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The Role of Pharmacists in Prenatal Healthcare Concerning Obesity, Hypertension, and Diabetes

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THE ROLE OF PHARMACISTS IN PRENATAL HEALTH CARE CONCERNING OBESITY, HYPERTENSION, AND DIABETES

by

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ABSTRACT

This thesis explores the role of pharmacists in prenatal health care for women with chronic diseases. This study consists of a systematic review of Medline and Academic Search Premier listed articles concerning pregnant women and obesity, hypertension, or diabetes and pharmacy, focusing special attention on 40 articles. The second part of the study consisted of pharmacist interviews with thirteen pharmacists on how they view the current role of pharmacists in caring for pregnant women who are obese, hypertensive, and diabetic. The literature review suggested that chronic diseases can have a detrimental effect on children, and that there were many gaps in knowledge on how to treat pregnant women with chronic diseases. The pharmacist interviews revealed that pharmacists do not currently have an established role in prenatal care for women with chronic diseases but provide medication information for these women. In conclusion, chronic diseases during pregnancy are detrimental to the health of both the mother and the child. Pharmacists can work with other health professionals to provide education and high quality care to this population.

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INTRODUCTION

This thesis investigates the role of pharmacists in providing prenatal care to women who are obese, hypertensive, and diabetic. I conducted a systematic review of literature from Academic Search Premier and Medline to learn about how pregnant women with chronic noncommunicable diseases are treated. After reviewing the outcomes, I interviewed pharmacists to investigate their view on how pharmacy can be connected with public health and nutrition can be used to improve the efficacy of prenatal care.

Mississippi has the highest infant death rate in the United States. According to the Mississippi State Department of Health, 8.2 infants out of 1,000 live births died within the first year of life in 2014. Premature birth, which is defined as less than 37 weeks gestation, is the leading cause of infant mortality in Mississippi, followed by birth defects and sudden infant death syndrome (Collier, 2015). Women entering pregnancy with conditions like obesity, hypertension and diabetes have an increased risk for premature birth. According to the Mississippi Behavioral Risk Factor Surveillance System Annual Prevalence Report conducted in 2014 by the Mississippi State Department of Health, 37% of women in Mississippi between ages 18 and 44 were obese, 17% had hypertensive disorders, and 4% had diabetes (MSDH, 2015). These numbers show that health interventions are necessary to minimize complications due to chronic diseases.

A common recommendation for pregnant women with chronic diseases is to see a high risk obstetrician/gynecologist. However, this may not be an option for women with limited healthcare access. Even women who can visit high risk specialists need extra support.

Pharmacists are the most accessible healthcare providers, since most women purchase prenatal vitamins at the pharmacy. Pharmacists do not require appointments for patient counseling, unlike physicians' offices. By developing a protocol for pharmacists to provide care for these patients, we could improve birth outcomes among high risk mothers.

SYSTEMATIC LITERATURE REVIEW

I searched Academic Search Premier and Medline Plus using combinations of three keywords to find articles. I conducted this literature review to see the current recommendations for prenatal pharmaceutical care for women with chronic diseases. I also researched how maternal chronic disease can affect children. I only reviewed articles that were complete and peer reviewed. The first set of terms were neonatal, prenatal, and antenatal. The second terms were maternal health, hypertension, high blood pressure, diabetes, noncommunicable disease, and obesity. The third terms were pharmacists and pharmacy. After conducting this search, I thoroughly reviewed 40 articles published between January 2004 and July 2014.

Most of the articles I found focused on the effects of obesity in pregnancy. Many articles also focused on gestational diabetes and pregnancy, and fewer articles focused on hypertension and pregnancy. Few articles looked into practice guidelines for treatment of patients.

Obesity

The most consistent result I found was that overweight and obese mothers have longer hospital stays than normal weight mothers (Chu et al., 2008). Longer hospital stays raise healthcare costs for these women and their families. In situations where the expectant mother is of limited financial means, these costs are ultimately absorbed by federal, state and/or local governments, as well as medical providers. Obese women have a higher risk of

fetal effects like macrosomia, intrauterine growth restriction, and fetal death in utero (Radulescu, Munteanu, Popa, & Cirstoiu, 2013). One Romanian study surveyed birth outcomes for children born to obese mothers at a Bucharest University Emergency Hospital. The study included all children born from January 1, 2012 to December 31, 2012. The researchers found that children born to obese mothers had a higher risk of needing intensive care after birth, higher risk of caesarean surgery, and higher risk of thromboembolic complications (Radulescu et al., 2013). The researchers also found that complications are increased in both number and severity with increasing maternal obesity. A retrospective study of fetal-infant mortality in a Healthy Start community in Michigan showed that obesity, inadequate weight gain and anemia contribute as much to fetal and infant mortality as maternal substance abuse (Kothari, Wendt, Liggins, Overton, & del Carmen Sweezy, 2011). The study also showed that the fetal mortality population was more likely that the infant mortality population to have no insurance, inadequate prenatal care, and previous fetal death. These findings show that health professionals should emphasize maternal nutrition and the importance of prenatal care to patients. Children of obese women are more likely to be born overweight or be born underweight (Zhang, Rattanatray, McMillen, Suter, & Morrison, 2011). Many studies have shown that children born either underweight or overweight have a higher risk of adult obesity (McMillen et al., 2008). These complications can lead to an intergenerational cycle of obesity, which perpetuates poor health outcomes.

Maternal obesity affects fetal growth and programs children's metabolisms for a lifetime of obesity. However, the standard advice to lose weight and exercise is not optimal because studies have shown that losing weight while pregnant can cause more problems than it solves. Children exposed to fetal undernutrition are at greater risk for coronary heart

disease, increased body mass index, and increased glucose sensitivity due to decreased insulin production (McMillen et al., 2008). Maternal undernutrition can lead to the fetus receiving less oxygen and glucose than necessary. If an overweight woman tries to lose weight within three months of conception, the child may be programmed for a lifetime of adversity, leading to obesity (McMillen et al., 2008). This undernutrition programs children to have a thrifty phenotype, meaning that their metabolic systems use calories more efficiently, leading to obesity.

Obese women also have a higher risk of hypertension and gestational diabetes than non-obese women. Children born to mothers with either gestational diabetes or obesity have a significantly increased chance of adult obesity and metabolic syndrome (McMillen et al., 2008). Fetal over nutrition can lead to children developing metabolic disorders later in life. Researchers have shown a connection between maternal obesity and risk of their children's obesity. They have hypothesized that maternal obesity can alter fetal appetite regulating networks, leading to altered postnatal development and an increased risk of obesity (Muhlhausler, 2007). Physiological responses to over nutrition can contribute to an intergenerational cycle of obesity.

Several animal studies have shown a link between maternal obesity and childhood obesity. Maternal ingestion of carbohydrates have a greater effect on the offspring's future health than maternal weight gain during pregnancy (Beck, Richy, Archer, & Mercer, 2012). Maternal diet affect offspring's food preferences throughout their lives. In a study on rats, a maternal junk food diet altered the offspring's reward systems (Ong & Muhlhausler, 2011). In this study, the junk food diet had a significantly higher amount of fat and sugar than standard rat chow. Another study conducted by the same researchers showed that maternal

junk food diet had a different effect on male and female offspring. Male rats born to mothers who were fed junk food were normal weight as adults. However, the female offspring of mothers fed junk food had a higher average body fat mass (Ong & Muhlhausler, 2014). The researchers showed how reward pathways in the brain were altered by maternal diet, as rats who's mothers were fed junk food showed upregulation of dopamine-regulated genes when fed junk food as adults. These results indicate that maternal diet could play a role in their children's food preferences.

Another study focused on how overnutrition in late pregnancy relates to maternal obesity as a risk factor for intergenerational obesity (Zhang et al., 2011). In this study, researchers studied lambs that were exposed to high levels of maternal nutrition in late pregnancy. The researchers observed that maternal overnutrition in late pregnancy combined with maternal obesity formed a two-hit risk factor for lamb obesity. The researchers also showed that lambs born to obese mothers who had a restricted diet in late pregnancy were less likely to be obese later in life but had a greater stress response (Zhang et al., 2011). These results show that maternal obesity and nutrition should be closely monitored during pregnancy to minimize adverse effects to the child. Maternal BMI plays a role in the offspring's BMI. Children born to overweight mothers are more likely to be overweight (Zhang et al., 2011). In swine, a maternal diet high in saturated fat led to offspring with metabolic and developmental abnormalities (Torres-Rovira et al., 2014). In a study conducted in lambs, researchers used an embryo transfer model to observe if maternal obesity and/ or weight loss had an effect on the offspring's hepatic fatty acid metabolism (Nicholas et al., 2014). The researchers found that oocytes and developing embryos were both sensitive to the effects of maternal obesity which can lead to adverse effects for

offspring. The embryos exposed to dietary restrictions in obese ewes still showed decreased function in hepatic enzymes for metabolizing fatty acids. These results suggest that weight loss during pregnancy does not prevent children from experiencing adverse effects of maternal obesity. The researchers stated that more studies are needed on the metabolic benefits and costs on different dietary interventions in groups of women.

