An Investigation of Women’s Experiences Seeking Pregnancy-Related Nutrition Information in Ontario, with an Emphasis on Online Resources

by

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ABSTRACT

AN INVESTIGATION OF WOMEN’S EXPERIENCES SEEKING PREGNANCY-RELATED NUTRITION INFORMATION IN ONTARIO, WITH AN EMPHASIS ON ONLINE RESOURCES

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This thesis investigates women’s information-seeking behaviours regarding nutrition during pregnancy and describes their experiences seeking this information online. A total of 97 pregnant women completed an online survey and six of these women participated in one-on-one semi-structured telephone interviews. The surveys were analysed using descriptive statistics and the interviews using thematic analysis. Prenatal nutrition information was most commonly sought online during the first trimester of pregnancy. Convenience was a major motivator for seeking information online. Positive changes were made to women’s diets after reading nutrition information online, however the participants indicted a lack of trust in online sources and seeking nutrition information online was sometimes related to feelings of frustration, confusion and worry. Nutritional support from health care providers is still desirable but is currently not meeting women’s needs. Suggestions are made to improve online sources of prenatal nutrition information and increase provision of prenatal nutrition education by health professionals.
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List of Abbreviations and Acronyms

AHA: American Heart Association
AHEI-P: Alternate Healthy Eating Index for Pregnancy
BMI: Body mass index
CI: Confidence interval
CPNP: Canada Prenatal Nutrition Program
CRH: Corticotropin-releasing hormone
DNA: Deoxyribonucleic acid
DQI-P: Diet Quality Index for Pregnancy
EWCFG: Eating Well with Canada’s Food Guide
FFQ: Food frequency questionnaire
GDM: Gestational diabetes mellitus
GWG: Gestational weight gain
HDL: High-density lipoprotein
HEI: Healthy Eating Index
IOM: Institute of Medicine
LBW: Low birthweight
LDL: Low-density lipoprotein
LGA: Large for Gestational Age
OC: Obstetric cholestasis
OR: Odds ratio
PPWR: Postpartum weight retention
RCT: Randomized controlled trial
REB: Research Ethics Board
RR: Relative risk
SAM: Suitability Assessment of Materials
SGA: Small for gestational age
SMOG: Simple Measure of Gobbledygook
SORT-R: Slosson Oral Reading Test-Revised
Chapter 1: Introduction & Objectives

Background

Poor nutrition during pregnancy is associated with a variety of negative health outcomes for both the mother and her baby, including gestational diabetes mellitus (GDM), pre-eclampsia, cardiovascular problems, preterm birth, large for gestational age babies (LGA), small for gestational age babies (SGA), poor cognitive and motor development, and even infant death (Bergen et al., 2012b; Dibley, Titaley, d'Este, & Agho, 2012; Eva Gesteiro, Bastida, Rodríguez Bernal, & Sánchez-Muniz, 2015; He et al., 2015; Imdad & Bhutta, 2012; Kim et al., 2012; Mireku et al., 2015; Olsen et al., 2007). It is crucial that pregnant women receive adequate amounts of micronutrients, especially folic acid, iron, and calcium, as well as an adequate amount of energy and macronutrients to prevent these adverse outcomes. Certain dietary patterns, such as the Mediterranean diet, are also associated with maternal and fetal outcomes, showing the importance of an overall healthy diet (Chatzi et al., 2012; Timmermans et al., 2012).

Maternal diet is also linked to gestational weight gain (GWG), which significantly impacts maternal and fetal health. High caloric intake, milk consumption, consumption of sweets, and binge eating are all correlated with excessive weight gain during pregnancy (Blumfield, Schreurs, et al., 2015; Olafsdottir, Skuladottir, Thorsdottir, Hauksson, & Steingrimsdottir, 2006; Park et al., 2015; Renault et al., 2015), which is associated with adverse outcomes for both the mother and child. These can be short-term effects, such as birth asphyxia in the infant (Tian et al., 2016) and GDM or high blood pressure (eclampsia) for the mother (Brunner et al., 2015; Fraser et al., 2011; Walter et al., 2015). The risk of health problems may be increased later in life as well. Excessive GWG has shown an association with increased blood pressure, insulin resistance, serum insulin, blood glucose, HbA1c levels, and lipid levels, and
decreased HDL-cholesterol and Apolipoprotein A1 levels in children aged two to nine years old, which are all metabolic risk factors (Dello Russo et al., 2013; Fraser et al., 2010). Mothers who gain excessive weight during pregnancy are also more likely to retain this weight for one or more years after delivery (Ashley-Martin & Woolcott, 2014). Inadequate GWG is associated with adverse outcomes as well, the most common being preterm birth and low birth weight (Han, Mulla, Beyene, Liao, & McDonald, 2011).

Studies from Canada and the U.S. show that the diet quality of pregnant women, on average, is low and there is significant room for improvement. A study of pregnant women in Alberta showed that 21% of women were consuming diets considered to have a “good” Healthy Eating Index, while the other 79% needed improvement (Pick, Edwards, Moreau, & Ryan, 2005). A study in North Dakota found that only 1.1% of pregnant women consumed diets of “good” quality, as rated by a diet quality index for pregnancy, while the majority (61.2%) needed improvement, and many of the women’s diets (37.7%) were considered “poor” (Watts, Rockett, Baer, Leppert, & Colditz, 2007). Pregnant women in Ontario are also not meeting the recommended number of food group servings, with particularly low consumption of grain products and fruits and vegetables (Fowler, Evers, & Campbell, 2012). Moreover, Canadian women are not meeting the GWG recommendations set out by Health Canada, with approximately half the women in each study gaining excessive weight during pregnancy and a significant proportion gaining below the recommendations (Begum, Colman, McCargar, & Bell, 2012; Cohen & Koski, 2013; Kowal, Kuk, & Tamim, 2012).

The education provided by health care professionals in Canada on prenatal nutrition and GWG also appears to be lacking, and is not well documented. Approximately 19% of women in an Albertan study reported that they did not receive any education from their health care
providers on consuming a healthy diet during their pregnancy (White, Fraser-Lee, Tough, & Newburn-Cook, 2006). For those who did, the type of information provided was not assessed. A larger proportion of women from this study (35.8%) did not receive any education on GWG. A study in Hamilton, Ontario found that even less women (51.3%) were provided with advice about GWG from their health care providers (McDonald et al., 2011). Since health professionals do not always provide enough information, many women turn to other sources such as the internet, books, pamphlets, friends and family (Huberty, Dinkel, Beets, & Coleman, 2013; Song, West, Lundy, & Smith Dahmen, 2012).

Rationale

Pregnancy has been identified as a time when women seek more information on nutrition, and the type and amount of sources they seek vary based on a number of factors, including whether they feel like a mother or not, their stage of pregnancy, and their socioeconomic status (Shieh, McDaniel, & Ke, 2009; Szwajcer, Hiddink, Koelen, & van Woerkum, 2005; Szwajcer, Hiddink, Maas, Koelen, & van Woerkum, 2008). Some in-depth studies on information seeking behaviours of pregnant women have been conducted in the Netherlands (Szwajcer et al., 2005; Szwajcer et al., 2008), however there are no studies to-date with pregnant women in Canada. The information seeking behaviours of Canadian women may be different than that of Dutch women, since it is influenced by factors such as available resources and economic status. It is important that we ask Canadian women directly about their experiences seeking prenatal nutrition information to better understand which sources they like to use and when they are looking for this information.

Written educational materials are an important source for information on prenatal nutrition. The readability, design, and content of written materials all affect what consumers will
get out of reading them. Using behaviour change theory and cognitive psychology theory has been shown to increase consumers’ understanding of health messages (Bull, Holt, Kreuter, Clark, & Scharff, 2001; Whittingham, Ruiter, Castermans, Huiberts, & Kok, 2008), and tailoring materials to the target population has been shown to promote behaviour change (Bull et al., 2001; Macario, Emmons, Sorensen, Hunt, & Rudd, 1998). While the goal of most educational material is to change consumers’ thinking and behaviour, there is little else in the literature about which components of materials are effective at creating these changes.

Since good nutrition during pregnancy is vital for the health of the mother and baby, there is a need to gain a better understanding of where pregnant women look for nutrition information, when they are accessing this information, and what their experiences with these sources of information are like. Specifically, we need to know how well pregnant women are understanding the information that they read, and if reading the information leads to changes in their emotions, thinking, and behaviour. This knowledge can then be used to create more effective resources to promote good dietary practices among Canadian pregnant women.

The overall goal and objectives of this research study will be outlined below, followed by a review of the relevant literature. Then the methods used to conduct this study will be explained and the results will be presented, along with a discussion of the results. Finally, some recommendations are made based on the findings of this research and directions for future research are identified.
**Overall Goal and Objectives of Research**

The goal of this research was to gain a better understanding of Ontarian women’s experiences seeking pregnancy-related nutrition information, particularly on the internet.

There were five objectives for this research study. The objectives align with the research questions, found in Appendix A, and are as follows:

1. Identify which sources pregnant women in Ontario are using to find pregnancy-related nutrition information.

2. Identify when pregnant women in Ontario are accessing sources of pregnancy-related nutrition information.

3. Explore the experiences of primiparous pregnant women in Ontario using internet sources of pregnancy-related nutrition information. Describe how, when and why women are accessing internet sources of information; how well they understand the information they read; how they feel when reading this information; how this information changes their thinking and behaviour; and what components of this information help promote understanding, decision-making, and behaviour change.

4. Explore whether primiparous pregnant women in Ontario feel that internet sources of pregnancy-related nutrition information are meeting their needs.

5. Explore possible ways that primiparous pregnant women in Ontario believe internet sources of pregnancy-related nutrition information could be improved.
Chapter 2: Literature Review

Nutrition plays a vital role in the proper development of a baby, from preconception right through to the infant’s birth. Research on nutritional status during pregnancy has focused on either individual nutrients or overall dietary patterns. Research has shown that nutrients of particular importance during pregnancy include micronutrients such as folic acid, iron, and calcium, along with the macronutrients.

Dietary Recommendations for Pregnancy

Health Canada has made a few dietary recommendations to pregnant women, which are based on scientific literature. They recommend that pregnant women take a multivitamin daily that contains 0.4mg of folic acid and 16-20mg of iron. It is also recommended that women consume a minimum of 150g of cooked fish per week, since fish is low in unhealthy fats and high in omega-3 fatty acids. Finally, women are advised to follow the guidelines set out in Eating Well with Canada’s Food Guide (EWCFG), which recommends that pregnant women consume the number of food group servings indicated for their age group, plus an additional two or three servings daily (Health Canada, 2011).

Effect of Individual Nutrients during Pregnancy

Micronutrients

Folic Acid

The first study to provide strong evidence that folic acid could prevent neural tube defects was conducted by the Vitamin Study Research Group in 1991. This randomized, double-blind prevention trial found that folic acid supplements were 72% effective at preventing neural tube defects, while ruling out the potential protective effects of seven other vitamins. Since then, numerous studies have been conducted on the importance of prenatal folic acid intake, and a
number of meta-analyses have provided strong evidence that folic acid is protective against neural tube defects, congenital heart defects, and oral clefts (Atta et al., 2016; Badovinac, Werler, Williams, Kelsey, & Hayes, 2007; Blencowe, Cousens, Modell, & Lawn, 2010; Feng et al., 2015). Although it is well established that folic acid is required for proper neural tube development, the biological processes involved are still in question. The most widely proposed mechanism for the association of folic acid with neural tube defects is that a deficiency of folic acid disrupts the methylation pathway. Since folic acid is a critical component of the methylation cycle, a deficiency can result in unmethylated genes, leading to abnormal neural tube development (Shookhoff & Gallicano, 2010). In both mouse models and chick embryos, a disruption of the methylation cycle resulted in impaired neural tube closure (Afman, Blom, Drittij, Brouns, & van Straaten, 2005; Dunlevy, Burren, Chitty, Copp, & Greene, 2006; Dunlevy, Burren, Mills, et al., 2006).

In addition to its role in neural tube development, a recent study found that folate may also play a role in pre-eclampsia, premature birth, risk of SGA infants, and low placental and infant birth weight (Bergen et al., 2012a). When compared to mothers in the highest quintile for folate, mothers in the lowest quintile had an increased risk for pre-eclampsia (OR 2.1), an increased risk for premature birth (OR 2.2) and an increased risk of SGA infants (OR 1.9). As well, the placentas of mothers in the lowest quintile weighed an average of 26 grams less, and their infants weighed an average of 125 grams less at birth. Although the evidence for each of these associations was quite strong, folate status was determined from only one blood sample taken in early pregnancy, which may not be representative of the entire pregnancy. Another study on folate also found that women with low serum folate levels were more likely to have preterm births than those with high serum folate levels, but folate status was again only measured
once during early pregnancy (Kim et al., 2012). The associations found between folic acid and SGA, low placental and infant birth weight, and premature delivery may be explained by the effect of folate on placental vascular resistance. Bergen et al. (2012a) found that women with low folate status had higher uterine and umbilical artery resistance. High vascular resistance leads to decreased blood flow to the placenta and infant, thereby impairing development. The decreased blood flow through the placenta may also be a cause for preterm delivery (Misra, Hobel, & Sing, 2009).

