phrase “nutrition” and the focus on BMI, suggesting that the two were used with excessive overlap. This participant followed up with questions: “If a woman is eating healthy, and active in her daily life, but has a higher than normal BMI – most likely OW [overweight] – what do we know about this in the picture of reducing the risks? Are reduced risks connected with BMI specifically or exercise and nutrition?” Another commented that s/he saw the information as more applicable to primary care providers than to those in OB/GYN, as s/he largely sees patients after they have conceived. One commenter stated, “would like to have seen a ‘for more information, see these resources’, only because it made me want to find out more.” Finally, two commenters suggested small edits to the documents, including spelling out

NTD, the acronym for Neural Tube Defects, and replacing “periconceptional” with “preconceptional” in one instance.

Limitations

One clear limitation of this study was the small number of participants involved. While the response was overwhelmingly positive, with only 16 participants reviewing the educational module, results cannot be generalized to the population of providers at large. Additionally, the participants were largely recruited from the author’s personal network, so they may represent a biased sample in terms of geography, age, or topic interest.

A second limitation was the time from literature review to intervention. With over six months between literature review and implementation, the educational module may be considered slightly out of date by the time of use. While this is inevitably a factor with any published document, it is especially true in a quickly developing field such as that of obesity research, and particularly the evolving understanding of the impacts of the gut biome within this field.

Finally, as participants pointed out, there were small flaws in the materials prepared for the study. Using “periconceptional nutrition” in an evaluation question, for example, may have led to skewed data, as most of the educational module referred to “preconceptional nutrition”. Conflation of “nutritional status” and “BMI” similarly represented a lack of specificity which may have confused participants.

Conclusions

This study suggests that providers found the educational materials developed and presented to them to be beneficial to their practice. Following education regarding nutrition's impact on pregnancy, all of these health care providers reported they felt better equipped in some way to carry out conversations about nutrition and weight counseling in preconception care.

While the majority of the participants were those health care providers that were the intended recipients of the module (APRN's, MD's, DO's, and PA's), one participant was a clinical psychologist. This participant reported just as high satisfaction with the education she received as the medical and nursing participants, and, like them, suggested that it would inform her conversations with patients going forward, and would allow her to improve her preconception care. Therapists were not originally considered as participants in this study primarily by tradition; that is, nursing projects typically examine impacts on students, physical health care providers, or patients directly. This author's experience suggests that it would be valuable to consider including mental health workers in the target audience for many nursing projects, as their role overlaps so heavily with that of a primary care provider in impacting patients' lifestyle modifications.

As the literature review suggests, increasing successful counseling in preconception nutrition and weight management could lead to decreases in many health issues of pregnancy, delivery, childhood, and even well into the adult lives of those children carried. These include a) improved rates of fertility for couples trying to conceive; b) healthier pregnancies for those who do conceive, with lower rates of miscarriage, preeclampsia, gestational diabetes, and

preterm labor; c) safer deliveries of babies, with lower rates of stillbirth, C-section, and maternal mortality and morbidity; d) healthier infants, with higher APGAR scores at birth, lower NICU admission rates, and lower rates of congenital defects; and e) healthier kids and adults in future generations, with lower rates of autism spectrum disorders, asthma, type II diabetes, and cardiovascular disease. Just as public awareness has led to great strides in reducing alcohol intake and smoking during pregnancy in past decades, awareness about the impacts of OW/OB on pregnancy could motivate patients to make lifestyle modifications with major positive impacts both for themselves and their children. While there is clearly no panacea for the myriad issues connected with overweight and obesity, given the context of a national epidemic of these issues, even small changes by percentage could be very impactful indeed.

A larger implementation of such an educational module could form the basis of further graduate research; additionally, continuing education in this area would be advisable at conferences of organizations of relevant health care providers, especially primary care providers. Therapists, too, would benefit from this education, given their role in helping patients with decision-making around family planning. In short, further education in this area for various established health care providers is warranted, and could potentially have wide-reaching positive impacts on the health outcomes of current and future generations.