Another group of researchers studied the effects of maternal overnutrition on hepatic enzymes as well (Philp et al., 2008). The researchers determined that maternal overnutrition can suppress AMP- activated protein kinase in the liver, which can lead to increased glucose production and basal hyperglycemia in lambs of overfed ewes (Philp et al., 2008). One study conducted in rats examined the effects of early postnatal malnutrition on breastfeeding pups. The mothers were fed protein restricted diets while lactating, which caused the pups to develop hypoinsulinemia and may have adverse effects on the autonomic nervous system that controls the stimulation of pancreatic beta-cells (de Oliveira, Grassiolli, Gravena, & de Mathias, 2012). This demonstrates that early postnatal malnutrition can be linked to autonomic nervous system imbalances later in life. These results show that further research is necessary in determining the effects of maternal nutrition in both animals and humans.

Some researchers have been examining nutrition as a way to break the intergenerational cycle of obesity. In a recent review article, one author analyzed articles on prenatal nutrition and obesity to compare different methods for improving maternal and fetal outcomes (Muhlhausler, Gugusheff, Ong, & Vithayahil, 2013). The authors began by stating that increased fat, caloric, and sugar intake, especially combined with micronutrient deficiencies, can lead to metabolic disease in children. The author found few studies on

nutritional interventions in pregnant women, but suggested that future research focus on low glycemic index diets and diets with maternal nutrient supplements and omega- 3- fatty acids.

Excessive gestational weight and high prepregnancy body mass index can negatively affect birth outcomes. One meta-analysis conducted by researchers at Chongquing Medical University in China analyzed the effects of excessive maternal weight gain during pregnancy on children. The researchers included twelve cohort studies, and showed that the risk of childhood overweight/obesity was significantly associated with excessive gestational weight gain (Tie et al., 2014). Low income women and women of color are disproportionately overweight and obese. Around sixty percent of women gain more than the Institute of Medicine recommends for gestational weight gain. Studies have shown mixed results for dietary and other behavioral interventions designed to reduce gestational weight gain. Other studies have focused on the relationship between chronic stress, high gestational weight gain, and depression among low income women. In a study of overweight low income pregnant women in the San Francisco Bay Area, researchers asked women about their lives to find out what interventions would be most effective for healthy gestational weight gain (Thomas et al., 2014). The researchers focused on asking questions about the women's concerns about gestational weight gain, things that stressed them out, and what they would suggest for an intervention. A major source of stress for these women was lack of adequate food or housing, as well as stress related to relationships. Pregnancy was also a significant stressor, and the women worried the most about their ability to take care of another child. The women also expressed uncertainty about the appropriate amount of gestational weight to gain, and also felt defeated about being able to gain an appropriate amount of weight. Most of the women said that they used eating as a coping mechanism from stress. The women were receptive

toward an intervention that targeted stress during pregnancy. These findings suggest that obesity interventions need to include more than just diet and exercise advice. Mindfulness and other stress reduction techniques can have a positive impact on healthy weight gain in pregnancy for women and lead to improved mental health. Further trials should look into the efficacy and effectiveness of interventions designed to reduce stress in low income pregnant women (Thomas et al., 2014). This study shows that women benefit from the support of a group in dealing with chronic stress during pregnancy. Support groups have also been shown to be effective in weight loss, and can lead to improved maternal health outcomes. Pharmacists can foster support groups by providing information for women who may benefit from them. The pharmacy is a major place that women purchase prenatal vitamins, and pharmacists can use this to spread information about resources available for pregnant women. In addition to sharing information, pharmacists could work with support group facilitators to inform women about medication questions they may have during pregnancy.

Gestational Diabetes

Gestational diabetes is another major health problem that affects pregnant women. Gestational diabetes lacks standard guidelines for diagnosis; so many women do not receive the treatment they need for optimal birth outcomes (Karagiannis, Bekiari, Manolopoulos, Paletas, & Tsapas, 2010). There is not a firm cutoff for gestational diabetes, and adverse effects due to excess glucose have been observed in women not diagnosed for gestational diabetes (Poolsup, Suksomboon, & Amin, 2014). A study conducted in Norway showed a connection between high fasting plasma glucose levels and increased risk of macrosomia. Women with a BMI of 27 or greater and a high increase in plasma glucose levels were 4.5 times more likely to have a macrosomic newborn (defined as 9.24 or more pounds).

Undiagnosed gestational diabetes can have detrimental effects on offspring and must be systematically diagnosed and treated for optimal birth outcomes. Another study conducted in Sweden compared birth outcomes in women with gestational diabetes, women with impaired glucose tolerance, and women with normal glucose tolerance (Anderberg, Källén, & Bentorp, 2010). The researchers found that women who with impaired glucose tolerance had a greater risk of complications associated with gestational diabetes than women with normal glucose tolerance. The women with gestational diabetes and impaired glucose tolerance had a higher risk of hypertension during pregnancy, induction of labor, large for gestational age infant, and use of the neonatal intensive care unit (Anderberg et al., 2010). This study illustrates how impaired glucose tolerance during pregnancy can cause complications, even if the level of impairment is not severe enough to be classified as gestational diabetes.

One study analyzed the prevalence of metabolic disorders among infants born to women with gestational diabetes (Boney, Verma, Tucker, & Vohr, 2005). The researchers followed children born at appropriate weights for gestational age, and large for gestational age who were born to women who were either obese or normal weight who either had or did not have gestational diabetes. The researchers documented the children's body mass index, blood pressure, blood glucose to blood insulin ratios, HDL levels, LDL levels, and triglyceride levels at ages 6, 7, 9, and 11. The researchers found that children born either large for gestational age to either obese or diabetic mothers had an increased risk of developing metabolic syndrome in childhood. These results suggest that obese women without gestational diabetes may have other metabolic risk factors which can influence their children (Boney et al., 2005). To help combat the intergenerational cycle of obesity and metabolic syndrome, healthcare providers must work together to help women make lasting

lifestyle changes. Pharmacists can work with other providers to insure that these women are receiving the best possible medications for their conditions.

Women with gestational diabetes have a higher risk for gestational hypertension, fetal macrosomia, poly-hydroamnios, and stillbirth. Having gestational diabetes increases the risk of developing gestational diabetes during subsequent pregnancies. Gestational diabetes also increases the risk of developing type two diabetes after pregnancy. In a recent meta-analysis on the effects of treatment for gestational diabetes, researchers found that women treated for their gestational diabetes had lower chances of poor birth outcomes than women with gestational diabetes who were untreated. The meta-analysis found that women who were treated for gestational diabetes had a reduced risk of macrosomia, large for gestational age births, shoulder dystocia, and gestational hypertension, without being at a higher risk of being born small for gestational age (Poolsup et al., 2014).

One way to manage gestational diabetes is proper nutrition. Nutritional counseling can improve maternal and fetal outcomes by controlling blood sugar. Women with gestational diabetes are advised to consult with a nutritionist at least three times during their pregnancy. In a study conducted in the United Arab Emirates, women in their third trimester of pregnancy with gestational diabetes were compared with women in their third trimester without gestational diabetes (Ali, Jarrar, Sadig, & Yeatts, 2013). The researchers focused on testing nutritional knowledge, habits, and number of consults with a registered dietician. 22.3% of the women with gestational diabetes did not meet with a registered dietician at all during their pregnancy, and only 12% met with a registered dietician three or more times during their pregnancy. Both women with and without gestational diabetes had similar knowledge about foods that increase blood sugar. Both groups of women had similar diets,

with women with gestational diabetes eating more dairy products and women without gestational diabetes consuming more fruit and fruit juices. Women knew relatively little about the role of carbohydrates in raising blood sugar (Ali et al., 2013). This gap in knowledge indicates that women with gestational diabetes should be referred to a dietician earlier in their pregnancies so they can be educated on proper nutrition during pregnancy.

Pharmacists can care for women with gestational diabetes by providing clinical care for patients in a hospital or by running special clinics for women with gestational diabetes. In a prospective, longitudinal, randomized control trial, researchers in the United Arab Emirates studied how pharmacists can improve health outcomes for women with gestational diabetes (Elnour, Mugammar, Jaber, Revel, & McElnay, 2008). The study was conducted over eighteen months and 165 women were recruited to the trial, with 99 being in the treatment group and 66 in the control group. Women in the treatment group received structured pharmaceutical care services, including education and introduction to intense self-monitoring, and women in the control group received traditional treatment. Women in the treatment group had significant improvements in knowledge of diabetes, health related quality of life, control of plasma glucose, maternal and neonatal complications (Elnour et al., 2008). Maternal health complications in this study included pre-eclampsia, eclampsia, severe hyperglycemic episodes, and need for Caesarian sections. Neonatal complications in this study included neonatal hypoglycemia, respiratory distress at birth, hyperbilirubinemia, and large for gestational age births. The improvements in all of these categories showed that the inclusion of pharmaceutical care in the management of gestational diabetes can improve maternal and neonatal outcomes. Pharmacist run clinics could be a possibility in improving prenatal pharmaceutical care for women with gestational diabetes. Pharmacists in the United

States can do glucose tests, and monitor medication for women (Evans & Patry, 2004). By having a pharmacist run clinic, women can have more access to high quality healthcare. Other clinics focusing on focusing on diseases states like diabetes, diyslipidemia, and metabolic syndromes have pharmacists working alongside other professionals to provide care to patients. A clinic for gestational diabetes could follow this collaborative practice model. However, this access to specialized clinics can be restricted due to cost barriers and geographical constraints, especially if the clinic is in a rural area. Further research is needed on how to implement cost effective, pharmacist run clinics for women with gestational diabetes.