Another way by which low folic acid levels may cause adverse pregnancy outcomes is through its effect on homocysteine. Low physiological levels of folate are linked to high levels of homocysteine and high doses of folic acid have been shown to reduce homocysteine concentrations, especially in women (Homocysteine Lowering Trialists’ Collaboration, 2005). Bergen et al (2012a) measured maternal homocysteine levels in their study along with folate, and found that high levels of homocysteine were associated with increased risk of SGA, and lower placental and infant birth weight. Furness et al. (2013) also found that high maternal homocysteine concentrations were associated with decreased fetal growth. It is thought that high concentrations of homocysteine can cause DNA damage in the mother, leading to intrauterine growth restriction, thus impairing growth of the developing fetus (Furness, Dekker, Hague, Khong, & Fenech, 2010; Furness et al., 2013). In addition, Kim et al (2012) measured serum homocysteine levels along with folate in their study, and reported higher levels of homocysteine in mothers with pre-eclampsia than those without. High concentrations of homocysteine likely cause dysfunction of endothelial cells, thereby increasing their rate of death (Lee et al., 2013; Xu, Neville, & Finkel, 2000). It is the dysfunction of endothelial cells that is thought to cause pre-eclampsia; damage to endothelial cells causes an increase in blood coagulation in the kidneys.
and placenta, leading to hypertension and proteinuria, the defining characteristics of pre-eclampsia (Gathiram & Moodley, 2016). The additional effects of high homocysteine levels caused by low physiological levels of folate are likely part of the reason for adverse pregnancy outcomes that are seen when maternal folate intake is suboptimal.

**Iron**

Inadequate iron intake during pregnancy has been investigated for its association with low birth weight and preterm birth. A randomized, double-blind control trial (Preziosi et al., 1997) found that women who were assigned to receive iron supplements during the last trimester of their pregnancies gave birth to significantly longer infants than the women who received the placebo. Similarly, Sekhavat, Davar, & Hosseinidezoki (2011) found that low hemoglobin levels in Iranian pregnant women were significantly associated with risk of low birth weight. Two additional studies conducted by the same researchers, one which used dietary recall and the other blood samples to measure iron status, found that low maternal iron status was associated with lower birth size and weight (Alwan et al., 2015; Alwan et al., 2011). Alwan et al (2015) suggest that low maternal iron status can lead to low birth weight due to the consequent low hemoglobin concentration, which results in an impaired delivery of oxygen to the placenta. It has also been suggested that low iron status can increase cortisol production in the fetus, which in turn inhibits growth (Allen, 2011).

Iron deficiency in pregnant women has also shown an association with preterm birth. A prospective study conducted in New Jersey showed that pregnant women with iron-deficiency anemia, compared to those without, were twice as likely to deliver preterm (Scholl, Hediger, Fischer, & Shearer, 1992). Similarly, in a study by Bánhidy, Ács, Puhó, and Czeizel (2011) Hungarian pregnant women who were not treated for iron deficiency anemia gave birth at a
significantly shorter gestational age than women who were treated with iron supplements. One explanation for the association of iron with preterm birth is that iron deficiency can cause stress in both the mother and the fetus, increasing the production of corticotropin-releasing hormone (CRH), which has previously been deemed a risk factor for preterm birth (Allen, 2001). An alternative hypothesis is that maternal iron deficiency can lead to increased risk of infections, which also increases production of CRH, leading to preterm delivery (Allen, 2001).

Maternal iron status may also affect mental development and motor function of the offspring. In a double-blind randomized control trial in China, children of mothers with iron-deficiency anemia had significantly lower mental development indexes at one year, 18 months, and two years of age than children of iron-sufficient mothers (Chang, Zeng, Brouwer, Kok, & Yan, 2013). An additional important finding in this study was that children of iron-deficient women who were treated with iron had similar mental development scores to children of iron-sufficient women, providing further evidence of the protective effects of iron supplementation. Mireku et al. (2015) investigated the relationship between maternal iron status, as measured by hemoglobin concentration, and the gross motor function of the infants. A quadratic relationship was found between maternal hemoglobin concentrations and the infants’ gross motor function at one year of age, meaning that both low and high concentrations of hemoglobin were associated with lower motor function in children. Hence, this study suggested that there is an optimal range of hemoglobin in pregnant women for proper motor development of their offspring. Since iron is a necessary nutrient for the development of the brain, it is possible that a deficiency of iron during prenatal development could result in impaired mental and motor function (Lozoff & Georgieff, 2006). The association of high hemoglobin concentrations and impaired motor function may be explained by the fact that high hemoglobin increases blood viscosity, resulting
in decreased blood flow to the fetus (Mireku et al., 2015), but this mechanism has yet to be tested.

**Combined Effect of Folic Acid and Iron**

Iron and folic acid may also be important in combination for infant survival. Dibley, Titaley, d'Este, and Agho (2012) found that consumption of prenatal supplements by Indonesian mothers containing both folic acid and iron reduced the risk of death in infants from birth to five years of age by 34%. The researchers also determined that there was a dose-response relationship between the amount of supplements taken and the risk of infant death. A total of 19 potential cofounders were controlled for in this study, which were based on an established framework for child survival. These included geographic location, tuberculosis and measles vaccination, maternal education, marital status, occupation of both parents, income status, maternal age, child gender, number of previous pregnancies and time between pregnancies, whether the pregnancy was planned, delivery complications, birth size and length of gestation, whether the child was breastfed or not, use of prenatal care, method of delivery, location of delivery, type of birth attendant used, the year the child was born, and the length of time between the delivery and the interview. By controlling for a large number of factors known to be related to infant mortality, the validity of the association between folic acid and iron-containing supplements with risk of infant death is strengthened.

**Calcium**

Another nutrient of importance to prenatal development is calcium. Calcium has been shown to decrease the risk of pre-eclampsia, and is related to both short-term and long-term effects on the offspring. A recent combined analysis of fifteen randomized controlled trials (RCTs) found that maternal calcium supplementation decreased the risk of pre-eclampsia in the
mothers by 52% (Imdad & Bhutta, 2012). A previous study by Belizán, Villar, Gonzalez, Campodonico and Bergel (1991) conducted a double-blind RCT to determine the effect of a two gram calcium supplement on gestational hypertension and pre-eclampsia in 1167 pregnant women. The women who received calcium supplements had a significantly lower incidence of both hypertension and pre-eclampsia. Furthermore, four perinatal deaths occurred in the placebo groups that were related to hypertension, while no deaths in the calcium group occurred in relation to hypertension. Moreover, Imdad and Bhutta (2012) found a significantly reduced risk of preterm birth and a significantly increased birth weight in children whose mothers received calcium supplements.

Maternal calcium intake may also have long-term effects on the offspring. A follow-up to the study by Belizán et al. (1991) took place with 591 of the children born to the mothers involved in the original study at 7 years of age (Belizan et al., 1997). The researchers found that systolic blood pressure was significantly lower and risk of high blood pressure was significantly decreased in children whose mothers received a calcium supplement during pregnancy. This effect was strongest in children with higher body mass index (BMI). A second follow-up study took place on 195 of the children when they were 12 years of age (Bergel, Gibbons, Rasines, Luetich, & Belizan, 2010). The aim of this follow-up study was to investigate the effects of maternal calcium intake on the prevalence of dental caries in the children, as measured by missing, decayed, or filled teeth. A 27% decrease in the risk of dental caries was found in children whose mothers received calcium during pregnancy.

While some associations of folate to pregnancy outcomes are still in question, it is clear that adequate maternal folate intake is essential for proper prenatal development. Folate certainly plays a key role in preventing neural tube defects, congenital heart defects, and oral clefts, and
may also be protective against low placental and infant birth weights, SGA infants, premature birth, and pre-eclampsia. Prenatal iron status also appears to be important for a healthy birth weight and protection against premature delivery. In addition, iron may affect the cognitive function and motor development of infants. Moreover, folic acid and iron in combination may be important for infant survival up to five years of age. Finally, calcium may reduce hypertensive disorders in pregnant women, hypertensive-related perinatal death, preterm birth, low-birth weight, high blood pressure in offspring, and dental caries in offspring. Thus, infant development and health relies heavily on adequate maternal intake of these micronutrients.

**Macronutrients**

**Protein**

Protein has been studied for its association with birth weight and may also be associated with risk of preterm birth and infant blood pressure. A study by Godfrey, Robinson, Barker, Osmond, and Cox (1996) found that a lower intake of dairy protein in late pregnancy was associated with a lower placental and birth weight. In contrast, Andreasyan et al. (2007) found a negative relationship between maternal protein intake and infant size, meanwhile the study by Watson and McDonald (2009) found that maternal protein intake above or below 17% of energy was associated with decreased birth weight. Moreover, a meta-analysis of eleven quasi RCTs and RCTs found a 31% reduction in the risk of SGA infants for mothers who consumed a diet with balanced protein-energy intake, defined as an intake of less than 25% of energy from protein (Imdad & Bhutta, 2011). This effect was even more apparent in undernourished women than women with adequate nutrition, suggesting that a limited intake of energy from protein could be beneficial when total energy intake is low.
In addition to birth weight, consumption of protein during pregnancy may be related to preterm birth. A case control study in India found that women who delivered preterm infants had significantly lower intakes of protein near the end of their pregnancies, as measured by an FFQ (Awasthi, Chauhan, Pandey, Singh, & Singh, 2015). More studies are required, however, to validate this relationship.

Finally, maternal protein intake may be associated with blood pressure of the offspring. Blumfield et al. (2015) conducted a prospective longitudinal study, during which they measured infant blood pressure a total of seven times up to four years of age. Infant blood pressure was the highest when maternal protein intake was at the lowest, suggesting that a higher intake of energy from protein may reduce child blood pressure.

Carbohydrates

Carbohydrate intake also appears to play a role in infant birth weight and length, blood pressure of offspring, body composition of offspring, and artery thickness in offspring. One study found that a high intake of carbohydrates in early pregnancy was associated with lower placental weight and infant birth weight (Godfrey et al., 1996). Another more recent study found that birth weight was highest when maternal intake of carbohydrates equalled 48% of energy and birth weight dropped with intakes either above or below this level, with the lowest birth weights found when energy from carbohydrates was highest (Watson & McDonald, 2009).

In their longitudinal study on blood pressure, Blumfield et al. (2015) also found that maternal carbohydrate intake may be associated with infant blood pressure. In contrast to protein, infant blood pressure was highest when maternal carbohydrate intake was the greatest, hence a lower proportion of energy from carbohydrates may be ideal.
Along with energy intake from carbohydrates, the quality of carbohydrates consumed may also be of great importance. One study found that pregnant women who consumed carbohydrates with low glycemic indexes and low glycemic loads had a better intake of micronutrients, which consequently influence fetal development (Goletzke, Buyken, Louie, Moses, & Brand-Miller, 2015). Horan et al. (2016) found an association between high glycemic index diets in the third trimester of pregnancy and increased fat composition of offspring, and Kizirian et al. (2016) found that high glycemic index diets in pregnancy were associated with higher birth weight and length, as well as thicker arterial walls in the offspring.

Furthermore, Whisner et al. (2015) found that although maternal sugar intake was not associated with increased birth weight, there was an association between high maternal sugar intake and increased abdominal subcutaneous fat in the offspring of adolescent females. Hence, both the amount and quality of carbohydrates consumed during pregnancy may influence infant development.

**Fat**

The percent energy consumed from fat during pregnancy may also impact birth outcomes, although studies focusing solely on fat intake are few in number. In the study by Watson and McDonald (2009) maternal fat intake above or below 35% was associated with decreased birth weight. Hence, both excessive and inadequate fat intake could result in a low birth weight infant.

As with carbohydrates, the type of fats consumed may also influence the outcomes seen. For example, a meta-analysis of nine studies found that interventions promoting consumption of omega-3 fatty acids were 58% effective at reducing the risk of early preterm delivery, and 17%
effective at reducing the risk of any preterm delivery (Kar, Wong, Rogozinska, & Thangaratinam, 2016).

Although studies on the effect of macronutrients on placental and birth weight have provided controversial findings, it appears that a balance between carbohydrates, fat, and protein may be the most important factor, and the differences found are likely due the type and quality of foods consumed within each category of macronutrients. More studies exploring the effect of dietary patterns containing different amounts and sources of fats, carbohydrates, and protein will be discussed next.

**Effect of Dietary Patterns during Pregnancy**

Although it is important to understand the effects of individual nutrients on prenatal development, the interaction of these nutrients and other components of the foods from which they are consumed are crucial factors to take into account. There is a growing amount of research on the effect of different dietary patterns on pregnancy and birth outcomes. Certain diets have been linked to risk of gestational diabetes, birth weight, risk of preterm birth, cardiovascular disease in offspring, offspring insulin resistance/sensitivity, and mother and offspring psychological and behavioural factors.

**Diet and Risk of Gestational Diabetes Mellitus (GDM)**

Overall, a healthier dietary pattern appears to be associated with decreased risk of developing GDM, although maternal diets are classified differently in each study. He et al. (2015) found that women with diets classified as the “vegetable pattern”, which included a variety of vegetables, fruits, nuts and cooking oils, had the lowest risk of GDM (RR = 0.79). Moreover, this effect was magnified among pregnant women who had a history of type 2 diabetes in their families (RR = 0.49). On the contrary, the women in this study with maternal
diets classified as the “sweets and seafood” pattern, characterized by a high intake of a variety of
seafoods, desserts and sugar-sweetened beverages and a low intake of vegetables and grain
products, had the highest risk of GDM (RR = 1.23).