References

- Gernand, A. D., Schulze, K. J., Stewart, C. P., West Jr, K. P., & Christian, P. (2016). Micronutrient deficiencies in pregnancy worldwide: health effects and prevention. *Nature Reviews Endocrinology*, *12*(5), 274–289. <http://doi.org/10.1038/nrendo.2016.37>
- Hemond, J., Robbins, R. B., & Young, P. C. (2016). The Effects of Maternal Obesity on Neonates, Infants, Children, Adolescents, and Adults. *Clinical Obstetrics and Gynecology*, *59*(1), 216–227. <http://doi.org/10.1097/GRF.0000000000000179>
- Kraschnewski, J. L., Sciamanna, C. N., Stuckey, H. L., Chuang, C. H., Lehman, E. B., Hwang, K. O., Nembhard, H. B. (2013). A Silent Response to the Obesity Epidemic: Decline in US Physician Weight Counseling. *Medical Care*, *51*(2), 186–192. <http://doi.org/10.1097/MLR.0b013e3182726c33>
- Li, Y.-M., Ou, J.-J., Liu, L., Zhang, D., Zhao, J.-P., & Tang, S.-Y. (2016). Association Between Maternal Obesity and Autism Spectrum Disorder in Offspring: A Meta-analysis. *Journal of Autism and Developmental Disorders*, *46*(1), 95–102. <http://doi.org/10.1007/s10803-015-2549-8>
- Ling, Z., Wang, J., Li, X., Zhong, Y., Qin, Y., Xie, S., Zhang, J. (2015). Association between mothers' body mass index before pregnancy or weight gain during pregnancy and autism in children. *Chinese Journal of Epidemiology*, *36*(9), 949–952.
- Mmbaga, N., & Luk, J. (2012). The impact of preconceptual diet on the outcome of reproductive treatments. *Current Opinion in Obstetrics & Gynecology*, *24*(3), 127–131. <https://doi.org/10.1097/GCO.0b013e3283530524>

NONPF. (2012). Nurse Practitioner Core Competencies. Retrieved May 4, 2016, from

<http://www.nonpf.org/?page=14>

Pak, T.-Y., Ferreira, S., & Colson, G. (2016). Measuring and tracking obesity inequality in the

United States: evidence from NHANES, 1971-2014. *Population Health Metrics, 14*(1).

<http://doi.org/10.1186/s12963-016-0081-5>

Papachatzki, E., Dimitriou, G., Dimitropoulos, K., & Vantarakis, A. (2013). Pre-pregnancy obesity:

maternal, neonatal and childhood outcomes. *Journal of Neonatal-Perinatal Medicine, 6*(3), 203–216. <https://doi.org/10.3233/NPM-1370313>

<https://doi.org/10.3233/NPM-1370313>

Ramakrishnan, U., Grant, F., Goldenberg, T., Zongrone, A., & Martorell, R. (2012). Effect of

women's nutrition before and during early pregnancy on maternal and infant outcomes:

a systematic review. *Paediatric and Perinatal Epidemiology, 26 Suppl 1*, 285–301.

<http://doi.org/10.1111/j.1365-3016.2012.01281.x>

Rasmussen, K. M., & Yaktine, A. L., Eds. (2009). *Weight Gain During Pregnancy: Reexamining the*

Guidelines. Washington (DC): National Academies Press (US). Retrieved from

<http://www.ncbi.nlm.nih.gov/books/NBK32813/>

Rosenberg, T. J., Garbers, S., Chavkin, W., & Chiasson, M. A. (2003). Prepregnancy weight and

adverse perinatal outcomes in an ethnically diverse population. *Obstetrics &*

Gynecology, 102(5, Part 1), 1022–1027.

<http://doi.org/10.1016/j.obstetgynecol.2003.07.005>

Shin, D., Lee, K. W., & Song, W. O. (2016). Pre-Pregnancy Weight Status Is Associated with Diet

Quality and Nutritional Biomarkers during Pregnancy. *Nutrients, 8*(3).

<http://doi.org/10.3390/nu8030162>

- Shin, D., & Song, W. O. (2015). Prepregnancy body mass index is an independent risk factor for gestational hypertension, gestational diabetes, preterm labor, and small- and large-for-gestational-age infants. *The Journal of Maternal-Fetal & Neonatal Medicine*, 28(14), 1679–1686. <http://doi.org/10.3109/14767058.2014.964675>
- Skelton, J. A., Cook, S. R., Auinger, P., Klein, J. D., & Barlow, S. E. (2009). Prevalence and trends of severe obesity among US children and adolescents. *Academic Pediatrics*, 9(5), 322–329. <http://doi.org/10.1016/j.acap.2009.04.005>
- Suren, P., Roth, C., Bresnahan, M., Haugen, M., Hornig, M., Hirtz, D., Stoltenberg, C. (2013). Association Between Maternal Use of Folic Acid Supplements and Risk of Autism Spectrum Disorders in Children. *Obstetrical & Gynecological Survey*, 68(6), 416–418. <http://doi.org/10.1097/01.ogx.0000431313.84585.bd>
- Thanoon, O., Gharaibeh, A., Mahmood, T. (2015). The Implications of Obesity on Pregnancy Outcome. *Obstetrics, Gynaecology and Reproductive Medicine*, 25(4): 102-105. <http://dx.doi.org/10.1016/j.ogrm.2015.01.008>
- Tsigga, M., Filis, V., Hatzopoulou, K., Kotzamanidis, C., & Grammatikopoulou, M. G. (2011). Healthy Eating Index during pregnancy according to pre-gravid and gravid weight status. *Public Health Nutrition*, 14(2), 290–296. <http://doi.org/10.1017/S1368980010001989>