Hypertension

Hypertensive disorders of pregnancy include preeclampsia and gestational hypertension. Gestational hypertension is defined as new onset hypertension that develops beyond twenty weeks of gestation, and preeclampsia is defined as new onset hypertension that begins beyond twenty weeks of gestation accompanied by proteinuria (Callaway, O'Callaghan, & McIntyre, 2009). These conditions are similar to one another, but preeclampsia more severe than gestational hypertension. Obesity and hypertensive disorders of pregnancy share common underlying causes, and obesity has consequences that can lead to the development of these disorders.

Gestational hypertension and preeclampsia can cause adverse health outcomes for infants. Preeclampsia is a hypertensive condition in pregnancy that decreases placental blood flow and can lead to intrauterine growth restriction in the second half of pregnancy (Callaway et al., 2009). Preeclampsia occurs in about 2-3% of pregnant women and is responsible for around 15% of all preterm births, which can lead to infant morbidity and

mortality. Some risk factors for preeclampsia include high BMI, chronic hypertension, diabetes mellitus, and family history of preeclampsia. Health care providers have advised some women to take vitamin C and E supplements to prevent these conditions (Rahimi, Nikfar, Rezaie, & Abdollahi, 2009). A meta-analysis conducted by researchers at the University of Medical Sciences in Tehran, Iran investigated the effects of vitamin C and E supplements on maternal and neonatal health outcomes. The outcomes of interest were gestational hypertension, preeclampsia, preterm delivery, small for gestational age infants, and low weight births (Rahimi et al., 2009). The researchers pooled seven studies for this meta-analysis, with 2982 pregnant women at risk for preeclampsia receiving combined vitamin C and E supplements and 2987 pregnant women at risk for preeclampsia receiving placebo treatments. The meta-analysis showed that not only did the supplements not improve maternal and fetal health outcomes, women who received the supplements had a higher risk of gestational hypertension and low birth neonates than women who received placebo treatments.

Maternal hypertension can affect neonatal pain responses. Hypertension has been linked to impaired pain response in adults, but the subjective nature of pain reporting has made it difficult to establish a definitive relation. In one study, eighty infants were video-recorded as they received a vitamin K injection. The videos were then shown to professionals who were experienced in gauging infant pain responses, and were rated on appearance. The families of the infants also completed a family medical history. Infants born to mothers with hypertension had shorter crying times and lower facial grimacing scores than infants born to mothers without hypertension (France, Taddio, Shah, Page, & Katz, 2009). These finding illustrates that pain responses in infants can be affected by maternal hypertension.

Anemia is another blood disorder that can affect pregnant women. Iron supplementation can be used to improve birth outcomes in anemic women. Anemia during pregnancy can have negative effects like preterm delivery, fetal growth restriction, and low birth weight, all of which can increase the risk of infant mortality. Researchers suggested that women at risk for anemia should take iron or iron-folic acid supplements during childbearing years to lower the risk of adverse birth outcomes. However, too much iron given to nonanemic women could increase the risk of gestational diabetes and preeclampsia (Scholl, 2011). One cohort study followed how heme iron intake and non heme iron intake can affect the risk of pregnant women developing gestational diabetes (Qiu et al., 2011). Heme iron is exclusively present in hemoglobin and myoglobin from animal sources. It is more bioavailable than nonheme iron, and has also been associated with a higher risk of developing Type 2 diabetes in the general population. Nonheme iron is found in grains, vegetables, fruits, vegetables, beans, and dairy products. In this study, women who consumed higher levels of heme iron had a higher risk of developing gestational diabetes. Women with the highest level of heme iron intake had at least a twofold risk increase over women who reported consuming lower levels of heme iron. This finding was after controlling for maternal age, prepregnancy BMI, parity, and other dietary factors (Qiu et al., 2011). These findings show that the levels of maternal iron as well as the origin of dietary iron could affect the risk for gestational diabetes and other complications. A recent review of literature published on iron and pregnancy showed that iron status in utero can have effects on brain development. The fetus is not able to get all of its iron from an iron deficient mother, which can cause issues in development. The researchers showed that multiple births, teenage pregnancy, obesity and gestational diabetes can all affect maternal iron stores differently, and

that further research was necessary to see how iron status can affect developing fetuses (Cao & O'Brien, 2013). These findings show that health care providers should make sure that women have adequate levels of iron before and during pregnancy. A study of women in Romania showed that prenatal education can lead to higher levels of multivitamin, iron, and folic acid supplementation (Popa et al., 2013). Nutritional knowledge was highly correlated with vitamin supplementation. With this in mind, healthcare providers could focus on educating women about prenatal vitamins to improve public health.

Postpartum

Postpartum maternal care for women with obesity, hypertension, and diabetes is an area that can be overlooked by healthcare providers. In a Swedish study, women with body mass indices between 25 kg/m^2 and 35 kg/m^2 who were 10-14 weeks postpartum were enrolled to test how diet and exercise affected postpartum weight loss (Brekke et al., 2014). The women were divided into four groups with interventions of diet, exercise, both diet and exercise, or control. The women assigned to the diet intervention group consulted with a registered dietician and followed a diet of 500 calories less per day than they usually ate. The exercise group had a meeting with a physical therapist and walked four times a week for forty five minutes each time. The combined group received both of these interventions, and the control group was instructed to live as they usually do. The groups were evaluated after twelve weeks, and again after one year. The women who followed the diet intervention programs had significant and sustained weight loss, as well as improved cardiovascular risk factors, including waist circumference and lower concentrations of blood lipids and fasting blood insulin. The women with the exercise intervention did not have different health outcomes than the women in the control group (Brekke et al., 2014). This study suggests that

nutrition plays a vital role in postpartum healthcare. Visits with a registered dietician may improve postpartum health outcomes for mothers.

Breastfeeding is another variable that can affect postpartum weight retention. In a study conducted of mothers enrolled in North Carolina's WIC program, women who breastfed reported greater weight loss than women who did not breastfeed. The women were weighed at three months postpartum and again at six months postpartum. At three months, the weight loss was the same among women who breastfed, formula-fed, or both breastfed and formula-fed their infants. However, at six months, women who breastfed lost more weight than women who did not breastfeed. These results were still significant after controlling for pre-pregnancy BMI, race, education, and gestational weight gain (Krause, Lovelady, Peterson, Chowdhury, & Østbye, 2010). Low income women are disproportionately affected by obesity and related health problems, which can be positively affected by breastfeeding. In previous studies of WIC programs, women were polled about their knowledge and attitudes about breastfeeding (Krause et al., 2010). Women enrolled in WIC were well informed about the benefits of breastfeeding but still had lower rates of breastfeeding compared to other mothers. The study also found that attitude barriers like perceptions of breastfeeding as limiting and being embarrassed about public breastfeeding inhibited more women from breastfeeding than structural barriers, like returning to work. This finding suggests that health professionals should reinforce the benefits of breastfeeding for postpartum health. Lactation experts can also talk to women about their breastfeeding concerns, and share ideas to help with attitude barriers. Lactation experts, as well as nutritionists, are important to insuring positive health outcomes in pregnant women.

The prevalence of mental illness has been rising in the United States, which leads to many women becoming pregnant while on behavior altering medication. Selective serotonin reuptake inhibitors are the most frequently prescribed medication to treat depression (Domar, Moragianni, Ryley, & Urato, 2012). Animal studies have shown that these medicines can effect neonates, since serotonin is used in many biologic processes including neurogenesis, neuron differentiation and regulation of food intake. One study conducted in Denmark observed the differences in children's weight at age seven based on prenatal exposure to SSRIs. The study observed mother-child dyads, and recorded the mother's use of SSRIs and history of mental illness. In 127 pairs, the mother used SSRIs during pregnancy, in 490 pairs, the mother reported a history of mental illness but no use of SSRIs, and 35,568 pairs reported no maternal use of SSRIs or history of mental illness. Maternal use of SSRIs was not shown to have a significant effect on children's weight at age seven. However, when children were separated into male and female, male children of women who had used SSRIs had an increased risk of being overweight compared to other children. Female children of mothers with a history of mental illness but no SSRI use were also had an increased risk of being overweight (Grzeskowiak et al., 2013). These results show a possible sex specific differences in how children are affected by SSRI use and maternal mental illness. Pregnant women frequently quit taking their prescribed medications because they believe that the medication would harm their unborn children (Lupattelli, Spigset, & Nordeng, 2014). One literature review conducted by researchers in Boston showed that SSRIs reduced infertility treatment efficacy in women. The literature review also showed that SSRIs were linked to increased risks of miscarriage, birth defects, preterm birth, persistent newborn pulmonary hypertension, and possible long term neurobehavioral effects (Domar et al., 2012). The study found that

SSRIs did not improve any pregnancy outcomes and that psychotherapy could be beneficial in treating depressive symptoms in women hoping to become pregnant. Some selective serotonin reuptake inhibitors can increase the risk of hypertension in pregnant women (de Vera & Bérard, 2012). However, withdrawals from SSRIs and untreated depression and anxiety can have detrimental effects on the fetus. Pharmacists and mental health care providers need to meet with pregnant women and nursing mothers to discuss how to manage their medications to provide the best possible scenario for mother and child.