Another study exploring the effect of diet on GDM classified the diets of pregnant
women into three separate categories, each with different unhealthy components (Shin, Lee, &
Song, 2015). The dietary patterns were classified as follows: pattern one was defined as high
intake of fruit juice, refined grains, fats and oils; pattern two as high intake of fat, nuts, seeds and
soybeans, and low intake of milk, cheese, fruits and vegetables; and pattern three as high intake
of organ meats and added sugars, and low intake of seafood, fruits and vegetables. Women with
high adherence to any of these diets had an increased risk for developing GDM when compared
to women with low adherence to these diets (OR = 4.9, 7.5, 22.3, respectively). This effect was
especially true for the third dietary pattern, perhaps due to the high intake of sugar and fat. The
authors explained that diets high in sugar and fat increase risk for obesity, which is a major risk
factor for GDM. High intakes of sugar may also lead to insulin resistance and increased blood
glucose levels, leading to development of GDM (Malik et al., 2010).

Finally, Tryggvadottir, Medek, Birgisdottir, Geirsson, and Gunnarsdottir (2016) found
that pregnant women with a “prudent” dietary pattern were less likely than women with low
adherence to this dietary pattern to develop GDM (OR = 0.44). The “prudent” diet was
characterized by high consumption of fruits, vegetables, vegetables oils, nuts, seeds, cereal,
pasta, eggs, seafood, tea, coffee, and cocoa powder, and low consumption of French fries and
soft drinks. The benefits of adhering to this dietary pattern were found for both normal weight
and overweight/obese women.
Due to the variation in dietary patterns identified in each of these studies, one type of diet cannot yet be identified as the most ideal for preventing GDM. This said, there are some consistent patterns that emerged across these studies; fruits and vegetables appear to be associated with decreased risk of GDM, and high intake of fats and refined sugars appear to be associated with increased risk for GDM.

**Diet and Offspring Birth Weight**

A few different types of dietary patterns have shown associations with infant birth weight, including the Mediterranean diet, high consumption of unhealthy snacks, and consumption of some specific foods. In recent years, the Mediterranean diet has been studied immensely for its relationship to many health outcomes. The Mediterranean diet is a diet consisting of mainly plant-based foods and is characterized by a high intake of fruits and vegetables, bread, potatoes, nuts, seeds and unsaturated oils, and low to moderate amounts of fish, poultry, and dairy products (American Heart Association, 2016). A prospective study by Timmermans et al. (2012) found that following a Mediterranean diet during pregnancy resulted in higher birth weight of offspring and higher placental weights. An FFQ was completed by 3207 pregnant women from Rotterdam, the Netherlands, during early pregnancy. Compared to those with low adherence to the Mediterranean diet, those with high adherence gave birth to offspring weighing 72 grams higher, on average, and their placentas weighed an average of 15 grams higher. Women with better adherence to the Mediterranean diet were also found to have higher folate concentrations and lower homocysteine concentrations. The high ratio of folate to homocysteine may help explain the better growth in these infants, as explained previously. A cohort study in Spain made similar findings pertaining to the Mediterranean diet and fetal growth. Chatzi et al. (2012) conducted FFQs with 2461 pregnant women and found that mothers
following a Mediterranean diet had a significantly decreased risk of delivering a child of low birth weight (RR = 0.5). Moreover, adherence to this diet was shown to increase birth length and weight in offspring of smoking mothers.

Maternal diets containing many unhealthy foods may also impact infant birth weight. A longitudinal study in Brazil compared food consumption patterns during the third trimester of pregnancy to infant birth weight (Coelho Nde, Cunha, Esteves, Lacerda, & Theme Filha, 2015). They discovered that pregnant adolescents who ate a diet consisting of many unhealthy snacks gave birth to significantly heavier babies (p = .04). Another study compared mothers who consumed a “junk food” diet, which was characterized by high consumption of fast food, soft drinks, processed meat and chips, to mothers with low consumption of these foods, while controlling for maternal age and weight both before and after pregnancy (Wen, Simpson, Rissel, & Baur, 2013). They found that the mothers classified as consuming a “junk food” diet had a significantly greater chance of giving birth to an infant weighing over four kilograms (OR = 2.78, 95% CI 1.10-7.14). This is an important finding as it eludes to the importance of a healthy maternal diet regardless of the mother’s weight status.

Certain foods have been shown to be associated with infant birth weight as well. A study on milk consumption of Danish women during pregnancy found that high milk intake was associated with a decreased risk of SGA births (OR = 0.51), but also with an increased risk of LGA births (OR = 1.59), while controlling for total energy intake of mothers (Olsen et al., 2007). Akbari, Mansourian and Kelishadi (2015) also studied the effect of diet on birth weight in terms of the intake of certain groups of food in Iran. It was found that maternal consumption of fruits and vegetables as well as protein, shrimp and fish significantly reduced the risk of having low birth weight offspring (p <.05). Evidently, a mother’s diet can have a large impact on the weight
of her developing baby, from her overall dietary pattern to consumption of specific foods and food groups.

**Diet and Risk of Preterm Birth**

The risk of preterm birth may be affected by some of the same components of the maternal diet that are associated with infant birth weight, including the Mediterranean dietary pattern and consumption of milk, fruits, vegetables, protein, shrimp, and fish. Saunders et al. (2014) conducted a cohort study with 728 overweight and obese pregnant women from a French Caribbean Island in which they found that those who adhered to a Mediterranean diet during pregnancy had a reduced risk of preterm birth (OR = 0.7, 95% CI: 0.6-0.9). The study by Akbari et al. (2015) examined the effect of diet on preterm birth along with birth weight and found that the same foods (fruits, vegetables, protein, shrimp and fish) as well as maternal consumption of dairy products significantly reduced the risk of preterm birth (p < .05). Another study assessed the effect of 3143 pregnant women’s diets from the U.S. during the second trimester of pregnancy on the risk of preterm birth (Martin, Sotres-Alvarez, & Siega-Riz, 2015). This study found that pregnant women with a dietary pattern characterized by red meat, processed meat, fried chicken and fish, cornbread, hushpuppies, eggs, biscuits, gravy, homo milk, collard greens, coleslaw/cabbage, and sugary drinks had an increased chance of preterm delivery (OR = 1.55, 95% CI: 1.07 – 2.24) when compared to those with a diet characterized by vegetables, fruit, high fibre, fortified cereals, whole wheat bread, low-fat dairy, and non-fried fish and chicken. The Mediterranean diet and other healthy food consumption patterns may therefore reduce the risk of delivering a preterm infant.
Diet and Risk of Cardiovascular Disease in Offspring

Many studies have shown that the Mediterranean diet can reduce the risk of various types of cardiovascular diseases in those who follow it (Dontas, Zerefos, Panagiotakos, Vlachou, & Valis, 2007). It is also possible that mothers who follow this dietary pattern during pregnancy can reduce their offspring’s risk of developing cardiovascular diseases. A cross-sectional study with 35 women from Mérida, Spain discovered that babies born to mothers following a Mediterranean diet had lower LDL cholesterol, apolipoprotein B, and apolipoprotein A1 to B ratio (p < .05), which are all indicators of decreased cardiovascular disease risk (Eva Gesteiro et al., 2015). A follow-up study would help determine if lower levels of these markers at birth reduces the risk of these children developing cardiovascular diseases later in life.

Diet and Insulin Resistance/Sensitivity in Offspring

The maternal diet has also been studied for its relation to insulin resistance and sensitivity in offspring. Gesteiro, Bastida, Bernal, and Sanchez-Muniz (2012) assessed maternal diet quality by assigning 35 mothers from Mérida, Spain a Healthy Eating Index (HEI) score during their first trimester of pregnancy. Mothers with low HEI scores consumed more total fats, saturated fats, and cholesterol, and consumed less carbohydrates and fibre than mothers assigned high HEI scores. The researchers found that offspring of mothers with low HEI scores had more insulin resistance and higher concentrations of insulin and glucose in their cord blood at birth (p < .05). Mothers with low adherence to the Mediterranean diet also had higher insulin resistance and cord blood concentrations of insulin and glucose at the time of delivery than those with high adherence to the Mediterranean diet (p < .05). Again, more follow-up studies are needed to determine the impact this could have on development of disease later in life, such as diabetes and metabolic syndrome.
Diet and Psychological/Behavioural Factors

While the maternal diet has mostly been researched for its effect on both the mother and child’s physical health, it may also affect their cognitive and behavioural functioning. A study was conducted with 7814 pairs of mother and children from South West England, which measured maternal diet using an FFQ at 32 weeks gestation (Pina-Camacho, Jensen, Gaysina, & Barker, 2015). An unhealthy maternal diet was defined by high consumption of processed foods and confectionaries. The researchers found an association between depressive symptoms in pregnant women and an unhealthy maternal diet (p < .001), although the direction of this association could not be determined as it was a prospective study. Moreover, an unhealthy maternal diet was found to be associated with more abnormal emotional and behavioural development in the offspring at two, four, and seven years old (p < .001). Hence, a mother’s diet during pregnancy may affect her own psychological functioning as well as the emotional and behavioural development of her offspring.

Despite the limited amount of research focusing on maternal dietary patterns, there is a clear association between an overall healthier diet and desirable health outcomes for both the mother and child. Further research would help to pinpoint which food consumption patterns should be recommended to pregnant women for the best results.

In summary, individual nutrients such as folate, iron, and calcium play very important and specific roles in prenatal development. A mother’s overall dietary pattern may also be paramount to proper infant development and for prevention of adverse pregnancy outcomes, however, further research is required in this area to more thoroughly describe links between maternal dietary patterns and the mother and infant’s health.
**Weight Gain during Pregnancy**

**Gestational Weight Gain Recommendations in Canada**

In Canada, there are guidelines that have been set for weight gain during pregnancy, which differ based on a woman’s pre-pregnancy BMI and the number of fetuses she is supporting. Health Canada recommends that a pregnant woman with a normal BMI (18.5 – 24.9) and a singleton pregnancy gains between 25 and 35 pounds during her pregnancy (Health Canada, 2014a). A woman with an underweight BMI (< 18.5) is recommended to gain more weight during her pregnancy, at a total of 28 to 40 pounds. On the other hand, a woman who is classified as overweight (BMI of 25.0 – 29.9) or obese (BMI > 30.0) is recommended to gain less weight, at a total of 15 to 25 pounds and 11 to 20 pounds, respectively. Women are also expected to gain most of the weight during the second and third trimester (approximately 0.5 to 1.0 pounds per week), while only gaining approximately 1.1 to 4.4 pounds in total during the first trimester. Further, women who are pregnant with twins or multiple fetuses are advised to gain more weight, although there are no established guidelines for underweight women carrying twins, or for women carrying more than two fetuses.

**The Maternal Diet and Gestational Weight Gain**

Although weight gain during pregnancy can vary from person to person, associations have been found between maternal dietary patterns and the amount of gestational weight gained. Olafsdottir, Skuladottir, Thorsdottir, Hauksson and Steingrimsdottir (2006) conducted a study with pregnant women in Iceland and found that the amount of food consumed during pregnancy as well as the amount of milk drank were positively related to maternal weight gain. The women in the study who gained excessive weight during pregnancy consumed significantly more food and drank more milk than women who gained optimal weight, and women who gained optimal
weight ate more food and drank more milk than those who gained inadequate weight during pregnancy.

In addition, women with excessive GWG in the study by Olafsdottir et al. (2006) were more likely to consume sweets during their pregnancy. This same association was found in obese pregnant women in Denmark in a study by Renault et al. (2015). In this randomized control trial, the women who were assigned to a reduced calorie, Mediterranean diet had significantly lower intakes of added sugar and gained significantly less weight. Intake of added sugar in the control group proved to be independently associated with gestational weight gain. The women who consumed more than two sweets per day gained an average of 5.4 kilograms more than women who consumed less than one sweet per week.

A study in Australia also found that portion sizes were related to weight gain during pregnancy (Blumfield, Schreurs, et al., 2015). The women in this study filled out two FFQs, one during the second trimester and one during the third trimester, which asked about their dietary intake during the previous three months. A positive association was found between portion size and GWG in women who were overweight and obese prior to pregnancy, and in women with high socio-economic status.

In addition, binge eating during pregnancy may be associated with excessive GWG. A prospective cohort study in Ontario asked women about their binge eating behaviour during the third trimester of their pregnancy through the use of a questionnaire (Park et al., 2015). It was found that women who reported more binge eating were significantly more likely to gain excessive weight than women with minimal binge eating (adjusted RR = 6.51). These findings suggest that the maternal diet, including total energy consumption, sweet intake, portion size and binge eating behaviour, is an important modifiable factor that can aid in the regulation of GWG.
**Excessive Gestational Weight Gain**

When a pregnant woman gains weight above the guidelines discussed above, it is considered excessive GWG. Excessive GWG during pregnancy has been shown to have both short-term and long-term effects on the offspring as well as the mother.

**Short-term Effects on the Offspring**

When a pregnant woman gains excessive weight during her pregnancy it can have immediate consequences for her infant, including increased risk of preterm birth, large-for-gestational age (LGA) infants, macrosomia, and caesarean delivery. A cross-sectional study by Dzakpasu et al. (2015) used a sample of 5591 Canadian women who were enrolled in the Canadian Maternity Experiences Study to determine if there was a relationship between excessive GWG and adverse birth outcomes, namely preterm birth, SGA and LGA births. Among the women who gained excess weight during pregnancy, there was a higher risk of preterm birth and LGA births (OR = 1.45 and 1.34, respectively) as compared to women who gained adequate amounts of weight. A study looking at women and children that were part of the Eden mother-child cohort in France also found a relationship between excessive GWG and LGA infants (Heude et al., 2012). When mothers with hypertension or GDM were excluded from analysis, excessive GWG was associated with an increased risk of LGA infants (OR = 2.08).