Appendices

Appendix A: Patient Infographic

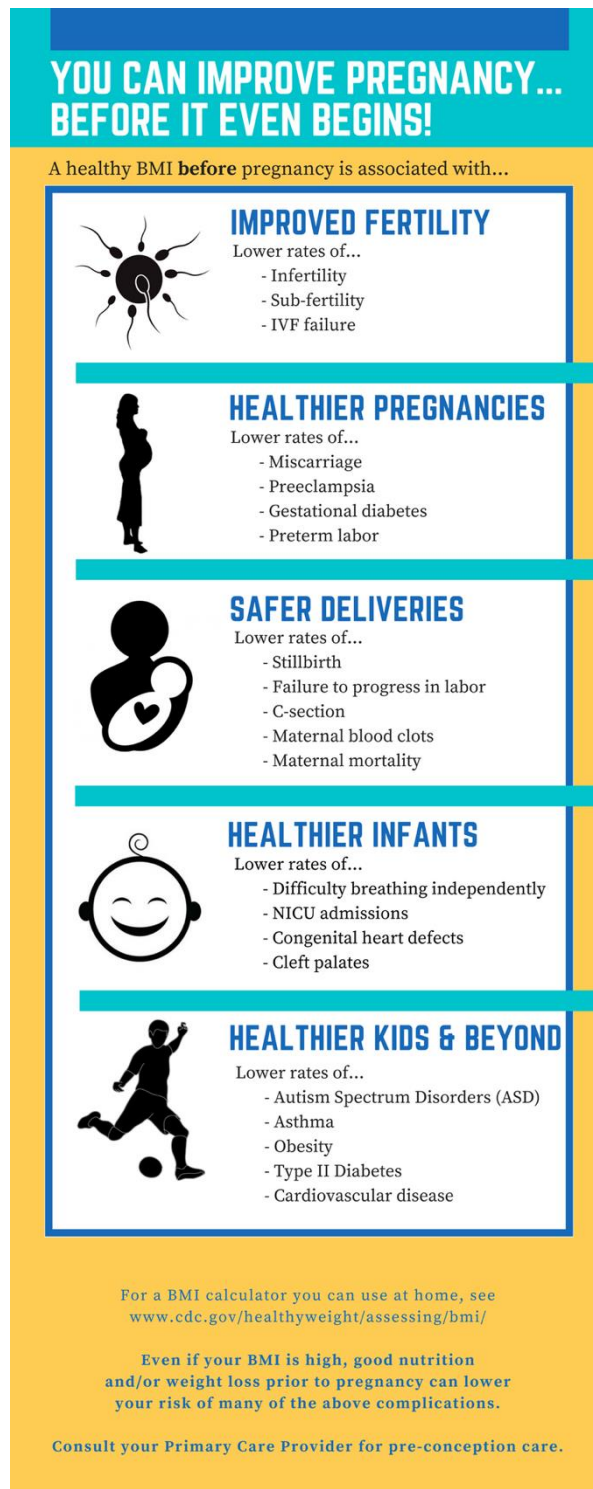


Figure 1

Appendix B: Pre-Survey (administered online and transposed here)

This survey will ask you three demographic questions about your education and practice, followed by four questions about your current understand of relevant topics. The survey should take less than 5 minutes to complete.