Vitamin D deficiencies have been linked to mental illness and other health conditions in postpartum women (Dror & Allen, 2010). In a study conducted in Finland, women who consumed the daily recommended amount of vitamin D were less likely to have children with type 1 diabetes. The children were followed up to one year of age, and were given vitamin D supplements (Hyppönen, Laara, Reunanen, Jarvelin, & Virtanen, 2001). The study found that vitamin D supplements in women and children with suboptimal vitamin D levels led to reduced risk of type 1 diabetes in the children. Finland has the highest worldwide incidence of type 1 diabetes, which some attribute to suboptimal levels of vitamin D (Hyppönen et al., 2001). Another study conducted on the importance of vitamin D during pregnancy showed that many pregnant women had suboptimal levels of this vitamin. Vitamin D is used by the body in skeletal development and cell differentiation. Lack of vitamin D can lead to poor bone mineralization, rickets, lower respiratory infections, and suboptimal brain development (Dror & Allen, 2010). This study clearly showed how pregnant women should be vigilant about their vitamin D levels. In a cross sectional study conducted in Australia, researchers showed that behavioral patterns were not as predictive as ethnicity, season, and BMI in determining vitamin D deficiency (Perampalam et al., 2011). Since most of the women

included in the study had at least one risk factor for low vitamin D, researchers suggested that women should take higher levels of vitamin D in pregnancy.

Limitations of the Current Literature

The most significant gap I saw in the literature is that there were very few articles dealing with testing drugs on pregnant women. Lack of research in this area means that few drugs have been proven to be safe during pregnancy. The articles that I read encouraged women of childbearing age to research the effects on medication on their future children (Riley et al., 2005). However, if there is no research on this subject, finding out which medications are safe and which are not is nearly impossible. A common recommendation for pregnant women is to stop taking all potentially harmful medication while they are pregnant. While this approach protects these women from unforeseen medication side effects, it might be worse for the mother and child to be affected by the untreated disease. Pharmacists and other health professionals need to stay up-to-date on medication safety research to provide counseling for pregnant women with chronic diseases. Health care providers must inform women on how to responsibly take medication while pregnant or planning on becoming pregnant.

There were also few articles about how pharmacists can improve prenatal and postnatal health care. During pregnancy, drug therapies must be altered to be safe for both mother and child. However, the lack of data on medications, as well as the lack of studies on ways to care for these patients, has led to gaps in protocol for how to care for pregnant

women with chronic diseases. Without protocols, women may not receive the highest quality care, which puts both them and their children at risk for complications.

Further research is needed to determine how to proceed with pharmaceutical treatments for pregnant women. There also needs to be more emphasis on forming an ideal health care team to care for pregnant women and new mothers. Instead of different specialists seeing the same people in different locations, health care professionals need to take a population health based approach to caring for pregnant women. In the remainder of this thesis, I will explore how pharmacists can be part of an effective team for optimizing birth outcomes.

INTERVIEWS

Methods

To gain perspective on how pharmacists provide prenatal care for women with chronic diseases, I interviewed pharmacists working in chain stores, independent pharmacies, clinics, and hospitals in either Mississippi or Memphis, TN. During these interviews, I asked the pharmacists about how they manage the medications for pregnant women with chronic diseases, how they worked with other healthcare providers to provide care, and what could be improved with prenatal pharmaceutical care for women with chronic diseases. The complete list of interview questions is included in Appendix I. I was referred to some of these pharmacists by my thesis advisors, and some of the pharmacists referred their colleagues to be interviewed. During these interviews, I asked about their professional experiences, their previous experiences of treating pregnant women with chronic diseases, how they think pharmacists can improve prenatal care for these women, and how pharmacists can work with other healthcare professionals to provide this care. Pharmacists were recruited over email, and interviews were conducted over the phone. The interviews were audio recorded for accuracy, and the complete results for these interviews can be found in Appendix II. Their

insight provided ideas about how pharmacists could provide a higher quality of care to these patients.

I took handwritten notes during the interview, then listened to the recordings and took additional notes. I then typed these notes and organized for by pharmacist for each question. After analyzing the responses for each pharmacist individually, I compiled the results, listed each pharmacist by letter, and saw the trends between pharmacists for answering each question. For each question, I grouped similar responses together, and recorded any significant differences between responses. Then, I looked at common answers to see overarching themes in the results.

ANALYSIS

I interviewed a total of thirteen practicing pharmacists for this thesis. Eleven of the pharmacists I interviewed currently work as pharmacists in Mississippi and two of them work as pharmacists in Memphis, TN. The Mississippi pharmacists practice primarily in North Mississippi, and none of them practiced further south than Jackson, MS. All but one of the pharmacists had experience working in retail pharmacy, whether independent or chain. The pharmacists agreed that most of their encounters with pregnant patients took place in a retail pharmacy setting.

At the time of the interviews, six of the pharmacists were working at ambulatory health clinics, and also taught at the University of Mississippi. Four of the pharmacists I interviewed worked in retail pharmacists, with two of the pharmacists in chain retail pharmacies in Memphis, Tennessee, and two in compounding retail pharmacies in Jackson, Mississippi. Two of the pharmacists worked in hospitals in Mississippi. One pharmacist worked in providing medications for assisted living facilities in North Mississippi.

The pharmacists thought that lack of education on medications was a major issue faced by pregnant women and breastfeeding mothers. Several pharmacists agreed that pregnant women are not given enough education on their medications. Pregnant women have different medication requirements than other populations. Data on medication safety for pregnant patients can be difficult to interpret for people who are not health professionals. According to these interviewees, pharmacists need to make sure that pregnant women understand what medicines are safe during pregnancy and how to take their medications correctly. Some pharmacists proposed making a database or handout on which drugs are safe for pregnancy. These resources could be distributed in community pharmacies.

Patient education for patients with gestational diabetes is critical. If a woman has no history of diabetes, she may not know how to test her blood glucose or self-administer insulin. The pharmacists I interviewed suggested that pharmacists could assist other healthcare providers by educating women with gestational diabetes on how to test their blood glucose and self-administer insulin. Pharmacists can also work with dieticians to help women manage their blood glucose. The pharmacists I spoke to said that pharmacists working in chain retail pharmacies may not have time for individual patient counseling appointments. Chain retail pharmacies focus on distributing as many medications as possible to maximize revenue. If pharmacists are not compensated for patient consultations, then the chain may discourage these interactions. Pharmacists recommended informing pregnant women with Type 2 diabetes about how their disease state may change during pregnancy. Patients may experience greater fluctuations in blood sugar during pregnancy. Since many oral antidiabetic medications are discouraged during pregnancy, pharmacists need to make sure that they can manage their diabetes without these drugs. Dieticians can provide guidelines for stabilizing

blood glucose through proper nutrition. Interdisciplinary collaboration can provide clear treatment plans for patients to follow.

The interviewed pharmacists were divided on suggesting interventions for obese pregnant women. Retail pharmacists, especially those working in chain setting, felt that offering unsolicited advice to obese pregnant women could be seen as offensive. These pharmacists expressed concern that offering advice could hurt the pharmacy's business and recommended only giving advice if women specifically asked. The clinical pharmacists advised speaking with obese pregnant women about healthy weight gain guidelines, and working together to make sure that their pregnancy was as healthy as possible. Clinical pharmacists also recommended working dieticians and other health professionals to provide the best care for each patient. The difference in recommendations could stem from the differences in retail and clinical pharmacy practice. Clinical pharmacists spend time one on one with each patient and build relationships that allow them to give patient specific advice. Retail pharmacists see many patients every day and may not have a close enough relationship with their patients to suggest individual interventions. These results indicate that more obese women should consult with clinical pharmacists to receive individual interventions.

When treating pregnant and breastfeeding patients, pharmacists said that they made sure to double check for medication safety. The interviewed pharmacists recommended that these patients take as few medications as possible since most medicines do not have safety data for pregnancy. Patients should also be advised to take birth control if they are prescribed medications that have potentially teratogenic effects. Health care providers can work with patients to provide treatment plans that include fewer medications.

Pharmacists need access to patient health records to know how to treat pregnant patients who have previously had a low weight or preterm birth. Many of the pharmacists stated that these cases were outside of their scope of practice. The other pharmacists said that they would need more information before they could treat these patients, since there are many possible causes for these conditions. Patient medical histories are vital to understanding the causes for these conditions. Some possible causes for low weight birth that the pharmacists discussed were malnutrition, nicotine consumption, genetics, and lack of prenatal care. The pharmacists recommended that these women keep all prenatal care appointments.