Tian et al. (2016) conducted a meta-analysis to determine the association between excessive GWG and the risk of macrosomia in the newborn infant. The combined analysis of 15 observational studies showed that excessive GWG is related to an increased risk of macrosomia (OR = 2.35). Consequently, macrosomic infants have been shown to be at higher risk of still birth, birth asphyxia (which can lead to brain damage), perinatal mortality, birth injuries, meconium aspiration syndrome (which usually causes respiratory problems), sudden infant death
syndrome, and are more likely to require caesarean delivery (Zhang, Decker, Platt, & Kramer, 2008). Dzakpasu et al. (2014) also found a connection between excess GWG and caesarean deliveries in their sample of Canadian women. The rate of caesarean delivery in women who gained above the recommendations was increased among nulliparous women (OR = 1.35), and the rate was increased more substantially among parous women without a previous caesarean (OR = 1.75).

Evidently, excessive GWG can have serious short-term effects on offspring, from increased birth weight and size to preterm birth to increased chance of caesarean delivery.

**Long-term Effects on the Offspring**

Beyond the immediate adverse effects of excessive GWG, gaining excess weight during pregnancy may also have long-term consequences on the offspring. Several studies have provided evidence that excessive gestational weight gain (GWG) is associated with an increased risk of childhood overweight/obesity in the offspring. A meta-analysis was conducted on this topic which included 12 cohort studies from four different countries (Tie et al., 2014). The combined analysis, which included children from 2-18 years old, found that children of mothers with excessive GWG were more likely to be overweight or obese (OR = 1.21) than children of mothers with optimal GWG. Another meta-analysis of 10 prospective studies and 2 retrospective studies studied the relationship of excessive GWG to the weight of the offspring, stratified into three different age categories: less than five years, five to 18 years, and over 18 years (Mamun, Mannan, & Doi, 2014). Similar to the previous meta-analysis, they found that offspring born to mothers with excessive GWG were more likely to be overweight or obese (RR = 1.40), and this risk was similar for all three age categories.
Beyond the effects of GWG on childhood weight status, excessive GWG may be associated with an increased presence of metabolic risk factors in offspring. Dello Russo et al. (2013) measured blood pressure, insulin resistance, serum insulin, blood glucose, HbA1c levels, and lipid levels in a cohort of 12775 children aged two to nine years from eight different countries in Europe. All measures were associated with GWG after the first analysis, however after controlling for the BMI of the offspring only HbA1c was associated with GWG. HbA1c was significantly higher in offspring of mothers with excessive GWG (4.69%) than those of mothers with adequate GWG (4.63%) and low GWG (4.60%). Fraser et al. (2010) also investigated the association of GWG with metabolic factors and blood pressure of offspring at nine years old. GWG in the second and third trimester of pregnancy was associated with increased interleukin-6 and triglyceride levels as well as decreased HDL-cholesterol and apolipoprotein A1 levels. Similar to the previous study, however, these associations failed to exist after controlling for the fat mass of the offspring. These findings indicate that excessive GWG may not be directly associated with metabolic risk factors in offspring, but may increase the presence of some risk factors through its direct effect on the body mass of offspring.

**Short-term Effects on the Mother**

In addition to the effects of excessive GWG on the offspring, excessive GWG during pregnancy may be associated with increased risk of hypertensive disorders of pregnancy, an increased risk of the mother developing GDM and more postpartum weight retention (PPWR) soon after pregnancy. A prospective cohort study conducted in the Caribbean measured the risk of hypertension in pregnancy and preeclampsia based on GWG (Chasan-Taber et al., 2016). Compared to women who gained recommended amounts of weight, women with excessive GWG had an increased risk of hypertension (OR = 3.82) as well as preeclampsia (OR = 2.94). A
dose-response relationship was also found, whereby for every 0.45-pound increase in weight per week, the odds of hypertension increased by 1.74, and the odds of preeclampsia increased by 1.86. Macdonald-Wallis, Tilling, Fraser, Nelson and Lawlor (2013) also found a dose-response relationship between GWG and hypertensive disorders of pregnancy. This study used data from 12,522 women involved in the Avon Longitudinal Study of Parents and Children, whose weight was measured a median of 12 times and blood pressure was measured a median of 14 times during pregnancy. For every 200-gram increase in GWG per week the odds of hypertension increased by 1.26, and the odds of preeclampsia increased by 1.31. Furthermore, the risk of hypertensive disorders in pregnancy may be increased in obese women with excessive GWG. Barton, Joy, Rhea, Sibai A. and Sibai B. (2015) studied data from 27,898 obese pregnant women from across the United States. From this data, it was found that obese women who gained excessive GWG were significantly more likely to develop hypertension or preeclampsia than women who gained within the guidelines (OR = 1.42). In addition, the prevalence of hypertensive disorders during pregnancy increased as the classification of obesity increased. The prevalence of hypertensive disorders in the class 1 obesity group (BMI = 30 – 34.9) was 15.2%, compared to 30.0% in the class 4 obesity group (BMI ≥ 50).

Development of GDM may also be influenced by GWG. Brunner et al. (2015) conducted a meta-analysis comprised of eight observational studies and found that women with excessive GWG were significantly more likely to develop GDM than pregnant women with adequate GWG (OR = 1.40). Interestingly, the women’s BMIs prior to pregnancy did not moderate this relationship, meaning that excessive GWG can increase the risk of developing GDM regardless of pre-pregnancy weight status.
Lastly, excessive GWG may lead to increased weight retention at six weeks and three months postpartum. Cohen and Koski (2013) studied 54 women attending prenatal classes in both Ottawa, Ontario and Montreal, Quebec. In this group of women, they found that those who met the recommendations for GWG in Canada were less likely to have retained more than 4.5kg of weight at six weeks postpartum (OR = 4.2). Begum, Colman, McCargar and Bell (2012) also compared women’s adherence to the Canadian GWG guidelines and PPWR, measured three months after delivery. The 489 women included in this study were part of the Alberta Pregnancy Outcomes and Nutrition study. Women who gained within the recommendations retained a significantly smaller amount of weight postpartum, at an average of 3.3kg, than women who gained above the recommendations, at an average of 5.9kg. After controlling for pre-pregnancy BMI, the relationship between GWG and PPWR remained significant in normal weight and overweight women. Excessive GWG can clearly have detrimental effects on the mother both during pregnancy and shortly after, from hypertensive disorders and GDM, to increased PPWR, regardless of weight status.

**Long-term Effects on the Mother**

As with the offspring, excessive GWG can have long-term effects on the mother as well. Mothers who gain excessive weight during pregnancy are more likely to have high blood pressure later in life and to have more PPWR over a year after pregnancy. A cohort study in Boston of 801 pregnant women measured gestational weight gain during each trimester, and a follow-up study was conducted at three years postpartum (Walter et al., 2015). Systolic blood pressure was shown to increase by 0.93 mm Hg for every 0.14 kilograms of weight gain in the first trimester of pregnancy. Fraser et al. (2011) conducted a prospective study with women from the Avon Longitudinal Study of Parents and Children in England. The researchers also measured
the effect of GWG on maternal blood pressure, but at 16 years postpartum. In contrast to the aforementioned study, they found that GWG in mid pregnancy, rather than early pregnancy, was related to blood pressure. When compared to women who met the recommendations for GWG, women with excessive GWG had systolic blood pressure that was 2.87 mm Hg higher and diastolic blood pressure that was 1.00 mg Hg higher. Longitudinal studies which measure blood pressure in women from conception to many years postpartum would help make more conclusive findings about the relationship between GWG and postpartum blood pressure in mothers.

Women with excessive GWG may also retain more weight long after their pregnancy. In a cohort study of 12,875 women from Nova Scotia, Canada, the women’s GWG was compared to their PPWR, which was calculated as the change in weight between pregnancies (Ashley-Martin & Woolcott, 2014). The time between pregnancies had to be at least one year, therefore PPWR was measured at a year or more after delivery. Women who gained excess weight during pregnancy had significantly greater PPWR (5.0 kg, 95% CI 4.9-5.2) than women who gained within the guidelines (2.1 kg, 95% CI 1.8-2.3), after controlling for age, pre-pregnancy BMI, time between pregnancies, breastfeeding, and mode of delivery. Excessive GWG not only affects the mother during pregnancy, but can also have long-lasting effects on blood pressure and weight retention many years later.

Gaining excessive weight during pregnancy can result in immediate consequences to both the mother and the baby, as well as long-term health consequences. Due to the elevated risk of several serious conditions associated with excessive GWG, it is important to prevent excessive weight gain during pregnancy if possible.
Adverse Effects of Inadequate Gestational Weight Gain

Gaining too little weight during pregnancy can also be problematic. Inadequate GWG has been shown to be associated with some adverse pregnancy outcomes, the most commonly noted being preterm delivery and low birth weight. Han et al. (2011) conducted a meta-analysis on the relationship between low GWG and low birth weight and preterm birth, which included 18 case-control studies and 37 cohort studies. Women with low overall GWG had significantly more incidences of preterm birth than women with optimal GWG (RR = 1.29). Moreover, these women had an especially increased risk of very preterm birth, described as less than 32 weeks (RR = 1.13). In addition, women with suboptimal weight gain during pregnancy were more likely to give birth to an infant of low birth weight than women with adequate weight gain during pregnancy (RR = 1.64). These women also had an increased prevalence of intrauterine growth restriction (RR = 1.54), which is thought to be a cause of preterm birth and low birth weight.

Inadequate GWG may also increase the risk of infant mortality. A study in the United States took a random sample of 100 000 records from the 2002 birth cohort file to analyze this relationship (R. Davis & Hofferth, 2012). After controlling for maternal age, education, race, gestational age, and low birth weight (LBW), infant mortality was significantly more likely among women who gained inadequate amounts of weight than women who gained adequate weight during pregnancy (OR = 1.84). An additional study by Davis, Hofferth and Shenassa (2014) used data from 159 244 pregnancies collected between 2004 and 2008 in the United States to investigate this relationship again, while stratifying by pre-pregnancy BMI. The risk of infant mortality was increased among women with inadequate GWG who were underweight, normal weight, and overweight (OR = 6.18, 1.47, 2.11, respectively). Although these prospective studies cannot provide a cause-and-effect relationship, the associations found are significant.
While it is important to avoid excessive GWG, it is also important to avoid inadequate GWG to prevent other adverse outcomes, including preterm birth, LBW infants, and infant mortality. Since women who gain optimal amounts of weight during pregnancy are more likely to have positive birth outcomes, it is important for health professionals to help women meet these guidelines.

**Dietary Intake Patterns of Pregnant Women**

Despite the vast number of studies comparing the dietary intake of pregnant women to different health outcomes, very few studies have focused on evaluating the dietary intake of pregnant women. There are only a few studies in Canada and U.S. that have measured overall diet quality of pregnant women and maternal intake from certain food groups. Studying the dietary practices of pregnant women is important to determine where to focus educational efforts in order to improve maternal nutrition.

**Diet Quality**

One study of diet quality in Canada and two studies in the U.S. indicate that, on average, pregnant women are not meeting dietary recommendations. Pick, Edwards, Moreau, and Ryan (2005) measured the diet quality of 52 pregnant women and 49 non-pregnant women from Edmonton, Alberta, using the U.S. Department of Agriculture Healthy Eating Index (HEI). The participants’ diets were assessed using four-day food records, and an HEI score was developed. The HEI score was based on 10 components: food group intakes of meat, milk, grains, fruits, and vegetables; total fat, saturated fat, cholesterol, sodium, and variety of diet. Out of a possible score of 100, a score of 80 or above was considered good, a score between 50 and 80 indicated a diet needing improvement, and a score of less than 50 was considered poor. The pregnant women and non-pregnant women had an average score of 75.0, ± 0.99, and 72.6, ± 1.52,
respectively. None of the pregnant women fell into the “poor” diet category, however 79% of the pregnant women fell into the “needs improvement” category.

An additional study of diet quality was conducted on 5861 pregnant women enrolled in the North Dakota Special Supplemental Nutrition Program for Women, Infants, and Children (Watts et al., 2007). Diet quality was measured using a diet quality index for pregnancy (DQI-P). This index measures diet quality based on 10 components: percent recommended intake of fruits, vegetables, grains, iron, folate, and calcium; cholesterol, total fat, saturated fat, and dietary diversity. With a highest possible score of 100, a score over 80 indicated a good diet, a score between 51 and 80 indicated a need for improvement, and a score of 50 or less indicated a poor diet. The average score of participants in this study was 53.9, suggesting that most of these pregnant women’s diet required improvement. A large proportion of women (37.7%) also fell into the “poor” diet category, and only 1.1% of the women in this study were found to have “good” diet quality.

Another U.S. study on diet quality was conducted in Massachusetts and included 1777 pregnant women (Rifas-Shiman, Rich-Edwards, Kleinman, Oken, & Gillman, 2009). Food intake was measured using an FFQ during the first trimester of pregnancy, and diet quality was assessed using the Alternate Healthy Eating Index for pregnancy (AHEI-P). This index has a total possible score of 90 and measures diet quality based on 9 components: ratio of red to white meat, ratio of polyunsaturated to saturated fatty acids, fruits, vegetables, trans fat, fibre, iron, folate, and calcium. The average score of the women in this study was 61.0 ± 10.0. The researchers also compared the AHEI-P scores to some of the participant characteristics and found that those who were older, more educated, had a lower pre-pregnancy BMI, and who had less children had higher scores. All three of these studies on diet quality only assessed intake of nutrients from
foods, not from supplements, and therefore the participants’ intake of these components may be better than indicated by their dietary index scores. However, the average diet quality scores are low in all of the studies, suggesting that the diets of pregnant women in Canada and the U.S. could use improvement.