1. I completed my medical or nursing education in:
 - a. 2010 – present
 - b. 2000 – 2010
 - c. 1990 – 2000
 - d. 1980 – 1990
 - e. 1970 – 1980
 - f. Prior to 1970

2. I currently work as a(n):
 - a. APRN – Nurse Practitioner
 - b. APRN – Certified Nurse Midwife
 - c. Medical Doctor or Doctor of Osteopathy
 - d. Physician’s Assistant
 - e. Other (please define in comments)

3. I currently work in:
 - a. Primary care/internal medicine
 - b. Obstetrics & Gynecology
 - c. Women’s health
 - d. Reproductive technology
 - e. Urgent/emergent care
 - f. Other (please define in comments)

4. I feel ____ about women’s health issues in general:
 - a. Extremely well-informed (Likert-scale 5)
 - b. Quite well-informed (Likert-scale 4)
 - c. Moderately well-informed (Likert-scale 3)
 - d. Mildly well-informed (Likert-scale 2)
 - e. Poorly informed (Likert-scale 1)

5. I feel ____ about current standards in preconception care:
 - a. Extremely well-informed (Likert-scale 5)
 - b. Quite well-informed (Likert-scale 4)
 - c. Moderately well-informed (Likert-scale 3)
 - d. Mildly well-informed (Likert-scale 2)
 - e. Poorly informed (Likert-scale 1)

6. At this point, my understanding of the impact of nutrition prior to pregnancy on pregnancy outcomes is:
 - a. It is extremely impactful (Likert-scale 5)

- b. It has significant impacts (Likert-scale 4)
 - c. It is moderately impactful (Likert-scale 3)
 - d. It is mildly impactful (Likert-scale 2)
 - e. It has little to no impact (Likert-scale 1)
7. At this point, my understanding of the impact of nutrition prior to pregnancy on infancy and childhood is:
- a. It is extremely impactful (Likert-scale 5)
 - b. It has significant impacts (Likert-scale 4)
 - c. It is moderately impactful (Likert-scale 3)
 - d. It is mildly impactful (Likert-scale 2)
 - e. It has little to no impact (Likert-scale 1)

Thank you for completing this pre-survey. Please close this window and return to the educational module powerpoint at this time. At the end of the module you will be directed to a similar brief post-survey.

Appendix C: Post-Survey (administered online and transposed here)

This survey will ask you four questions about the value of the information presented in the educational module, then allow room for feedback (optional). The survey should take less than 5 minutes to complete.

1. I feel better informed about the impacts of periconceptual nutritional status on a pregnancy as a result of this educational module.
 - a. Strongly agree (Likert scale 5)
 - b. Agree (Likert-scale 4)
 - c. Neutral (Likert-scale 3)
 - d. Disagree (Likert-scale 2)
 - e. Strongly disagree (Likert-scale 1)
 - f. Comments (optional):

2. This educational module was useful in encouraging me to discuss nutritional issues with women prior to conception.
 - a. Strongly agree (Likert scale 5)
 - b. Agree (Likert-scale 4)
 - c. Neutral (Likert-scale 3)
 - d. Disagree (Likert-scale 2)
 - e. Strongly disagree (Likert-scale 1)
 - f. Comments (optional):

3. I found the infographic useful for offering information to my patients of childbearing age.
 - a. Strongly agree (Likert scale 5)
 - b. Agree (Likert-scale 4)
 - c. Neutral (Likert-scale 3)
 - d. Disagree (Likert-scale 2)
 - e. Strongly disagree (Likert-scale 1)
 - f. Comments (optional):

4. I will make changes (however small) to my family planning and/or preconceptional care as a result of this module.
 - a. Strongly agree (Likert scale 5)
 - b. Agree (Likert-scale 4)
 - c. Neutral (Likert-scale 3)
 - d. Disagree (Likert-scale 2)
 - e. Strongly disagree (Likert-scale 1)
 - f. Comments (optional):

5. Feedback (*This is an opportunity to provide feedback on this module, including the PowerPoint and/or the surveys. Suggestions of things that could have been done better are welcome. Feedback is completely optional; if provided, it will remain anonymous.*)

Thank you again for participating in this module! As you know, provider participation is key in such projects. Please feel free to get in touch for hard copies of the infographic included in the presentation, or with questions. You may now close this window. Alexa Holleran, AGNP student, University of Vermont. alexa.holleran@uvm.edu.