Limited access to high quality healthcare is another issue for pregnant patients. Since Mississippi is mostly rural, healthcare access can be limited by geographic barriers. These geographic barriers can discourage women from seeking prenatal care. Some solutions that have been proposed are having traveling health care providers practice in several rural areas, as well as group interventions to lower financial cost for patients. Group interventions can also benefit patients by providing a support system. Pharmacists recommended group interventions as a way to reinforce individual prenatal care.

Studying population health trends can assist providers in finding issues that can be treated in a group setting. All of the clinical pharmacists knew the meaning of "population health", while many of the community pharmacists did not. All of the pharmacists had studied health trends in the population they served. This suggests that pharmacists incorporate population health into their practice, even if they did not know the specific term. Pharmacists recommended educating groups on health issues like medication safety and

management. They also suggested partnering with other community organizations and programs like WIC and religious groups to reach a wider audience.

Prenatal care is typically given in a physician's office. However, if a woman does not have the resources to see a physician for all prenatal Pharmacists were asked about the best setting for women to receive prenatal care. Most pharmacists agreed that the best place for a woman to receive prenatal care was somewhere she felt comfortable. They also agreed that women needed to receive care from a provider who has their complete medical records. A couple of the pharmacists said that prenatal care could be given in a group setting, but the majority said that one on one interventions were still the best. Pharmacists said that retail pharmacies were not optimal for prenatal care because there were no private counseling area. However, clinical pharmacies and community health centers can be sites for prenatal counseling.

Gaps in prenatal and postnatal care for patients can negatively affect patient health. The pharmacists said that lack of patient knowledge about prescription and over the counter medications is a major gap in patient care. Patients do not have a clear source of information on medication safety during pregnancy. Pharmacists should be proactive about advertising their services as medication experts. Some pharmacists recommended for patients to schedule an appointment with their pharmacist to go over how pregnancy affects medication use. They also recommended giving patients handouts on safe medications in pregnancy, as well as verifying patient's understanding of how to use their medications.

Pharmacists recommended more communication among health care professionals to improve care for pregnant women with noncommunicable diseases. The current model for healthcare usually involves a patient seeing several different health professionals in different

offices. This model can discourage interprofessional collaboration and potentially cause gaps in patient care. Providers caring for the same patient may not know one other's area of expertise or all of the services each professional can offer. Pharmacists suggested greater team interaction to promote more unified health care for these patients. Team members need to meet together to discuss their individual strengths and training. Then they can develop a plan for patient care to make sure that all patient needs are being met. While this approach will require more time to plan, it could improve patient outcomes.

All of the pharmacists I spoke to advocated for more communication with providers and patients to provide high quality healthcare. They also said that pharmacists should be more involved in educating pregnant women about their prescription and over the counter medications. The pharmacists also agreed that pharmacists need to communicate more with other healthcare providers to make sure that other providers know what pharmacists can add to a healthcare team.

The clinical pharmacists I spoke with said that their clinics did not treat pregnant patients. The women are cared for by an OB/GYN as long as they are pregnant and breastfeeding. This scenario protects clinic health care providers from liability, but burdens the OB/GYN with health conditions that may be outside their scope of practice. In addition to changing the women's healthcare team, women often have to change medications while pregnant. Pharmacists could assist women by double checking that their medicines are safe. By keeping the woman's pharmacist as a constant provider, the woman has at least one permanent member of her healthcare team. Having the same pharmacist throughout this experience will also smooth the transition between healthcare teams.

Most of the pharmacists I talked to agreed that education was important for every step of prenatal care. However, pharmacists are limited in their patient interactions by time constraints in retail chain pharmacies. Pharmacists may also not want to offend patients by providing unsolicited advice. Patients may respond better to advice from clinical pharmacists since clinical pharmacists have more time to spend on patient care. Patients may also trust clinical pharmacists more, since they see the same pharmacist for health care.

Another area for improvement is communication between pharmacists and other healthcare providers. This can make communication more difficult and cause gaps in patient care. Providers need to effectively communicate and divide responsibilities to improve patient care. Pharmacists need to advertise their skills to other healthcare providers to make sure that they are providing the best possible care. Pharmacists can inform patients about appropriate medication choices, as well as make sure that their over-the-counter medicines are safe.

None of the pharmacists I spoke to felt that they were qualified enough to counsel pregnant women with chronic diseases. The pharmacists also said that there were no continuing education credits that they were aware of offered to teach pharmacists about fetal and maternal health. Pharmacists need to be offered training in this area so that they can be effective team members for treating pregnant women with chronic diseases.

There are few treatment guidelines given for pregnant women and new mothers, especially concerning hypertension and diabetes. The pharmacists I spoke to recommended healthy weight gain and proper nutrition to improve birth outcomes. However, this is unfeasible for many women. Food deserts in rural areas can make it difficult to find nutritious food. Financial constraints can also limit patient access to nutritious food.

Pharmacists and other health care providers need to work together to provide feasible diet plans for pregnant women with chronic diseases.

CONCLUSION

Discussion

The interview portion of this study was limited by a relatively small sample size of pharmacists who were available to be interviewed. Nonetheless, by combining the systematic literature review with the experiences and views shared by pharmacists in the interviews, the overall study helped to shed light on the current roles and challenges to engaging pharmacists in maternal health care. Additionally, this research resulted in recommendations for engaging pharmacists.

Future Research

To build on this thesis, future research should focus on interviewing pregnant women on gaps in their prenatal care, especially as they concern the pharmacy practice. Other

healthcare workers should also be interviewed about how pharmacists could become a more active member of the prenatal health care team. Two additional areas for research are the effects of obesity on children and how to improve the birth outcomes of obese women.

In the future, I hope that someone will develop a program to include pharmacists in care for pregnant women with chronic diseases. I do not know of any programs that currently exist that include pharmacists in this capacity. Having a pharmacist on the team to support the other providers and provide advice on drugs will be an asset to women. A clinic with a pharmacist in residence will help women navigate through pregnancy and beyond.

Developing a continuing education for pharmacists about prenatal care would improve pharmacist's knowledge of how to treat pregnant women. This could be developed with the assistance of an OB/GYN, and provide guidelines on how to act in common prenatal care situations. By educating community pharmacists about prenatal care, they will be better equipped that handle questions from the public.

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APPENDIX I

Pharmacist Interviews Questions

1. To start, please tell me about your work as a pharmacist.

2. What do you see as the greatest health challenge facing pregnant women?

3. What do you see as the role of pharmacists in regard to prenatal and postnatal care for these women?

4. Are there any special approaches for mothers who are (probe for each): obese, have Type II diabetes, have gestational diabetes, have had a preterm birth (<37 weeks gestation), have had a low-weight birth (<2,500 grams)?

5. How do you manage the medications of a pregnant woman/breastfeeding mother differently than another patient?

6. How do you think that pharmacists can improve prenatal care?

7. Have you heard the concept “population health”? What does this mean to you as a pharmacist?

8. How can a population health mindset improve prenatal and postnatal pharmaceutical care?

9. How can pharmacists work with other health care providers to best provide prenatal and postnatal care?

10. From your perspective, what is the best environment for a woman to receive prenatal and post-natal care? (community health clinic, hospital, neighborhood pharmacy, or other)

11. What are the major gaps you have observed in prenatal and postnatal care?

12. Do you have any recommendations for non-pharmacists concerning how they can better interact and work with pharmacists to provide maternal health care?

APPENDIX II

Coded Results

1. Pharmacist A currently works in the neonatal intensive care unit at a hospital and has also had experience in retail pharmacy. He focuses on antibiotic fluids and nutrition.

Pharmacist B has worked in both chain and independent retail settings. She currently works in a university as a clinical pharmacist and specializes in tobacco cessation.

Pharmacist C works in a university as a clinical professor. She also works with physicians and nurse practitioners in a rural clinic focusing on cardiometabolic disorders, diabetes. dyslipidemia, hypertension, and smoking cessation. She completed a community pharmacy residency where she worked with immunizations in a school clinic, community pharmacy in both a chain and independent setting. She has also worked with other professors on developing medicine synchronization programs so patients can receive all of their medications at one time.

Pharmacist D works as a clinical pharmacist in several different clinics in rural Mississippi. She also works at a chain community pharmacy. In one clinic, she works with a physician and nurse practitioner to monitor patient's A1C, blood pressure, and cholesterol. She also counsels patients on tobacco cessation. These programs are funded by the CDC. She counsels

diabetic patients on medication therapy management and self-monitoring resources, like glucometers. She educates patients on side effects and complications, and also uses a variety of approaches like ACE inhibitors, carbohydrate counting, exercise, and statins to control these conditions. She gives vaccines, performs eye and foot exams and waist circumference tests and makes recommendations to the providers for treatments.

Pharmacist E works as a hospital pharmacist in Mississippi.

Pharmacist F works in clinical practice in an urban setting. She works in a diabetes clinic that cares for patients with diabetes, hypertension, and weight issues. She provides medication therapy management services, answers medication questions, and educates patients about their condition. She has also worked in providing medication therapy management in both a chain and independent retail setting. Before working in the diabetes clinic, she worked in a metabolic clinic and a family medicine clinic. She works health fairs in the Mississippi Delta.