**Food Group Intake**

As previously mentioned, EWCFG recommends that pregnant women consume an additional two or three servings of each food group daily. Fowler, Evers, and Campbell (2012) conducted a study to compare the diets of pregnant women in Canada to the recommendations in EWCFG. This study included 2313 women from London, Ontario. Dietary data was collected via an FFQ, which measured food intake over the last month. The researchers found that the majority of women were not meeting their food group recommendations. Only 3.5% of the women consumed the recommended number of servings for all four food groups, and 15.3% of the women did not reach the recommended amount of servings for any of the four food groups. The most poorly consumed food group was grain products, with only 8.6% of women consuming the recommended seven servings and the average consumption being 4.1 servings. Fruit and vegetable consumption was also inadequate, with 35% of women consuming the recommended eight servings and the average consumption being 7.2 servings. Approximately 57% of women met the recommendation for milk and alternatives, with an average consumption of 3.2 servings. Finally, 64.9% of women consumed the recommended amount of meat and alternatives, with an average consumption of 2.5 servings. On average, the women in the study consumed 4 servings of “other foods” daily. The women’s consumption of “other foods” may make up for the missed caloric intake from their low consumption of grain products, but these “other foods” likely do not provide as many essential nutrients. Overall, this sample of women from London, Ontario did
not meet the recommendations for food groups servings set out by Health Canada, which indicates that changes need to be made to maternal diets in Canada.

**Gestational Weight Gain in Canadian Women**

Research on GWG in Canada indicates that many Canadian women are gaining excessive amounts of weight during pregnancy. Kowal, Kuk, and Tamim (2012) studied data from the Canadian Maternity Experiences Survey, which was conducted in 2006 by Statistics Canada. In this study, 8542 women were selected to complete the survey, and 6233 provided information on GWG. Almost half of the women surveyed (48.7%) gained above the recommendations, and 18.7% gained below the recommendations, meaning only 32.6% of women gained within the guidelines for GWG.

Another study on GWG in Canada was conducted with 472 women from Alberta (Begum et al., 2012). The women were weighed once during each trimester by trained staff, but pre-pregnancy weight and the highest weight of each woman during pregnancy was self-reported. Total and weekly weight gain was reported based on BMI category. Excessive total gestational weight was gained by 30% of underweight women, 46% of normal weight women, 80% of overweight women, and 80% of obese women. Most women also had excessive weekly weight gain, with 38%, 66%, 87% and 76% of underweight, normal weight, overweight, and obese women, respectively, gaining above the recommendations. Evidently, excessive GWG is an issue for many women from Alberta, especially those who are overweight or obese prior to becoming pregnant. Some women (11%) also gained weight at a slower rate than recommended. Overall, only 18% of women gained weight at the recommended weekly rate.

Cohen and Koski (2013) also conducted a study on a smaller sample of Canadian women (n = 54) from Montreal and Ottawa who attended prenatal classes. The proportion of women
with excessive GWG was slightly higher in this subgroup, at 54%. It is clear that excessive GWG, and possibly inadequate gestational weight gain, is a major issue in Canada, despite the guidelines that have been put forth.

**Prenatal Education in Canada**

The amount and quality of education that pregnant women are receiving in Canada regarding nutrition and GWG is not well documented, however there appears to be a need for improvement. Education on weight gain in particular seems to be lacking, and although most women report receiving education on certain nutritional topics, a significant number of women are still not receiving this education.

A study on prenatal education was conducted in Edmonton and Calgary, Alberta with 1265 women (White et al., 2006). Each woman completed a computer-assisted telephone interview within three months of delivery, which asked about a range of prenatal care topics, including medical procedures, health education, and health advice. The most consistently received piece of health advice was to take vitamin and mineral supplements, with 93.1% of women reporting having received this advice. 81.3% of women reported receiving education on consuming a healthy diet, 77.3% reported being advised to take folic acid, and 64.2% reported receiving advice on weight gain during pregnancy. It is concerning that 35.8% of the women in this study did not report receiving any advice about GWG. Even regarding the advice to take vitamins and minerals, 6.9% of the women (approximately 87 women) did not receive this advice from a health care provider. Furthermore, the quality of the information provided was not assessed in this study, therefore the depth and accuracy of the information the women received is unknown.
McDonald et al. (2011) conducted a study in Hamilton, Ontario, which assessed what counselling and education women received about GWG. The 310 women included in the study were asked whether their health care provider made a recommendation about how much total weight they should gain during their pregnancy, and if so, what they recommended. Only 28.5% of the women reported that they received a recommendation from their health care provider about how much weight to gain and only 12% of the women reported that they were given a recommendation that fell within the Institute of Medicine (IOM)’s 2009 weight gain guidelines. Just over half the women (51.3%) reported that GWG was not discussed at all with their health care provider - a higher percentage than that of the previously discussed study in Alberta. Only 22.3% and 25.5% of women reported that their health care provider told them there were risks associated with inadequate or excess GWG, respectively. When asked how much weight they had planned to gain, 23.9% reported a number below, and 39.2% reported a number above the IOM guidelines. This study clearly illustrates that pregnant women are not receiving adequate education on GWG from their health care providers.

**Sources of Information on Maternal Nutrition**

There are numerous possibilities of where pregnant women can find nutrition information, including books, brochures, the internet, health professionals, family and friends. Most of the available literature on pregnancy information sources asks women about their preferred sources of information through interviews or surveys, but few studies have explored women’s experiences seeking information in depth.

**Using the Internet to Find Pregnancy-Related Information**

Many women now report the internet as a common source for pregnancy-related information. Although there have not been any studies on Canadian women’s use of the internet
for seeking pregnancy-related information, some studies have been conducted in the U.S., Italy, China and Australia. Song, West, Lundy, and Smith Dahmen (2012) conducted interviews with 32 women from the Southeastern United States who were either pregnant or had given birth in the last year. All of the women interviewed except for one were Caucasian, all but one had a college education or higher, and the majority made over $80 000 per year. Thirty out of the 32 women in this study (94%) reported that they used the internet to find pregnancy-related health information. When looking for specific information the women usually used search engines, and when looking up information on fetal development they commonly looked at websites such as BabyCenter and WebMD. Many women also reported using message boards to talk to other pregnant women as a source of support and comfort.

Another study that examined women’s internet usage for pregnancy-related health information was conducted in the Midwestern United States (Huberty et al., 2013). A total of 293 women who were pregnant or who had given birth in the past year completed a survey. Most of the women in this study came from predominantly white neighbourhoods, were married and had a college education or higher, and their incomes ranged from lower to upper class. It was found that 94% of these women used the internet to find pregnancy-related health information. The average woman used the internet to find pregnancy-related health information six to ten times during her pregnancy. Almost all these women (98%) used search engines to find information online, 57% of the women used websites containing information written by health professionals, such as Mayo Clinic, and one third of the women used government websites or online research articles.

Bert et al. (2013) completed a study with 1306 pregnant women in Italy to determine their use of the internet to find pregnancy-related health information. The majority of women in
this study were married, employed, and had completed high school or university. Most of the women who completed the survey (93%) used the internet to find pregnancy information online. Search engines were the most common method of finding information online (96%), followed by hospital websites (16%), and a small number of women (11%) participated in online discussions.

Gao, Larsson and Luo (2013) examined Chinese pregnant women’s use of the internet to find pregnancy information. A total of 332 women who were thirty-two weeks pregnant or more filled out a questionnaire. Most of the participants were primiparous, married, employed, and had a post-secondary education. It was found that 82% of participants in this study used the internet to find pregnancy information.

Research by Willcox et al. (2015) investigated pregnant women’s information-seeking behaviours regarding GWG. A questionnaire was completed by 368 pregnant women from Melbourne, Australia. Most of the participants were born in Australia, had post-secondary education, and had an annual household income of more than $78 000. Just over half the women in their study (55%) actively searched for information on GWG, and of these women 83% looked for this information online.

A few of these studies also asked about women’s motivations for using the internet for pregnancy information. Song et al. (2012) found that the main reasons women searched for information on the internet were to ensure that “I’m not doing anything wrong” and “I’m not the only one”. As this could usually be confirmed or denied quite quickly, women generally looked no further than the first two pages of search results. Another reason for using the internet was to take control. The internet was seen as a source that could provide information beyond that provided by health professionals, allowing women to make more informed decisions for themselves. Huberty et al. (2013) discovered some similar reasons for using the internet. Almost
all the women in this study (98.5%) reported that they used the internet to find information not provided by their health care professionals, and many (87.6%) used the internet to add to information provided by their health care professional. Also similar to the previous study, 78% of these women used the internet to increase their control over decisions relating to their pregnancy. Bert et al. (2013) found the main motivation for using the internet was the speed of finding answers. The anonymous nature of the internet, ease of use, and the desire to increase knowledge on pregnancy-related topics were top reasons for searching online as well. The internet has become a commonly used source for seeking pregnancy-related information in the U.S. It is a quick way for women to find reassurance and it also allows them to have more control over their own pregnancies as it contains such a vast amount of information. Similar research in Canada is necessary, however, to determine if Canadian women are using the internet in comparable ways.

**Information Sources Chosen by Low-Income Pregnant Women**

Two studies on sources of pregnancy information chosen by low-income women have been conducted in the U.S. Lewallen (2004) interviewed 150 low-income, pregnant women from the Southeastern United States about their preferred sources of pregnancy information. The top four sources for health information were, in order, books, themselves, family, and health professionals. A variety of written materials were reported as significant sources of health information, including books, magazines, and pamphlets, with books as the top source. These women also described themselves as being important sources of health information, especially those who had been pregnant before. Other people were reported as an important source for information on healthy behaviour during pregnancy, with female family members as the most popular choice and health professionals as the next most popular choice. Interestingly, the
internet was not mentioned in this article. It is unknown whether this was overlooked or if the internet was simply not a significant source for these women.

Shieh, McDaniel, and Ke (2009), also interviewed 84 low-income pregnant women from Indiana, U.S., about their sources of pregnancy information. Similar to the Lewallen study, the top four sources used by these women, in order, were health professionals, books/brochures, friends/family, and newspapers/magazines. Using themselves as an information source was not provided as an option in this study. The internet, however, was included as an option in this study and emerged as the fifth most common source for finding pregnancy information.

Along with asking about women’s preferred information sources, Shieh et al. (2009) also asked the 84 low-income women in their study about the factors that affected their information-seeking behaviour. The five biggest barriers to accessing pregnancy information were the lack of information through mass media sources (including television, radio, newspapers, and magazines), a lack of access or inability to use the computer, lack of community health fairs or activities nearby, no family or friends with pregnancy knowledge, and lack of transportation to sources of information. The researchers found that the more barriers a woman reported, the less information-seeking she did. Thus, addressing these barriers would help women to access more information on pregnancy.

For low-income pregnant women, books, friends, family and health professionals appear to be important sources of information, while the internet is used less often. This differs from studies of higher-income pregnant women, who reported the internet as a top source. A lack of access to a computer or an inability to use a computer, reported as a barrier by Shieh et al. (2009) may explain this inconsistency. Thus, income appears to play a role in determining the type of information sources women use to find pregnancy-related information.
Other Sources of Pregnancy Information

While the internet is a popular source, many other sources are consulted for pregnancy information as well. A study in Australia surveyed 350 women about the information sources they used to find pregnancy, birth and postpartum information (Grimes, Forster, & Newton, 2014). These women were mostly married with post-secondary education and had a range of incomes. They found that midwives were the most popular source, used by 70% of participants, and the internet was only used by 44% of participants.

Two studies in the Netherlands also explored the use of different information sources by pregnant women (Szwajcer et al., 2005; Szwajcer et al., 2008). In both of these studies the internet was rated as the most commonly used source for finding pregnancy information. The internet, along with magazines and brochures, was used to find current information, while books were used to find more detailed and reliable information. Women reported using nine-month calendars and brochures as well, although they felt brochures to be less informative sources of information. Many women also rated midwives and health professionals as significant sources of pregnancy information. Other people were considered important sources as well, including friends, family, neighbours, and colleagues.

There are numerous sources used by women to find pregnancy-related information. The internet appears to be one of the top sources, but factors such as income, location and access to resources can all affect which sources a woman will use.

When are Women Seeking Pregnancy-Related Nutrition Information?

A women’s stage of pregnancy and whether she feels like a mother or not will also influence the type of sources she chooses to use. In the study by Swzajcer et al. (2008) four groups of approximately 100 Dutch women each (women trying to become pregnant, and women
who were pregnant for the first time in their first, second, and third trimester) completed a questionnaire. The women in all four groups reported that they were more interested in nutrition information than before trying to conceive or before pregnancy. The first trimester of pregnancy, however, appeared to be the time when women were most interested in nutrition information, as the women in this group reported significantly greater interest in this information than women in the other three groups. Women in their first trimester also searched for nutrition-related information most frequently. The women in each of the four groups were also asked to name their three primary sources for nutrition information. In all four groups, the internet was rated as the primary source. Women in their first, second, and third trimesters of pregnancy rated midwives as the second most popular source and books as the third most popular source. For those trying to conceive, primary care physicians were reported as the second most common source and gynaecologists as the third most common source for nutrition information. Szwajcer et al. (2008) also interviewed 12 women who were pregnant for the second time. These women sought less information than those trying to conceive or those who were pregnant for the first time. They sometimes consulted midwives and books for specific nutrition information, but otherwise used knowledge from their previous pregnancy.