Appendix D: Pre-Survey Results

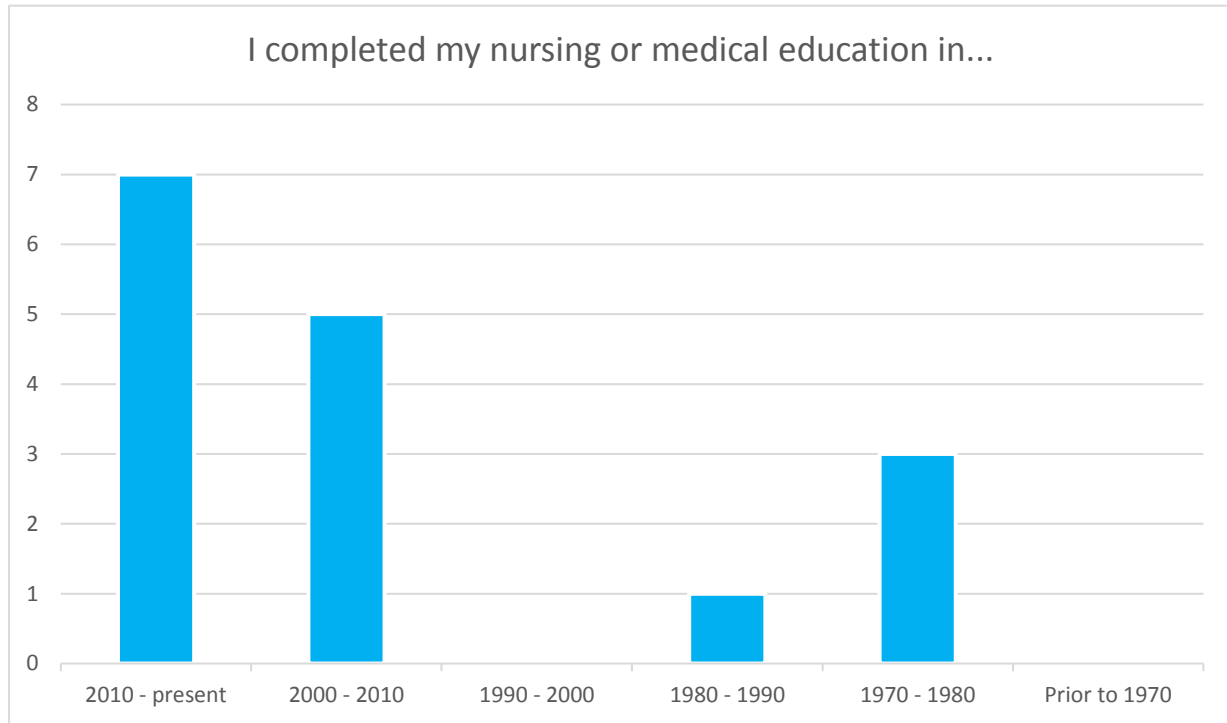


Figure 2