Pharmacist G currently works as a retail pharmacist in a suburban area. He has previously worked with a home health pharmacy group that delivered nursing home care. He also worked with hospital and retail pharmacies in the US military, as well as working as a poison control pharmacist and a 911 specialist.

Pharmacist H has been a pharmacist for fifteen years and has worked in a hospital pharmacy, a retail pharmacy and in pharmacy contracting. She has seen most pregnant women in a retail setting.

Pharmacist I has a wide experience in clinical pharmacy and has worked with patients with diabetes, hypertension, dyslipidemia, asthma, and chronic kidney disease. She has reviewed medicines and made recommendations for patients. She now educates patients on disease

states and modifications in a clinical setting. She also helps students transition to adult care insurance with medications and managing care.

Pharmacist J has worked in a suburban chain retail pharmacy where he fills prescriptions, monitors drug interactions, checks on inaccurate dosing and bad prescriptions. He also counsels customers on medications, directives and side effects. He also provides economic counseling for patients to help provide more affordable medications.

Pharmacist K currently works as a compounding pharmacist in an urban area. She has worked in an independent retail pharmacy, hospital and nursing home as well as providing home IV services. She compounds bioidentical hormones as well as transdermal treatments and creams.

Pharmacist L has been practicing for fifteen years in a variety of settings. He has worked in a hospital pharmacy and with research and development in industry. He currently works in a university and as a clinical pharmacist with patients with major diabetes, thyroid disease, hypertension, dyslipidemia, and occasionally pregnant patients with type 1 or 2 diabetes.

Pharmacist M currently works as a pharmacy manager and distributes medicines to nursing homes and assisted living facilities. He has also worked in chain retail pharmacy.

2. The pharmacists I interviewed mostly agreed that lack of education on medication use during pregnancy was the greatest health challenge facing pregnant women. Pharmacists D, E, F, G, and M recommended that community pharmacists should instruct patients on which medications are safe for pregnancy. Pharmacists can also dispel myths surrounding medications during pregnancy. The pharmacists also stated that lack of knowledge about over the counter drugs and supplement use during pregnancy can be dangerous to women and

their children. Pharmacist G recommended creating a database about drug safety in pregnancy with nontechnical language. He believed that technology was a valuable tool for education on medications during pregnancy. Pharmacist I said that patients are uninformed about health struggles in pregnancy and do not ask their healthcare provider enough questions. She recommended that pharmacists be more involved in checking the safety of prescription medications for these women as well as offering prenatal pharmaceutical counseling. Pharmacist K who had worked in a variety of roles said that nonlife threatening but painful conditions like hypertension, diabetes, reflux, and hemorrhoids are the biggest problem facing pregnant women. She recommended educating women on what to expect from their bodies during pregnancy, and how to deal with new health challenges that they may face. By giving women more information about the safety of medications during pregnancy, women can have better control of their health.

Another common theme in the pharmacists' responses was the importance of management of chronic disease states before becoming pregnant. Pharmacist L who worked with diabetes patients recommended therapeutic lifestyle changes for women to have a healthier pregnancy. Pharmacist J agreed with this view and added that proper sleep, diet, and exercise are vital to a healthy pregnancy. He advised women to watch their weight while pregnant and exercise safely to have better birth outcomes. Pharmacist M added that lifestyle modifications can be used to manage patients with prehypertension so that they do not have to go on prescription medication.

Pharmacist B who works in North Mississippi said that unequal access was a major challenge facing pregnant women in this state. Depending on location, women can have access to affordable, convenient healthcare or not. Pharmacist C agreed that limited

healthcare access was a major problem, especially in women with chronic diseases living in geographically isolated areas. She suggested that practitioners should travel to rural areas to offer treatment to patients who would otherwise not have access. She also emphasized the importance of services like family planning, and pregnancy preparation. Pharmacist H said that lack of access to healthcare can lead women to not seeking out prenatal care. Some women also may not find out about their pregnancy until three or four months along, which can prevent them from seeking early prenatal care. Pharmacists and nurse practitioner could take a more active role in educating isolated patients in their area of practice.

Pharmacist A stated that illicit drug use was a huge problem in the neonatal intensive care unit. Heavy drug use causes premature delivery, and most babies in the intensive care unit are premature. He stated that prescription drugs were not nearly as much of a problem as legal drugs like nicotine and ethanol.

3. Most of the pharmacists agreed that educating women on the safety of their medications was the role of pharmacists in prenatal care for women with chronic diseases. Pharmacist B stated that pharmacists should be aware of the safety risks in all the medications that are sold to pregnant women. Pharmacist F thought the most important role in a community pharmacy setting was providing prenatal OTC vitamins. Pharmacists can talk through cost effective options. Pharmacists H and M observed that most people come to the pharmacists before the doctor for advice about prenatal care and vitamins. Pharmacist M added that since pharmacists are accessible to patients, it is the pharmacist's responsibility to make sure that patients are fully educated on their medicines and do not fall through the cracks of the healthcare system. Pharmacist J recommended counseling on proper nutrition and selection of prenatal vitamins. He said that some nonprescription vitamins were good for

most women. He sees around 40 pregnant women every month in his practice and they very rarely ask for advice. Most of them receive prenatal vitamins through tenncare.

Pharmacist A thought that educating women on the safety of their medications was the most important role of the pharmacist in providing prenatal and postnatal care for these women. He also recommended educating women on the effects of recreational drugs during pregnancy. He also suggested reviewing the medication list for each patient to make sure that their drugs are in safe categories. If the patient is on antidepressants or other potentially harmful medications, he recommended shifting their therapy to less dangerous drugs.

Pharmacist C stated that a possible role for pharmacists in prenatal and postnatal care could be assisting providers in treating patients with serious medical conditions. She recommended that follow ups can happen with providers and pharmacists. She also suggested that pharmacists educate patients on both pharmaceutical and nonpharmaceutical methods for controlling their disease states. Pharmacist F stressed the importance of open lines of communication between healthcare providers and patients in clinical pharmacy. Clinical pharmacists are more involved with consulting and medication therapy and focus more intensely on patients. Pharmacist L focused on the importance of counseling diabetic patients on the importance of optimal glucose control through diet and correct use of insulin.

Pharmacist D thought that education was important but did not do any good if patients do not know how to use resources. Retail pharmacists are the first line of counseling and should be proactive about asking patients if they quit birth control. Make sure women with chronic diseases understand diet and healthy weight gain. Since time is limited to about five minutes per visit in retail pharmacy, pharmacists should make an effort to talk to pregnant women about their medications. Pharmacists should also be sure to note whether

pregnant patients have gestational diabetes or Type 2 diabetes. Pharmacists should make an effort to prevent patients from falling through the cracks.

Pharmacist E thought that pharmacists should assist in clarifying the doctor's instructions for the patient. He did not think that pharmacist should recommend drugs to patients and instead recommended that pharmacists emphasize the importance of medication adherence to patients. He also observed that supplements are not well regulated and encouraged pharmacists to tell pregnant women to talk to a physician before starting any supplements.

Pharmacist G thought that the pharmacist's role in prenatal care was dealing with minor problems, and dealing with lack of physician access. Some concerns that he raised were the how to treat both the mother and child effectively, and how the lack of studies on medications in children can lead to treatment issues. He said that pharmacists see many different postnatal issues like yeast, thrush, ear and eye infections, as well as allergic reactions in children. He recommended that pharmacists stay on top of current treatment protocol in case of an emergency.

Pharmacist I stated that pharmacist should make an effort to see the whole patient instead of just a list of medications or disease states. She also recommended that women not achieving goals need to work with providers to get conditions under control. Pharmacists can augment care and assist women to maintain control postnatally. She suggested a team based approach composed of more than just pharmacists and doctors to optimize birth outcomes.

Pharmacist K also thought that communication and encouragement were key to a pharmacist's role in prenatal and postnatal care for women with chronic diseases. She also recommended emphasizing the important of good nutrition and adherence to blood pressure

medications. She also suggested that pharmacists should be involved in community outreach to provide more support for these women.

4. i. Pharmacists A, E, and K stated that counseling obese pregnant women was outside of their scope of practice.

Pharmacist B added that she would not change anything with their treatment, and would not recommend weight loss. She also recommended checking blood pressure to make sure it is within healthy limits.

Pharmacists C, F, I, and L suggested working with the patients to develop diet and exercise plans for them during pregnancy. Pharmacist C did not recommend a special course of treatment and said that patient should not be on many medications during pregnancy. She also said that support groups could help patients adhere to these treatments. Pharmacist F said that good nutrition could help women have healthier pregnancies. Pharmacist I said that patients should work with a dietician to gain less weight during pregnancy.

Pharmacist D recommended that pharmacists explained the effects of maternal obesity to the patients. Pharmacists D and F also recommended counseling patients on healthy weight gain during pregnancy and emphasizing the health of the baby as a priority.

Pharmacist G said that more research was necessary on how to treat obese pregnant women. He pointed out that there is not an established protocol for treating these patients.