Gao et al. (2013) also asked the women in their study in China about when they were seeking pregnancy information online. Similarly, they found that most women (82%) started searching for pregnancy information in their first trimester, while 14% started searching in their second trimester and 5% started searching before becoming pregnant. However, unlike the findings by Szwajcer et al. (2008), 40% of women said they searched for information evenly throughout their pregnancy while 25% searched most frequently in their second trimester and 20% searched most frequently in their first trimester.
Szwajcer et al. (2005) conducted another study, which explored the use of different information sources by five groups of 12 women (women hoping to become pregnant, women who were pregnant for the first time in their first, second, and third trimesters, and women in the first trimester of their second pregnancy). Most of the women in their study who were hoping to become pregnant did not seek much nutritional information, although many of them did seek general information about pregnancy. Women who were in the first trimester of their second pregnancy sought out less nutrition information than those who were pregnant for the first time. This was mostly explained by their perceived greater competency from having been pregnant once before. The primiparous women in the study were split into three different groups based on their feelings of motherhood. There were those who felt like a mother as soon as they found out they were pregnant, those who felt like a mother further into their pregnancy, and those who were pregnant but did not yet feel like a mother. The researchers found that the women chose different sources for nutrition information based on these categorizations. For women who felt like a mother right away, information-seeking on nutrition was highest during the first trimester of pregnancy when they had many questions. The media was their primary source for information, which includes the internet, magazines, books, nine-month calendars, and brochures. The internet was chosen most commonly due to its anonymity, since most of these women had not yet shared with others that they were planning a pregnancy. Information-seeking then decreased during the second trimester of pregnancy due to what some women called an “information overload” during the first few months. Midwives, friends, family, colleagues, and neighbours became important sources of information for these women in their second trimester. Books also remained important sources of information further into their pregnancies as well. Then some women sought more information again during the third trimester of pregnancy, while
others avoided more information in order to reduce their stress. These women reported that midwives did not provide much additional information than what they had found on their own, and therefore found the information from people in their social circles to be more useful and personal. For women who felt like mothers later in their pregnancies, it was common for information-seeking to be highest during their second trimester of pregnancy. This was often because the women could hear their baby’s heart beat at this time, and there was a decreased likelihood of miscarriage, causing the women to share the news of their pregnancy with more friends and family. Midwives and brochures which were provided by midwives were reported as important sources of nutrition information, since they did not seek much information on their own earlier in their pregnancies. Finally, women who did not yet feel like a mother did much less information-seeking than women in the other two categories. These women commonly thought about their pregnancy as a natural event and reported that they thought they already had enough knowledge about nutrition. Nutrition decisions were often made using common sense rather than seeking information from another source, but for those in this group who sought out information, midwives were reported as the main source.

A woman’s information-seeking behaviour can be affected by many factors, including whether or not she feels like a mother yet, the stage of her pregnancy, her ethnicity/place of residence and her economic status. The internet appears to be an increasingly common source for pregnancy-related information for many reasons, including its anonymity and speed, for women to confirm that what they are doing is right, take control of their own decisions, and expand on information provided by health professionals. Understanding what information sources pregnant women use, in addition to how and why they use these sources, can help design future educational resources that are best suited to pregnant women’s needs and desires.
What Makes an Effective Educational Resource

A large variety of educational resources exist for almost every health topic. While many of these materials contain similar information, the way the material is presented can affect whether or not the consumer benefits from reading it. The effectiveness of written materials can be evaluated in a few different ways, including the reading level, design, content, and ability to promote behaviour change. The literature has some suggestions for the appropriate reading level to use for written materials, as well as how to design them and what type of content to include. There are only a few studies, however, that have assessed the ability of printed materials to produce behaviour change.

Readability

In 2012, approximately 48.5% of Canadians aged 16-65 years old had low literacy skills (Government of Canada, 2016b). This was indicated by a literacy score of less than level 3, which is considered the standard level to be competent at most jobs in Canada and to complete everyday tasks (Parliament of Canada, 2012). Therefore, in order for most patients to understand the materials provided to them, it is recommended that they be written at a seventh or eighth grade reading level, which is the average reading level of an American adult (National Center for Education Statistics, 2016). When the readability of health information is too difficult it may reduce the benefit to consumers, as indicated by French and Larrabee (1999). In their study, 50 adults from Tennessee, U.S., who had been diagnosed with hypertension were asked to read a pamphlet about high blood pressure. The reading grade level of the pamphlet was grade 12, as assessed by Simple Measure of Gobbledygook (SMOG). The reading level of each of the participants was also assessed using the Slosson Oral Reading Test-Revised (SORT-R). The average reading grade level of the participants was 6.57. Upon analysis, it was found that as
participants’ reading grade level increased, their perceived benefit from reading the pamphlet also increased ($r = 0.40, p = 0.004$). Hence, it is important to take into account the reading grade level when writing and administering health information intended for consumers. Unfortunately, evaluations of printed educational materials suggest that they are written at a level exceeding that of the average consumer. Shieh and Hosei (2008) conducted an evaluation of printed health materials in Indiana, U.S. This evaluation consisted of three separate rounds. In the first round, seven nursing students enrolled in a practicum course assessed the readability of 21 printed health materials collected from the community. These materials focused on a variety of topics, such as diabetes, heart health, and antibiotics. The students assessed the readability of the materials using SMOG. The reading grade level of the 21 materials ranged from grade 6 to 13, with an average level of 10.1. Only three of the materials were considered suitable, with reading grade levels of eight or below. The second part of the study involved nine more nursing students, also enrolled in a practicum course. For this round, 15 printed materials containing information on prenatal health were collected from a Healthy Start program, designed to help low-income pregnant women. The students assessed the readability of these 15 materials using the Suitability Assessment of Materials (SAM) as well as SMOG. In the final phase of the study, nine registered nurses evaluated the readability of the same 15 materials from the Healthy Start program, using both SMOG and SAM. The assessments by both students and nurses were then combined. The reading grade level of these 15 materials ranged from 6.3 to 10.5, with an average of 8.4. Just under half of the materials ($n = 7$) had reading grade levels of eight or below. Other studies on the readability of various health materials have also found that printed materials are not being written at levels that are appropriate for the average American (Boles, Liu, & November-Rider,
2016; Ryan et al., 2014; Ryu & Yi, 2016; Williams, Muir, & Rosdahl, 2016). Thus, the reading levels of printed materials may be hindering their effectiveness on consumers.

Several assessments of online health information have shown that they are written above a seventh or eighth grade reading level as well (Balakrishnan, Chandy, & Verma, 2016; Eltorai et al., 2016; Gupta et al., 2016; Hadden et al., 2016; Kumar et al., 2016; Risoldi Cochrane, Gregory, & Wilson, 2012; Roberts, Zhang, & Dyer, 2016; Walsh & Volsko, 2008). For example, Risoldi et al. (2012) assessed the readability of consumer health information found on five government-funded websites and six commercially-funded websites. From each website, ten webpages were selected for analysis on ten different health topics. According to SMOG, the average reading grade level for the government-funded websites was 12.8, and for the commercially-funded websites it was 13.2. Hence, both types of websites were well above the recommended reading grade level of seven or eight. Another study on readability of health information found online examined information from five American websites (Walsh & Volsko, 2008). They included the American Cancer Society, American Diabetes Association, American Heart Association, American Lung Association, and American Stroke Association. From each of these websites, 100 articles containing consumer health information were analyzed. Overall, the average reading grade level of all the articles, according to SMOG, was 13, and the majority of articles were rated as grade 9 reading level or above. It is evident that consumer health information, both in printed format and online, is too difficult for the majority of Americans to comprehend, which may be reducing the materials’ ability to help their intended audiences.

**Design/Type of Content**

The way in which educational materials are designed and the type of information included can also affect the impact they have on their readers. One study was conducted in
Boston Massachusetts to determine how to best provide nutrition information to clients with low literacy skills (Macario et al., 1998). Focus groups were conducted with 50 participants of adult basic education classes, and interviews were conducted with 35 health care providers. They asked the health care providers for suggestions on how to provide information to those with low literacy skills and how to create better educational resources. The adult participants were asked about how they would like to receive nutrition information and about their preferences for both the type of information and the format. Some of the most common suggestions made were that educational materials should be visually attractive, interactive, include pictures of the target population, quotes from the target population, culturally appropriate information, and the target population should be included in the creation of the material.

Eames, McKenna, Worrall, and Read (2003) assessed the design and content of 53 educational materials written for stroke survivors and their caregivers. Information was collected through face-to-face interviews with 21 stroke survivors and 14 caregivers from Australia. The participants identified some components of the materials that hindered their understanding of the content. These included small font size, technical words, poor organization, and too much information. The use of colour and instructional diagrams to go along with text were considered helpful components.

Another study in Sydney Australia, by Arora et al. (2012), found that readers of their materials liked similar components. The written materials used for this study were two leaflets on infant dental health. Twenty-four mothers were asked to evaluate the leaflets during an interview. Some desirable components of the leaflets reported by the mothers were good organization (information was divided into age categories), colour-coding, and the use of pictures to help explain text. Difficult dental terms, the inclusion of too much information on one
leaflet, and a lack of detail on certain topics were some common complaints that were mentioned.

These studies point out some important factors to take into consideration pertaining to the design and content of health information materials, including font size, organization, and pictures to explain text. They also show the importance of receiving feedback from the population of interest in order to tailor the materials to their needs and preferences.

**Focus on Behaviour Change**

While it is important that the target audience for an educational resource is able to read the material and approves of the design and content, the ultimate purpose of any educational resource is for those reading it to change their behaviour. Using theory to create written educational materials may be a good starting place. Whittingham, Ruiter, Castermans, Huiberts, and Kok (2008) tested the effect of a brochure that aimed to prevent alcohol abuse by undergraduate students against a modified version of the same brochure. The modified version contained the same information with a few alterations to the wording and design that were based on three components from cognitive psychology theories. These components were: text coherence, which refers to the relationship between different parts of text that make it logical to the reader; integration of pictures and text; and highlighting important aspects of text. Two separate studies were conducted. The first study included 75 first-year students from Maastricht University, the Netherlands, who were provided with the brochures part way through the semester. The second study involved 80 undergraduate students in any year from Maastricht University, who were provided with the brochures at the beginning of the school year. The main outcome measure was knowledge of the consequences of alcohol abuse, as knowledge is often a core determinant of behaviour change. The results from both experiments were similar. When
students were asked to subjectively indicate their understanding of the materials, there was no difference in comprehension between those who read the revised brochure and those who read the original. When comprehension was measured objectively, however, those who read the revised brochure scored significantly higher (M = 73.72, p < .001) than those who read the original brochure (M = 61.64, p < .001). Thus, by incorporating components of cognitive psychology theories, students were able to understand the educational material better, which may be an important first step to creating behaviour change.

Another study compared the ability of three different educational materials on weight loss to produce a series of steps associated with behaviour change, as outlined in McGuire’s (1989) theoretical model (Bull et al., 2001). The participants were 189 adults with BMIs of 27kg/m² or greater who were interested in losing weight. The participants were randomly assigned to one of three materials: an individually tailored material, which was tailored to each participant’s age, gender, culture, motives, and barriers; a general weight loss information booklet created by the American Heart Association (AHA); and the AHA booklet formatted the same as the tailored material to rule out any effects of formatting on the outcomes. Early steps associated with behaviour change (from McGuire’s 1989 model), including attention to the material and liking the material, were positively associated with perceived attractiveness of the material, as well as how informative and encouraging the materials were perceived to be. More attention was also paid to the tailored material than the AHA material, and participants indicated that they liked the tailored material more. Some of the middle steps associated with behaviour change, such as skill acquisition, attitude change, and remembering concepts, were associated with receiving the tailored material as well. Finally, the later steps of re-reading the material and showing the material to others were associated with reading the tailored material and perceiving the material
as more encouraging. Overall, the tailored material proved to be more effective at producing many of the steps associated with behaviour change. Materials that are perceived as attractive, informative, and encouraging may also produce more behaviour change in their readers. Using theory to design written educational materials and tailoring materials to specific audiences may be effective ways of increasing knowledge and other steps associated with behaviour change. Further research is necessary, however, especially research that specifically measures the behaviour of interest as an outcome. Designing written educational materials that include components associated with behaviour change will provide consumers with the most valuable resources to aid them with a variety of health topics.
Chapter 3: Methods

Mixed-Methods Approach

A mixed methods approach was used to assess the experiences of women with seeking pregnancy-related nutrition information. This approach was suitable for this research because the factual questions could be answered with a quantitative method, and then the more complex questions could be explored using a qualitative method, which can acquire more detailed information (Chow, Quine, & Li, 2010). Therefore, a quantitative approach was used to meet the first two objectives, and a qualitative approach was used to achieve the last three objectives.

Quantitative Methods

A quantitative survey was used to answer the first two research questions for this study (see Appendix B). These questions required a simple descriptive analysis in order to determine which sources women use most often to find pregnancy-related nutrition information, and when they are accessing these sources. The answers to these questions then helped guide the rest of the study. Quantitative research is beneficial because statistical tests can be used on the data to find trends or differences between groups (Madrigal & McClain, 2012). Quantitative research, however, does not provide an explanation of the data, such as why women are using these sources, which is why qualitative interviews were conducted following the quantitative component.