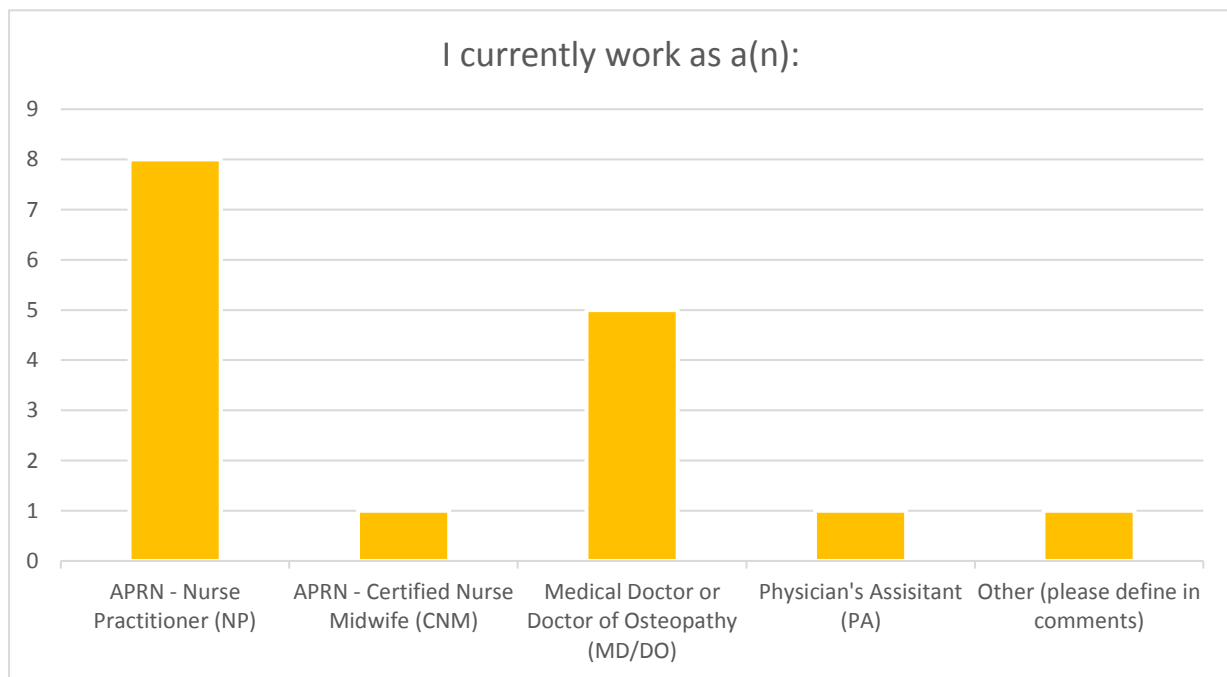


Figure 3

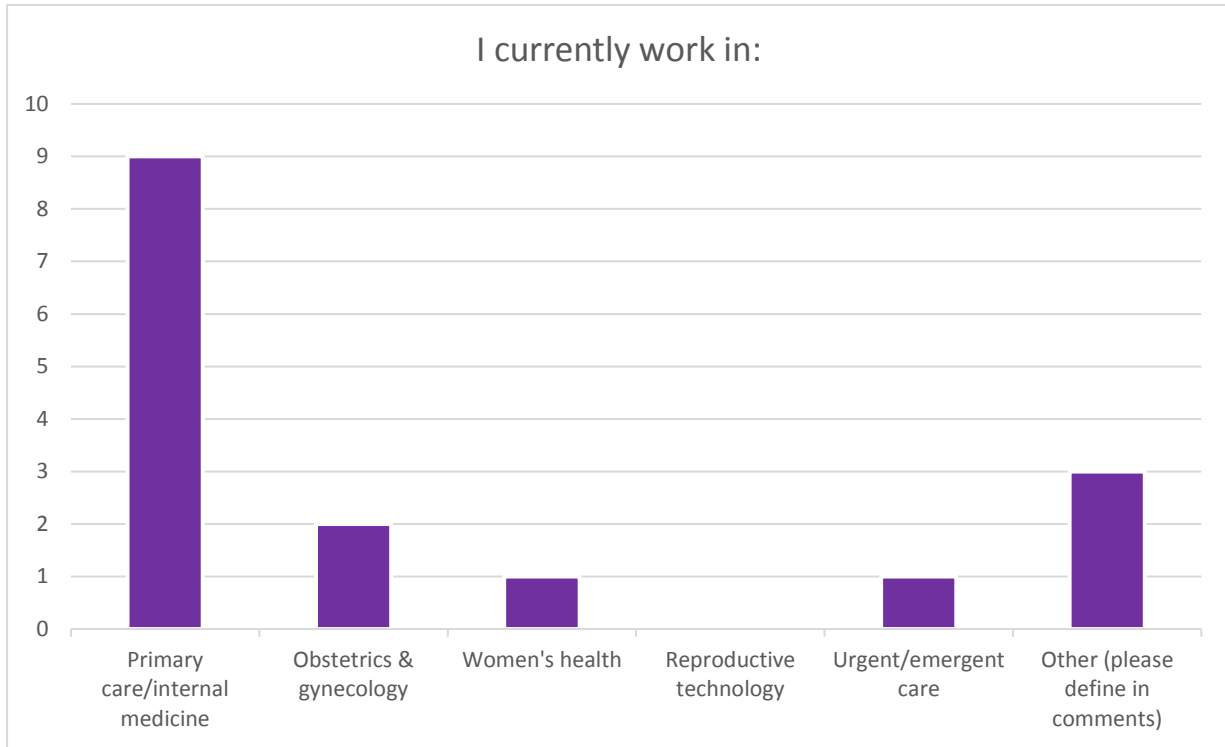


Figure 4