Pharmacists J and M said that they did not offer advice to obese patients in a retail pharmacy setting. Both expressed concern about how that could offend patients and hurt the business of their pharmacies.

Pharmacist H said that obese women were less likely to get and stay pregnant. She also said that they find out about pregnancy later, which can lead to a lack of prenatal care.

ii. Pharmacists C, D, I, J, and L both thought that treating pregnant patients with Type II diabetes should be centered on blood glucose monitoring. These pharmacists advised patients to either quit or change their oral antidiabetic medicines to medicines with no potential teratogenic effects. Pharmacist J encouraged patients to invest in a blood glucose machine, which periodically tests for blood sugar and can track trends. He also said that yeast infections can occur more frequently in patients with diabetes. Pharmacist L recommended planning pregnancies so women can be on the appropriate medications before they get pregnant.

Pharmacists D, E, and M all stressed the importance patient adherence to treatment regimens and using diet to control blood sugar. Pharmacist D said that patients should be educated on why their blood sugar is less stable than usual, and how to control their blood sugar. She also recommended explaining how Type II diabetes can affect a growing fetus.

Pharmacists I and L recommended women with Type II diabetes to keep a stricter control over their blood glucose and A1C levels. Pharmacist I also said that since fetal abnormalities can occur within the first seven weeks, both patients and providers need to be on the same page about care.

Pharmacist C said that medications were more difficult for pregnant Type II diabetes patients, and that treatment should emphasize monitoring blood sugar. Pharmacist B and M said that pregnant patients with Type II diabetes should try not to take multiple medications. Pharmacist C also recommended talking with Type II diabetic patients in a group setting so that they could share conversations about issues they face. She said that group education fosters accountability and encourages women to follow through on what they have learned.

Pharmacist F said that her diabetes clinic no longer cares for pregnant patients. She added that Type II patients have the basic knowledge to deal with diabetes, but need to be informed about how pregnancy can affect diabetes.

Pharmacist G said that he would recommend sugar free drugs to Type II diabetic women.

Pharmacist H said that she would counsel diabetic women on the signs of pregnancy since diabetes can affect these signs.

Pharmacist A, K said that counseling pregnant women with Type II diabetes was out of their scope of practice.

iii.

Pharmacist B, C, D, and J said that patients should be informed that gestational diabetes can recur in subsequent pregnancies.

Pharmacists B, C, D, and L recommended counseling these patients on therapeutic lifestyle changes since gestational diabetes raises the risk of having Type II diabetes after pregnancy.

Pharmacists F, I, and J said that patients with gestational diabetes should keep tight control over their blood glucose levels.

Pharmacists G and M said that pharmacists should make sure that patients with gestational diabetes know how to treat themselves with insulin since they have never done it before.

Pharmacist C said that these women should see their providers at least once a year to have their blood glucose tested

Pharmacist L said that he did not usually see patients with gestational diabetes since his clinic did not treat pregnant patients.

Pharmacist E said that patients with gestational diabetes should talk to their physicians about their treatment and not self-medicate.

Pharmacist A, I, and K said that counseling pregnant women with gestational diabetes was out of their scope of practice

iv. Pharmacists B, D, F, I said that the cause of the previous preterm birth needed to be determined before the patient could be treated.

Pharmacist D added that pregnant women who had had a preterm birth should be sure to attend appointments with their OB/GYN.

Pharmacist H said that pharmacists should emphasize the importance of prenatal care to women who had had a preterm birth and also discuss possible causes for preterm births.

Pharmacist L recommended referring women who had had a preterm birth to a high risk OB/GYN.

Pharmacist A, C, E, G, J, K, and M said that counseling pregnant women who had had a preterm birth was out of their scope of practice

v. Pharmacist B, D, F, I, and L said that the pharmacist must know the reason for the low weight birth before treating the patient.

Pharmacists J and L observed that smoking can lead to low weight births, and that pharmacists can counsel patients on how to quit before pregnancy.

Pharmacists H and L said that if the mother had significant nausea during pregnancy, the child's size may be affected due to malnutrition.

Pharmacist E said that pregnant patients who had had a low weight birth should be sure to attend follow-up appointments with their healthcare providers.

Pharmacist L said that if the parents are small, then the child may be genetically predisposed to be small.

Pharmacist A, C, G, K, and M said that counseling pregnant women who had had a low weight birth was out of their scope of practice.

5. The pharmacists agreed that medications for pregnant women and nursing mothers must be handled more carefully than medications for the general public. Pharmacist B recommended that pharmacists check over these prescriptions to make sure of the effects for the mother and infant. Pharmacists A, E, J, and M all said that pharmacists should explain to patients what medications are safe for pregnancy and breastfeeding. They also agreed that medication adherence should be emphasized and that women should not change their medications without talking to a physician or pharmacist. Pharmacists C, I, and H agreed with this view and added that community pharmacists should inform patients about which over the counter medications and supplements are safe to take while pregnant or breastfeeding. They also suggested reviewing the patient's medical history to make sure that all drugs are safe and necessary. Pharmacist H added that if a medication could harm the mother or child, the pharmacist should inform women of the dangers and talk to the prescriber about changing the therapy. Pharmacist D echoed this view and said that women should know how trimesters affect the risk of adverse effects from certain medications.

Pharmacists F and L recommended counseling patients who could become pregnant on how the medications that they are on could affect potential children. Pharmacist F thought that pharmacists should ask patients of childbearing age if they were on birth control or plan on becoming pregnant. She thought that pregnancy should be planned in women with chronic diseases to optimize outcomes for both mother and child. If the woman plans on getting

pregnant, her medications should be changed to drugs that are not harmful during pregnancy. She stressed that diabetes and blood pressure change from trimester to trimester and require tight control to stay regulated. Pharmacist L stated that diabetic patients should be counseled on medications during pregnancy and only be on medications that cannot go into breastmilk. He said that insulin is fine during breastfeeding, but some other antidiabetics can be transmitted in the breastmilk.

Pharmacist G recommended that community pharmacists check drug interactions for these patients. He said that electronic prescriptions and databases of certain medications including Sudafed can help pharmacists monitor the patient's medication history, especially if they get medicines at multiple pharmacies.

Pharmacist K was very cautious about medication use in pregnancy and recommended that patients take as little medication as possible during pregnancy unless there is clear data on fetal safety.

6. All but one of the pharmacists I spoke to said that interacting with patients is an important way for pharmacists to improve prenatal care. Pharmacist A stated that pharmacists need to make educating the population on prenatal care a priority, since lack of education can lead to adverse outcomes. Pharmacist D echoed this idea, and encouraged pharmacists to educate and identify high risk patients on issues they may face in their pregnancies as well as medication safety. Pharmacist E said that pharmacists should reinforce the importance of adherence to medication to patients and also advise patients against self-medicating with herbal medications. Pharmacists F and H both suggested having reading material available in the pharmacies that listed resources for pregnant women, as well as counseling patients individually when possible. Pharmacist F acknowledged the difficulty of

finding time to educate patients in a community pharmacy setting because of limited time for patient interaction. In a clinical setting, she recommended tailoring patient care to each patient's individualized medications and health concerns. She emphasized the importance of affordability and awareness in providing education in both clinical and community settings. Pharmacists B and G suggested that pharmacists need to have full access to patient information and specialized training to best provide prenatal care to patients. Pharmacist B reiterated the importance of pharmacists having full access to the patient's profile to provide the best care. Pharmacist G pointed out that prenatal care education is not mandatory for pharmacists, which can lead to gaps in knowledge on how to treat these patients.

Several of the pharmacists also discussed the importance of a healthy lifestyle in a health pregnancy. Pharmacist I thought that pharmacists should make sure that women understand the importance of prenatal care. She added that women with chronic diseases needed to have an appropriate diet. Pharmacist J took this idea further by saying that pharmacists could encourage women in childbearing years to stay healthy by exercising regularly, having proper nutrition, sleeping well, and giving up alcohol and nicotine. He recommended that pregnant women as few medicines as they could. Pharmacist B agreed with this and added that pharmacists should provide extra support for these patients. Pharmacists L and M both focused on the importance of taking folic acid and prenatal vitamins during pregnancy. Pharmacist L stated that pharmacists should talk to patients about family planning and nutrition. Since folic acid is especially important in the first eight weeks of pregnancy, he recommended that pharmacists stock affordable folic acid so that patients would be more likely to take it. He also recommended educating patients on how to read nutrition labels and how to be healthy on a tight budget.

Pharmacist K was the only pharmacist who did not respond to this question.

7. Pharmacists B, C, G, H, and J had not heard of population health. Pharmacists D, K and M knew a little about population health. Pharmacists A, E, F, I, and L had all heard of population health. Pharmacists A and B discussed how groups could be beneficial for improving the health of the population. Pharmacist A maintained that treatment still needed to be one on one, but groups could reinforce individual therapy. Pharmacist B suggested that pharmacists could hold group classes on important topics for the population like tobacco cessation, nutrition and supplement awareness. Pharmacists B and M both said that pharmacists should strive to dispel misinformation in the community. Pharmacist M focused on how pharmacists should be proactive about interacting with patients and make sure that patients understand their medications.