Qualitative Methods

Qualitative methods were used to conduct the second part of this research. Qualitative methodologies can be used for exploratory research, as they focus on meanings, descriptions, concepts, and characteristics of things (Berg & Lune, 2012). Qualitative research is also suitable for exploring new areas of study (Neuman & Robson, 2012). There was little previous research
on women’s experiences seeking pregnancy-related nutrition information, therefore qualitative research was utilized in an effort to gain new insights on this topic.

In particular, a phenomenological approach was adopted for this research study. Simply put, phenomenology is the study of experience (New World Encyclopedia, 2015). This approach was appropriate for this research study because it seeks to understand the nature of a person’s experience from his or her own point of view. Additionally, phenomenology emphasizes the relationship between the experiencing subject and the object they are experiencing, which in this case would be the women and prenatal nutrition information.

**Ethical Approval**

Ethical approval was requested from the University of Guelph prior to commencement of the study. The certificate of approval was obtained on November 25, 2016 (REB#16-12-749). A copy of the ethics approval letter can be found in Appendix D. The researcher also completed the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE; see certificate in Appendix E). All participants were required to provide informed consent before participating in the study.

**Method 1 – Online Survey**

The first two research questions were explored via an online survey. Previous research has used surveys, both online and in print form, to investigate the information seeking behaviours of pregnant women (Bert et al., 2013; Gao et al., 2013; Huberty et al., 2013; Willcox et al., 2015). While online surveys do not provide as much detail and depth as qualitative methods such as interviews and focus groups, they allow the researcher to gather information from a larger group of women than can be interviewed, within a relatively short period of time.
In addition, by including a survey, some of the information obtained through this research study will be more representative of the larger population of pregnant women in Ontario.

**Participants**

**Inclusion/Exclusion Criteria**

Women were eligible to participate in the survey component of this study if they were 18 years of age or older, resided in Ontario, were able to read and speak English, and were pregnant during completion of the online survey. Participants had to be at least 18 years of age in order to provide their own informed consent in Canada (Health Canada, 2014b). The province of Ontario was chosen to recruit a large number of pregnant women for the online questionnaire within a defined geographic region including urban and rural communities. The participants also had to be able to read English because this is the language the survey was written in, and there were insufficient research funds to hire a translator. In addition, the participants had to be pregnant when they completed the online survey. Previous research on information seeking behaviours of pregnant women has also been done with women who were pregnant at the time of the study (Huberty et al., 2013; Lewallen, 2004; Shieh et al., 2009; Song et al., 2012). This timeframe was chosen to help the participants correctly recall their experiences with seeking information during their pregnancy. Finally, multiparous and primiparous women were included in the survey portion of the study so the results could be compared between primiparous and multiparous women to see if their information seeking behaviours differed.

**Sample Size**

The goal for the survey was to obtain approximately 100 participants. Previous research investigating which information sources are preferred by pregnant women has used sample sizes close to this number (Lewallen, 2004; Shieh et al., 2009; Szwajcer et al., 2008). A study in the
Southeastern U.S., for example, interviewed 150 pregnant women to determine their preferred sources of information (Lewallen, 2004), and another study in Indiana, U.S., interviewed 84 pregnant women (Shieh et al., 2009). In a study in the Netherlands, four groups of 100 women each completed a questionnaire to determine their top three sources for pregnancy information (Szwajcer et al., 2008). This sample size was also chosen because 100 responses was believed to be a reasonable amount to collect in the time span of this study, and should be large enough to provide a idea of where and when women are seeking prenatal nutrition information in Ontario.

Recruitment

Women were recruited for the online surveys from a variety of places across Ontario, including community health centres, public health centres, Canada Prenatal Nutrition Programs (CPNPs), midwifery practices, online pregnancy forums, and Facebook groups for pregnant women. The researcher contacted dietitians or those in charge of prenatal services at community health centres, public health units, CPNPs, and midwifery practices and emailed them information about the study along with a poster (see Appendix F). The poster contained the researchers’ contact information and the link to the online survey. They were asked to hang the poster in their facility to advertise the study to pregnant women who may be interested in completing the survey. In the case of online forums and Facebook groups, the managers of the groups were contacted and either the manager posted the study information and the link to the survey or the researcher posted this information with the managers’ permission.

Development of the Online Questionnaire

The questions for the online questionnaire were developed based on the first two research questions for the online survey (see Appendix A). The survey was administered using Qualtrics (Qualtrics, 2017), but a written version of it can be found in Appendix B. The guidelines from
the Research Ethics Board (REB) entitled “Using Qualtrics for Research” were followed when creating the survey (Guelph, 2015).

Another member of the research team, who has experience with pregnancy research, reviewed the questions in the online survey to ensure they had face validity and aligned with the research questions. Two pregnant women were also asked to pilot the questionnaire to confirm its relevance and to provide their input on the length of the survey, comprehension of the questions, and user friendliness. Only one issue was noted with a link in the survey, which the researcher fixed prior to sending the survey out.

**Online Questionnaire Procedures**

The first page of the online questionnaire contained information about the study. At the bottom of this page participants had to choose “I agree” to provide their consent to participate in the study. This page was also available for printing so the participants could keep the study information for future reference. Upon clicking “I agree”, the survey would begin. First, the participants were asked if this was their first pregnancy or not, and how far along they were in their pregnancy. Then they were asked to indicate all the sources they used to find prenatal nutrition information, and which source they used most often. Next, they were asked when they looked for this information and when they looked the most. After the pregnancy-related questions were answered, some demographic information was collected from each participant, including age, ethnicity, marital status, education and income. The next page asked only those who were on their first pregnancy if they would like to take part in an interview at a later date (see Recruitment section for interviews below). Then participants were given the option to leave their email addresses if they wanted to receive a summary of the results from the survey. Finally, participants were thanked for their involvement in the study, provided with a brief explanation of
what would be done with the information collected, and presented with a few links to credible sources for pregnancy-related nutrition information.

**Data Analysis**

The questionnaires were analyzed using descriptive statistics in SPSS (IBM Corp, 2016) to determine which prenatal education sources women were using most often and when they were looking for information. Chi-square tests were used to determine if participants’ demographic information, stage of pregnancy and parity influenced the types of sources they consulted or when they sought nutrition information.

**Method 2 – Semi-Structured Telephone Interviews**

Semi-structured telephone interviews were conducted to complete the second part of this research study. Semi-structured interviews have been used successfully in many other studies to complete research on pregnancy-related topics (Graham, Mayan, McCargar, & Bell, 2013; Jette & Rail, 2014; Song et al., 2012; Szwajcer et al., 2005; White et al., 2006). The interview questions focused on the experiences of primiparous pregnant women using the internet to find pregnancy-related nutrition information. The internet was selected as the topic of interest because current research shows that it is an increasingly common source used by expecting women (Huberty et al., 2013; Song et al., 2012; Szwajcer et al., 2005; Szwajcer et al., 2008), yet there are few studies in Canada on this topic. Semi-structured interviews were chosen because they allow for comparisons between each of the interviews by asking the same series of questions to each participant, while also providing detailed, personal accounts through the use of open-ended questions and encouraging participants to expand upon their answers (Berg & Lune, 2012). This can result in the discovery of important information that the researcher may not have found if a fully structured interview with closed-ended questions was implemented. The
interviews were conducted individually to provide a safe, comfortable environment for the women to share information. Telephone interviews were used instead of in-person interviews due to the large geographical distribution of the participants. Telephone interviews have some limitations in that they do not allow the interviewer to pick up on non-verbal cues, such as facial expressions or hand gestures, (Berg & Lune, 2012), however they allowed the researcher to collect data from women in a variety of places across Ontario.

**Participants**

**Inclusion/Exclusion Criteria**

The women who participated in the interviews were also required to be 18 years of age or older, residents of Ontario and fluent in English. Interview participants also had to be pregnant for the first time, but could be up to three months post-partum. Only primiparous women were invited to take part in the interviews because women who are pregnant for the first time tend to seek more information during pregnancy than women who have previously been pregnant (Szwajcer et al., 2005). Since a smaller number of women (12-15) were interviewed, this restriction was made to provide the researcher with the most information possible about women’s information seeking experiences during pregnancy as first time mothers-to-be.

Interview participants were not required to be pregnant at the time of the interview as recruitment was done through the online survey and the interviews were conducted a few months after the survey was made available. This meant that some women had given birth before they took part in an interview, but their pregnancy was still very recent.

**Sample Size**

For the interviews, the researcher aimed to recruit 12-15 women. Guest (2006) conducted a research study on self-reported health behaviours of women in Africa to determine how many
interviews are required to reach saturation. Thematic analysis was used to analyze data from 60 previously conducted interviews and it was found that saturation occurred after 12 interviews. Other studies exploring the experiences of pregnant women have reached saturation at 12 or 15 interviews. Swzajcer and colleagues (2005), for example, interviewed five groups of 12 women in different stages of pregnancy to inquire about their use of different information sources. Another study in Alberta assessed the sugar consumption habits of pregnant women and reached saturation after 15 interviews (Graham et al., 2013). A study in Ottawa, which explored pregnant women’s experiences with GWG, also reached saturation at 15 interviews (Jette & Rail, 2014).

Recruitment

Interview recruitment took place through the online surveys. Near the end of the survey, participants who indicated that they were pregnant for the first time were asked to provide their email address if they were interested in taking part in a semi-structured telephone interview in the future.

Development of the Semi-Structured Interview Guide

The interview guide was developed in collaboration with the research team. The interview questions were created to align with the three research questions developed for the interviews (see Appendix A). A modified version of the interview protocol described by Harrell (2009) was used to guide the interview sequence. The interviews began with an introduction question, which asked participants how their pregnancy was going or how it went overall. This question was used to break the ice and led into the more specific questions. These questions asked about where women looked for prenatal nutrition information, how they accessed this information online, what nutrition topics they looked for online, why they used the internet, whether they could find the information they were looking for, how well they understood the
information they read online, whether they would recommended the internet as a source of prenatal nutrition information, emotional responses to information found online, changes to their thinking and behaviour after reading this information, and ways prenatal nutrition information on the internet could be improved. Some questions included additional probing questions or probing words, which were only used if the interviewee needed assistance to understand and answer the question properly. At the end, the interviewee was given a chance to add anything they wanted to share that was not covered, and asked if they had any questions. Finally, the participant was debriefed and thanked for their involvement with the research project. (See Appendix C for the interview guide).

Pilot Testing the Interview Guide

To ensure the trustworthiness of the interview guide, it was reviewed by a research team member who had experience with both pregnancy research and conducting interviews. The questions were also reviewed by two pregnant women to ensure they were suitable for this population group. Finally, an interview was conducted with one pregnant women who fit the inclusion criteria as a pilot test. The researcher also analyzed this interview to ensure the effectiveness of the interview guide for answering the research questions. This interviewee was also asked for her feedback on the interview, including comprehension of the questions, length of the interview, and sound quality over the phone. She provided only positive feedback.

Interview Procedures

Since the interviews were completed over the phone the participants could be in any location of their choice, although they were asked to pick a quiet location with minimal distractions. The researcher set up a time at which to complete each interview with the participants via email. The length of the interviews varied based on the length of the participants’
answers, but took an average of fifteen minutes. Swzajcer et al. (2005) conducted in-depth interviews with 60 pregnant women about their preferred information sources which took approximately one hour each. Some other studies on information sources used by pregnant women have solely used questionnaires (Huberty et al., 2013; Shieh et al., 2009). Since this was a two-part study, a shorter interview length was expected as the interviews were providing additional details to the surveys. The participants were emailed information about the study prior to completing the interviews. This email included information on the purpose of the study, the length of the interview, assurance of confidentiality and anonymity, and a brief explanation of what would be done with the data obtained from the interviews. When the phone call began, the interviewer reviewed some important points outlined in the email and answered any questions the participant had. Then the participants were asked to provide verbal consent. After consent was established, participants’ demographic information was collected along with their stage of pregnancy or time post-partum, and then the interview questions were asked. The interviews wrapped up with the researcher thanking the participant, informing them of the next steps in the research, and offering to provide with a summary of the results after completion of the study.

The interviews were audiotaped, beginning when the interviewer asked for consent. The audio files were stored at the University of Guelph on an encrypted and password protected laptop. All the interviews were transcribed verbatim and the participants were given pseudonyms in the analysis to ensure anonymity.