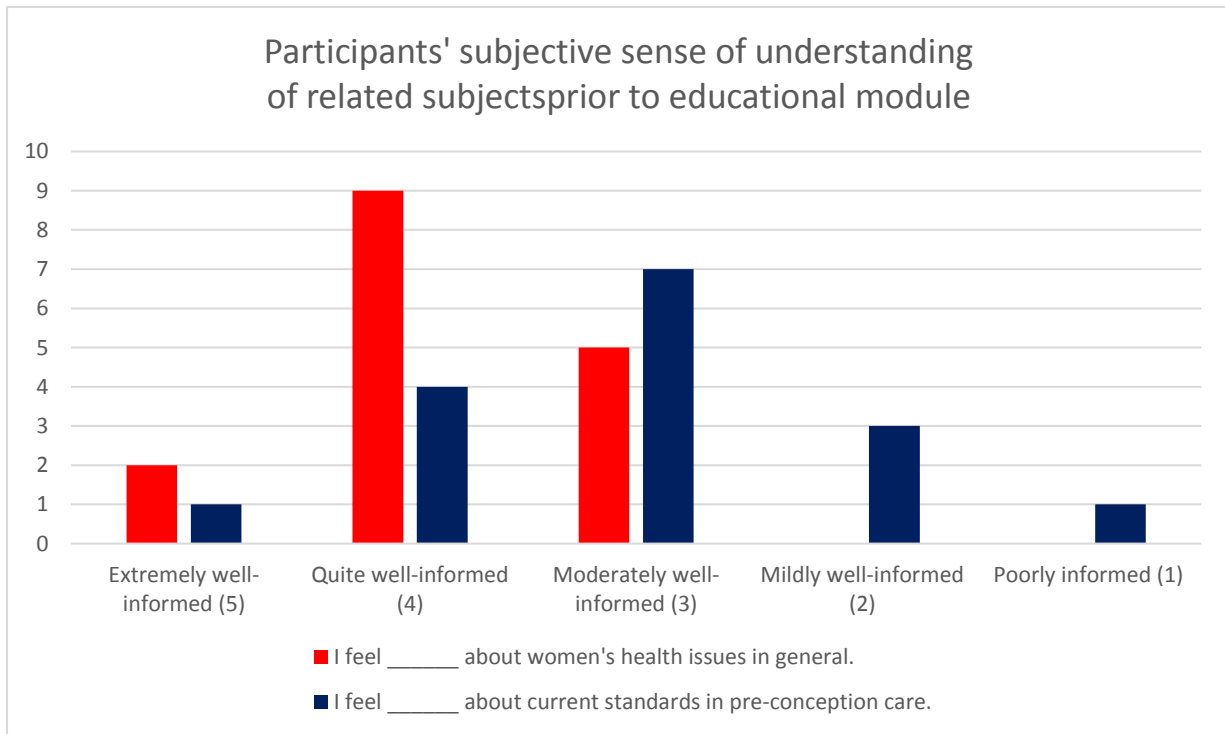


Figure 5

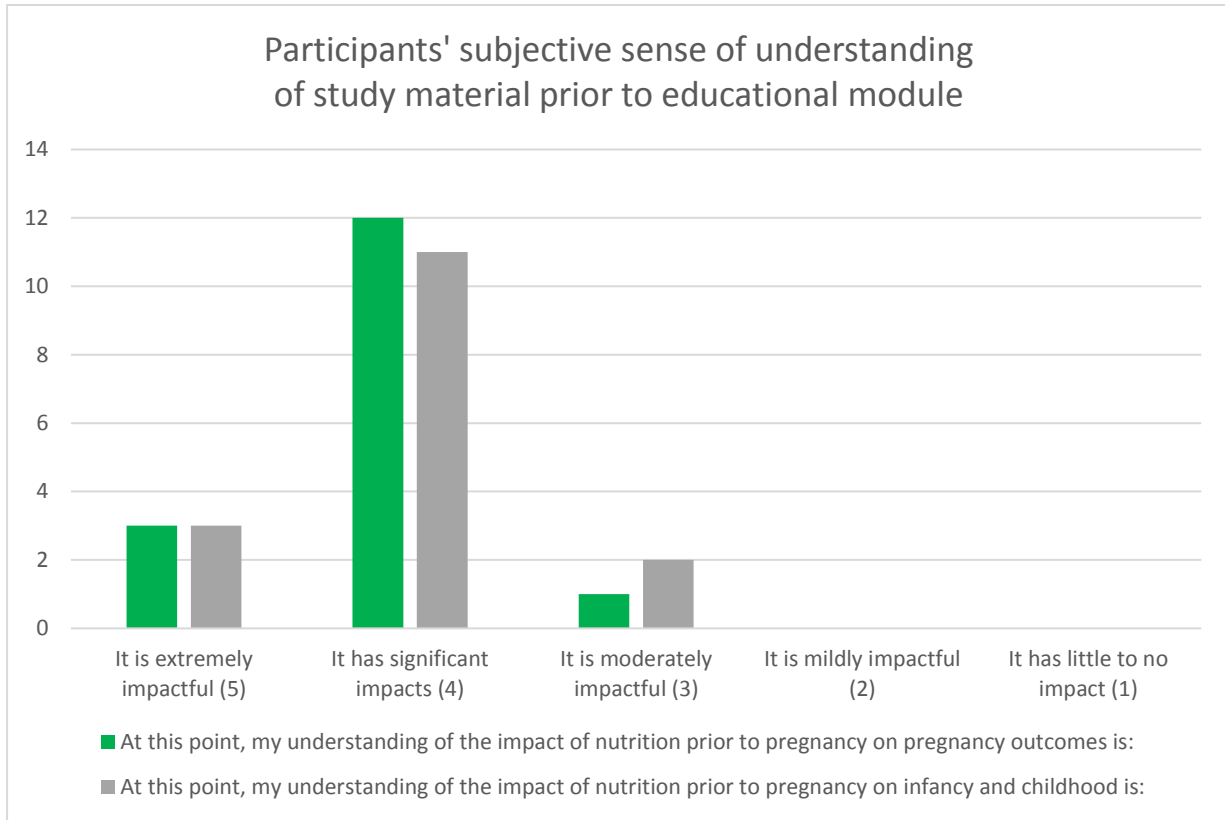