Pharmacists C, D, E, and L all said that population health involved looking at health trends in the population they served to determine the best ways to treat their patients. Pharmacist L was in favor of treating groups and analyzing their outcomes to produce the best treatment protocols over time. Pharmacist E recommended putting patients into different categories based on disease state and treating based on those categories. Pharmacist D used geographic area to identify health needs in a population. She also discussed how community health centers are helping patients who would otherwise fall through the cracks, and referenced grants, programs, and research that are working together to improve population. Pharmacist C focused on environmental factors for disease and how changing these factors can lessen the prevalence of disease in a population.

Pharmacists F, G, and I focused on how using community resources effectively can improve population health. Pharmacist F spoke about how health departments can raise

awareness of affected populations. She also supported reaching out to medically underserved communities as a group to improve access for patients. Pharmacist G agreed and added that there were some church organizations for prenatal care that used principles of population health. Pharmacist I thought that pharmacists should be well informed about common heath issues in the population they served and address their services to these issues.

Pharmacist H stressed the importance of the pharmacist's point of view in providing care for patients. However, Pharmacist K reiterated how chain community pharmacies have little time for patient interactions. Pharmacist J did not answer the second part of this question.

8. Most of the pharmacists agreed that raising awareness for health issues and improving communication between pharmacists and members of the community was important for improving prenatal and postnatal pharmaceutical care.

Pharmacists B, D, G, H, K, and M agreed that educating women in a group setting can help outcomes by spreading information to many people instead of just one. Pharmacist B claimed that classes can also serve as a support group, especially when patients are trying to quit smoking. Pharmacist D urged pharmacists to look into partnering with WIC, Medicaid, and other organization to provide classes on community health issues. Pharmacists G and M agreed that educating women could have a snowball effect in the community with women sharing their knowledge with others in similar situations. Pharmacist K said that health professionals should look into more venues for providing group educations, as well as partnering with doctors, nurses and nutritionists to provide prenatal care.

Pharmacists C, E, and F highlighted how pharmacists need to be aware of community issues to effectively counsel patients. They all agreed that pharmacists should target care for

pregnant women by focusing on specific health issues they may face as a population. They also said that pharmacists should be sure to answer patient questions and ask themselves how their pharmacy could improve community health.

Pharmacists J, and L focused on how pharmacists could use population health concepts to improve individual care. Pharmacist J thought that prescribers and pharmacists should be educated on recommendations for care, especially concerning prenatal vitamins. Pharmacist J also said that knowing the health trends of the population could give pharmacists insight into how to treat individual patients. He also stressed the importance of having a full medical profile on patients to provide the best treatment. Pharmacist L focused on educating individual patients to their level. He discussed the importance of having wellness and nutrition programs for prenatal care as well as providing education on family planning. He said not to assume that the patients understand the terms associated with their disease, and to take care to explain things in easy to understand terms. He recommended asking patients about their disease states to make sure that they understand their conditions. He stressed educating patients to their education level. He also discussed how lack of provider status for pharmacists means that pharmacists are not paid for patient consultation. This means that pharmacies only make money by filling prescriptions, which is driving down the time for patient interactions. Pharmacist A did not respond to this question.

9. Pharmacists B, C, F, G, H, J and M all thought that pharmacists should communicate more with physicians to get a clear profile of each patient. Clear communication will also help pharmacists counsel patients on medication adherence. Pharmacists B and C agreed that working with the physicians to identify needs and find solutions could improve patient care. Pharmacist G agreed with this and added that pharmacists must be vigilant to make sure that

all prescriptions are safe and necessary for each patient. Pharmacist M referred to this idea as the pharmacists being the bridge between physician instructions and patient interpretation.

Some other pharmacists focused on improving patient and pharmacist interactions to improve prenatal and postnatal care. Pharmacists C, E, and G all said that pharmacists should emphasize adherence to patient treatment plans to improve prenatal and postnatal healthcare. Pharmacists A, C, F, and K all focused on patient education. Pharmacists A and K said that pharmacists should review prescription medications, herbal supplements, and over the counter medications for pre and post-natal care.

Pharmacists B, G, and L said that listening to patients and paying attention to their needs was the best way to provide prenatal and postnatal care. Pharmacist B recommended asking patients about their struggles and then looking into options to help each patient. Pharmacist L also advocated asking women how they felt post-partum and also watching for signs of post-partum depression.

Pharmacists I and J agreed that patients should have a patient centered medical home that consists of a team of healthcare professionals working together to provide care. Pharmacist I said that pharmacists should inform other healthcare providers about the services they can provide to patients. Pharmacist J said that pharmacists in the same office as other healthcare providers could give advice on nutrition and exercise to patients. She said that since pharmacists were not recognized as healthcare providers, it was difficult to get reimbursements for patient counseling, which could discourage counseling.

10. Pharmacists C, F, G, and H agreed that the best place for a women to receive prenatal care was somewhere accessible where she feels comfortable. Pharmacist C reflected that prenatal care can be difficult if providers are far away from patients. Pharmacist F said that

the best setting depends on what the patient has access to, and where the patient trusts the providers. Pharmacist G proposed that some women may benefit from home visits. He also thought that places providing prenatal care should have a more comfortable atmosphere to put patients at ease. Pharmacist H agreed and said that patients usually see pharmacists first to fill their prescriptions.

Pharmacists B, D, and E all agreed that prenatal care was best provided at a doctor's office. Pharmacist B added that community pharmacists were well equipped to answer questions about postnatal care. Pharmacist D said that some community health centers offer programs for high risk pregnancies and can offer referrals for patients. She recommended developing a protocol for treating these patients.

Pharmacists A and M agreed that if pharmaceutical care should be given in a clinical pharmacy setting. Since chain retail pharmacies are not designed for counseling, lack of privacy can be an issue.

Pharmacist I thought that any setting was good for providing prenatal care, as long as everyone was communicating with each other. If the patient has chronic conditions, then a high risk OB/GYN should be part of the healthcare team.

Pharmacist L thought that some prenatal care could be given in a group setting, since a group may provide reinforcement for care. He also supported healthcare teams to treat pregnant women with chronic diseases. He proposed a team made of a high risk OB/GYN, pharmacist, nutritionist, and nurse educator to best treat these patients.

Pharmacist J thought that prenatal care should be given by the provider with the patient's full medical history.

Pharmacist K maintained that one on one interventions were best for providing prenatal care.

11. Pharmacists A, E, F, G, H, I, L, and M agreed that lack of patient education was a major gap in prenatal and post-natal care. These pharmacists agreed that pharmacists should be proactive in educating women on their medications and potential side effects. Pharmacist E and G said that many women lack a reliable source of information about medication safety during pregnancy and that pharmacists should step up to inform patients about this. Pharmacists F and L suggested that women schedule a follow-up appointment with the pharmacy to go over medications and side effects. Pharmacist H said that pharmacists need to advertise their services to the population more effectively to improve patient outcomes. Pharmacist M suggested that pharmacists have a list of medicines that are safe during pregnancy to give to women who are unsure.

Pharmacists B, C, D, and J did not see a clear role for pharmacists in providing prenatal or post-natal care. Pharmacist B thought that women differed in their willingness to seek out prenatal care. Pharmacist D echoed this idea by saying that many women got lost in the system since providers see so many patients. Pharmacist C thought that pharmacists were better suited to provide preventative care like immunizations instead of being directly involved with prenatal care. Pharmacist J said that pharmacists and providers did not usually monitor postnatal patients. She thought that pharmacists could get more involved in postnatal care by training a pharmacist to care for women with gestational diabetes.

Pharmacists G, J, and K observed that post-partum depression was often overlooked when providing postnatal care. They recommended monitoring women on antidepressants to make sure that the medicines were not being transmitted through breastmilk. They also said that women on antidepressants should be monitored for hypertension. Pharmacists G and K said that hormone levels should be monitored in women to look for signs of post-partum

depression. Pharmacist K thought that hormone therapy could possibly ease post-partum depression with fewer side effects than traditional antidepressants.

Pharmacist L thought that food deserts and lack of access to nutritious food was a major health concern.

12. Pharmacists A, B, C, D, E, F, H, I, K, L, and M all recommended open lines of communication between pharmacists and non-pharmacists to improve working relations. Pharmacists A and I encouraged pharmacists to let other professionals know about their role in care with over the counter drugs and herbal products. Pharmacist A also stressed the importance of the pharmacists working with lactation consultants to make sure that breastfeeding is safe for mothers. Pharmacist B supported team based healthcare and recommended that pharmacists have an open conversation with their teammates about each member's strengths and scopes of practice. She said that it was important for teammates to collaborate and not compete in healthcare. Pharmacists C, D, E, H, L, and M all advocated for teammates to get to know pharmacists so that they can better work together. They highlighted that pharmacists offer services like immunizations and medication therapy management which can benefit patients. Pharmacist M added that pharmacists should be more proactive in educating patients on their medications.

Pharmacists G, I, and J all thought that pharmacists should lobby for more continuing education offered on maternal pharmaceutical care.