Figure 6

Appendix E: Post-Survey Results

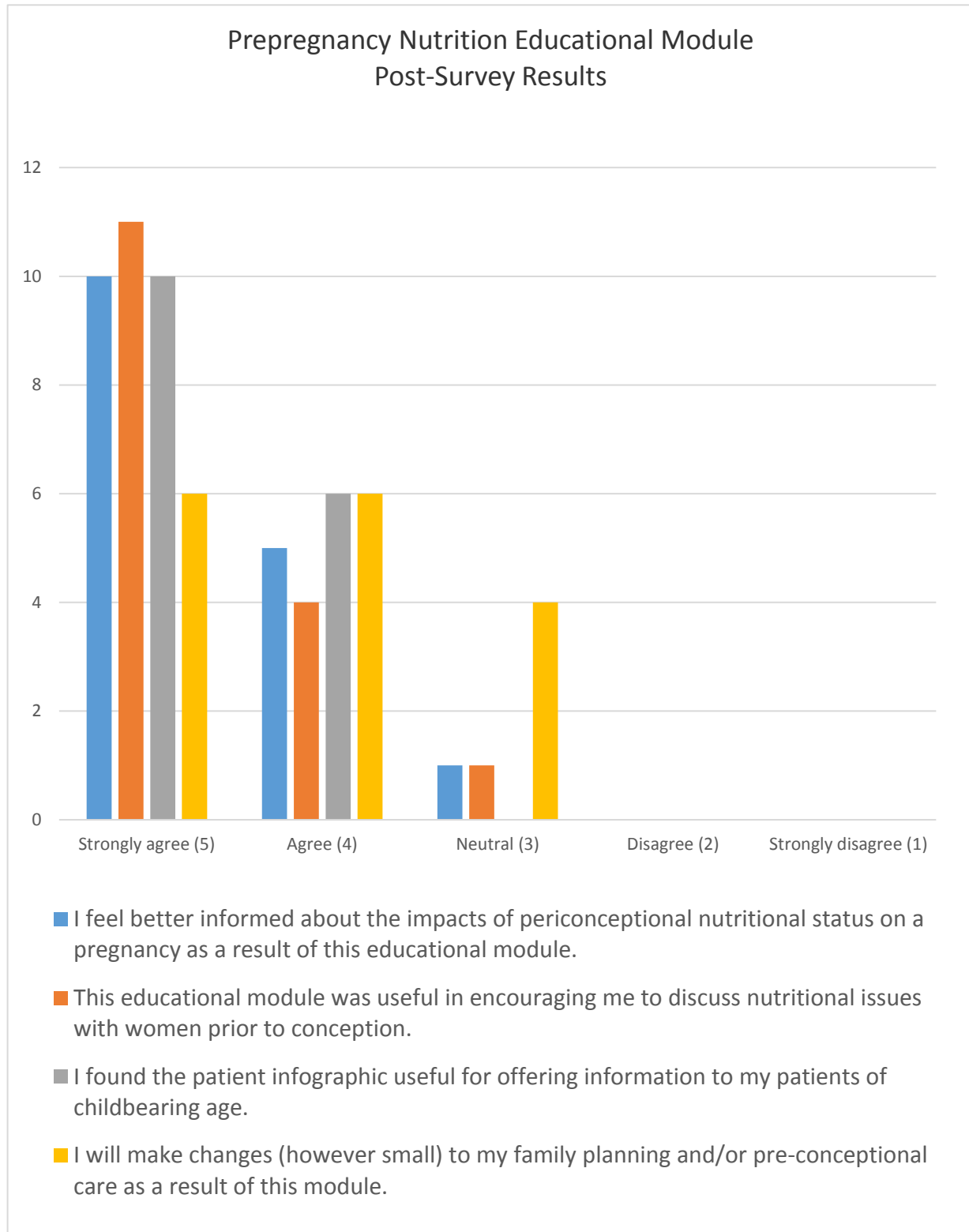


Figure 7