Data Analysis

Thematic analysis was used to analyze the data derived from the interviews (Boyatzis, 1998). This type of analysis has been used in other qualitative studies investigating the health practices of pregnant women (Hoek, Gifford, Maubach, & Newcombe, 2014; Hunter-Adams &
Thematic analysis is a very flexible method of analysis, which means it is suitable to use with a variety of theoretical positions, including phenomenology (Braun & Clarke, 2013). If done properly, thematic analysis has the potential to provide a rich and thorough description of data. The process of thematic analysis followed for this study is summarized in detail below:

The researcher initially became familiar with the data through conducting the interviews and subsequently transcribing some of the interviews or checking over the transcriptions that were transcribed by the research assistants. Each of the transcripts was then read repeatedly to look for patterns in the data. To create the codes, the researcher organized each interview line by line and identified interesting features, such as nutrition topics that were difficult to find online. The initial codes were generated from semantic content. This means they were based on what was written, not on any further interpretation of the data. This was done in order to keep the analysis as objective as possible and eliminate bias from the researcher. The codes were recorded and organized in NVivo (QSR International Pty Ltd, 2015), and notes were made about each code to explain when they should be used. Next, the codes were sorted into broader categories called themes. These themes were then organized into a mind map to show the relationships between each of the themes, and some subthemes were also created. The mind map helped to organize the data and determine which themes could be grouped together. Data within each theme was required to have good internal homogeneity, meaning that each piece had a similar meaning and supported the overall theme. Each theme was also required to have good external heterogeneity, meaning they were distinctly different from one another. The validity of each theme was checked to ensure they aligned with the data set, and the entire thematic map was checked to ensure it accurately represented the meanings that were present in the complete data set. The data was
reviewed and revised until a thematic map was formed that fit all the data well. The next phase involved identifying what each theme represented. Within NVivo, nodes were created to represent each theme. The themes were allocated names to define their meaning, and memos were created about each node to further illustrate each meaning. The final phase involved writing the entire report, which essentially told a story that was derived from the data. The themes were grouped into two large categories and ordered in a logical sequence to show their connections to each other. Each theme was described in detail using extracts from the interviews as evidence.
Chapter 4: Results and Discussion – Online Survey

Results

**Demographic Data of Survey Participants**

A total of 97 pregnant women completed the online survey. The demographic characteristics of the participants are summarized in Table 3 below. The majority of survey participants indicated that they had been previously pregnant (59%), while the rest were pregnant for the first time. The women’s stages of pregnancy varied greatly, however almost half of the participants (45%) were in their third trimester. Most of the women who participated in the survey (74%) were between 26 and 35 years old and a large majority of the participants (94%) identified as European, Canadian, Caucasian or White. Most participants were either legally married (76%) or common-law married (20%). Almost all the women had post secondary education (97%), and 26% of these women had at least some graduate education. Participants were diverse in terms of household income but most (68%) were considered upper-middle or upper class. The results were analyzed to determine if there were any differences in sources used and time of seeking based on the participants’ parity, stage of pregnancy and demographic characteristics, but no significant differences were found.

**Table 1. Demographic Data of Survey Participants**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number of Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PREGNANCY NUMBER</strong></td>
<td></td>
</tr>
<tr>
<td>First pregnancy</td>
<td>40 (41)</td>
</tr>
<tr>
<td>Have been pregnant before</td>
<td>57 (59)</td>
</tr>
<tr>
<td><strong>STAGE OF PREGNANCY</strong></td>
<td></td>
</tr>
<tr>
<td>0-3 months</td>
<td>28 (29)</td>
</tr>
<tr>
<td>3-6 months</td>
<td>25 (26)</td>
</tr>
<tr>
<td>6-9+ months</td>
<td>43 (45)</td>
</tr>
<tr>
<td><strong>AGE</strong></td>
<td></td>
</tr>
<tr>
<td>18-25</td>
<td>11 (12)</td>
</tr>
<tr>
<td>26-35</td>
<td>70 (74)</td>
</tr>
<tr>
<td>36-45</td>
<td>14 (15)</td>
</tr>
</tbody>
</table>
**ETHNIC BACKGROUND**

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Nations/Métis/Inuit</td>
<td>7 (7)</td>
</tr>
<tr>
<td>European/Canadian/Caucasian/White</td>
<td>88 (94)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (5)</td>
</tr>
</tbody>
</table>

**MARITAL STATUS**

<table>
<thead>
<tr>
<th>Status</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legally married/Common-law married</td>
<td>91 (96)</td>
</tr>
<tr>
<td>Never legally married/divorced/widowed</td>
<td>4 (4)</td>
</tr>
</tbody>
</table>

**EDUCATION**

<table>
<thead>
<tr>
<th>Level</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed high school</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Post secondary education</td>
<td>67 (71)</td>
</tr>
<tr>
<td>Graduate education</td>
<td>25 (26)</td>
</tr>
</tbody>
</table>

**ANNUAL HOUSEHOLD INCOME**

<table>
<thead>
<tr>
<th>Class</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower class ($0-$39,000)</td>
<td>8 (9)</td>
</tr>
<tr>
<td>Lower-middle class ($40,000-$59,000)</td>
<td>10 (11)</td>
</tr>
<tr>
<td>Middle class ($60,000-$79,000)</td>
<td>12 (13)</td>
</tr>
<tr>
<td>Upper-middle class ($80,000-$100,000)</td>
<td>26 (28)</td>
</tr>
<tr>
<td>Upper class ($100,000+)</td>
<td>37 (40)</td>
</tr>
</tbody>
</table>

*Participants were asked to choose all that apply.

**Sources used to Find Pregnancy-Related Nutrition Information**

When asked to indicate all the sources they used to find pregnancy-related nutrition information, most participants (96%) said they had used the internet (See Figure 1 below). Books were the next most popular source followed by midwives, which were each used by nearly half of the women. When asked what source they used most often to find nutrition information relating to pregnancy, 75% of participants said the internet. (see Figure 2 below).
Figure 1. Nutrition Sources Used by Pregnant Women

*Participants were asked to choose all that apply

Figure 2. Nutrition Sources Used Most Often by Pregnant Women

*Participants could only choose one answer
**Time of Seeking of Pregnancy-Related Nutrition Information**

When asked to indicate all the time periods during which they looked for nutrition information, nearly all the participants (94%) said they looked during their first trimester, while approximately 75% of women who had reached their second and third trimester searched for information during these times (See **Figure 3** below). When asked when they looked for nutrition information relating to pregnancy most often, the majority of the participants (77%) said during their first trimester, while the next most common seeking time was before becoming pregnant (See **Figure 4** below).

**Figure 3. Nutrition Information Seeking Times**

*Participants were asked to choose all that apply
*Values for the 2nd and 3rd trimesters are only based on women who had reached those stages of pregnancy
Figure 4. Most Common Nutrition Information Seeking Time

*Participants could only choose one answer
*Values for the 2nd and 3rd trimesters are only based on women who had reached those stages of pregnancy
Discussion

Introduction

The survey results provide a better understanding of where women in Ontario are looking for prenatal nutrition information, as well as when they are seeking this information. These insights can be used to develop better resources that are tailored to the needs of pregnant women today and address gaps in the timing of prenatal education.

Sources used to Find Pregnancy-Related Nutrition Information

This study showed that women used a variety of sources to find nutrition information, but the internet was used by almost all participants and it was the most frequently used source of information. Books and midwives were the second most popular sources. These findings are comparable with previous research in the U.S. (Huberty et al., 2013; Song et al., 2012), which found that 94% of women used the internet to find pregnancy-related health information, and studies in Italy and China (Bert et al., 2013; Gao et al., 2013), which found that 93% and 82% of pregnant women, respectively, used the internet to find pregnancy information. Two studies in the Netherlands also found that the internet was the most frequently used source of pregnancy information (Szwajcer et al., 2005; Szwajcer et al., 2008), and the latter study found that midwives and books were the second and third most popular sources. Conversely, one study in Australia found that less than half of women used the internet for pregnancy, birth and postpartum information, and instead midwives were the most popular source of information (Grimes, Forster, & Newton). The women in this study, however, were more likely to be seeing a midwife because they gave birth at The Royal Women’s Hospital, which offers midwifery care.

Family physicians were only consulted by just over a quarter of participants for prenatal nutrition information. Since the survey did not allow participants to provide any context to their
answers, it is unclear why such a small number of women received nutrition information from their family doctors. It is possible that doctors may not have provided nutritional advice, or that some women were seeing other health professionals, such as midwives, as their primary care providers during pregnancy. The Midwifery Association of Ontario assisted with recruitment for the survey, therefore the sample may have contained a large percentage of women who were receiving care from midwives.

The information sources used by women in this study were similar to that of women in other studies with middle to high incomes and education levels (Huberty et al., 2013; Song et al., 2012; Szwajcer et al., 2005; Szwajcer et al., 2008). Other studies have shown that sources used to find pregnancy-related information differ for low-income women in the United States (Lewallen, 2004; Shieh et al., 2009). The women in these studies reported using the internet less frequently and considered friends and family to be more important sources of pregnancy information. These women also faced numerous barriers to accessing pregnancy information which affected the sources they could use. No differences were found in sources used in the current study based on the participants’ incomes, but there were not many low-income participants.

This study confirms that information finding trends are similar in Canada, the United States, Italy, China and Netherlands, and adds to the current literature because it specifically asked about nutrition information, rather than general pregnancy information or health-related pregnancy information. It is important to know where women are finding nutrition information relating to pregnancy to ensure that these sources contain accurate and current information that will aid women in having a healthy pregnancy.
Time of Seeking of Pregnancy-Related Nutrition Information

This study showed that the first trimester was the most popular time that women looked for nutrition information, however most women reported looking for nutrition information in all trimesters of pregnancy. Less than half of participants looked for prenatal nutrition information in the period before becoming pregnant. Few studies that have explored when women are seeking pregnancy-related nutrition information but one study by Szwajcer et al. (2008) also found that women in their first trimester of pregnancy were more interested in nutrition information and sought more nutrition information than women in their second or third trimester or women trying to conceive. These findings are inconsistent with research in China, however, which found that although most women began to look for pregnancy information in their first trimester, they looked most frequently during their second trimester (Gao et al., 2013). Most women seem to be aware of their changing nutritional needs once they are pregnant, but this research emphasizes the lack of nutrition information-seeking in the pre-conception period.
Chapter 5: Results and Discussion – Interviews

Results

Introduction

Six participants were recruited through the online survey to take part in semi-structured telephone interviews. The interviews lasted between twelve and twenty minutes, with an average length of fifteen minutes. The interviewees were first asked a few questions about themselves. Next, they were asked how far along they were in their pregnancy, or how long ago they gave birth, and how their pregnancy was going or went overall. Then they were asked about where they looked for pregnancy-related nutrition information and where they found it. The rest of the interview questions elicited more detailed information about their personal experiences finding nutrition information online. Finally, the participants were asked for their ideas on how to improve the nutrition information found online for pregnant women.

In this chapter, the demographics of the participants will be presented first to provide some background information on the women who were interviewed. This will be followed by a description of where women looked for nutrition information online, when they were looking, and what type of nutrition information they were seeking. Then some common themes that emerged from the interviews will be presented alongside the participants’ recommendations.

Demographic Data of Interview Participants

The demographics of each of the six interview participants are displayed in Table 4 below. Each of the participants were given a pseudonym in place of their real name to protect their identity. The participants ages ranged from their late twenties to their mid thirties. All except one participant described their family background as Canadian, and they lived in a variety of urban and rural places across Ontario. All the women interviewed were either married or
common-law. They all had post-secondary education, with most having a graduate education, and their incomes were upper-middle or upper class (Maclean's, 2015). Half of the participants were still pregnant at the time of their interview, while the other three women were less than three months post-partum.

Table 2. Demographic Data of Interview Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Location</th>
<th>Marital Status</th>
<th>Highest level of Education</th>
<th>Annual Household Income</th>
<th>Pregnancy Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Francesca</td>
<td>31</td>
<td>Canadian/British</td>
<td>Eastern Ontario</td>
<td>Married</td>
<td>University</td>
<td>Upper-middle</td>
<td>17 weeks pregnant</td>
</tr>
<tr>
<td>Maryam</td>
<td>33</td>
<td>Canadian/Western European</td>
<td>GTA</td>
<td>Married</td>
<td>Masters</td>
<td>Upper-middle</td>
<td>39 weeks pregnant</td>
</tr>
<tr>
<td>Jodie</td>
<td>33</td>
<td>Canadian/British</td>
<td>Eastern Ontario</td>
<td>Married</td>
<td>Masters</td>
<td>N/A</td>
<td>7 weeks postpartum</td>
</tr>
<tr>
<td>Ariella</td>
<td>32</td>
<td>Polish</td>
<td>South-western Ontario</td>
<td>Married</td>
<td>PhD</td>
<td>Upper</td>
<td>10 weeks post-partum</td>
</tr>
<tr>
<td>Rebecca</td>
<td>28</td>
<td>Canadian</td>
<td>Central Ontario</td>
<td>Common-law</td>
<td>Masters</td>
<td>Upper</td>
<td>18 weeks pregnant</td>
</tr>
<tr>
<td>Nadine</td>
<td>32</td>
<td>Canadian</td>
<td>GTA</td>
<td>Married</td>
<td>Masters</td>
<td>Upper-middle</td>
<td>8 weeks postpartum</td>
</tr>
</tbody>
</table>

**Processes of Searching for Prenatal Nutrition Information**

**Location**

All of the women interviewed discussed the many ways they found nutrition information on the internet. Each of the participants said they used Google, often as a starting point when they had a nutrition-related question. Women then discussed how they would filter the search results for reliable information, as Maryam said, “*usually it was a Google search and then I looked at a couple of the top pages that came up and if they looked like reputable websites.*” Other participants discussed how they looked for information that had grounding in research, such as Francesca who stated, “*[for] the recommended dietary intake I went more towards scholarly articles…things that had been researched and had backing behind them.*”
Baby Centre was a website that was mentioned frequently by two thirds of the women interviewed. It was generally perceived to be a reliable source for pregnancy-related nutrition information. One woman explained how she and her partner selected well-known websites:

“...we would always look for it to be from a website that we trusted so, like the Government of Canada or you know, the Canadian Cardiac Society or something that was backing it a little bit. So you know where the data source was from.” (Jodie)

The same participant, Jodie, also explained how she trusted websites that she found in brochures at her doctor’s office and would use these as a starting point:

“If I looked at a brochure in my doctor’s office then if they had a website I would usually trust that website and then from there you might kind of start kind of bouncing and hopping around.”

Only one participant read nutrition information from an online chatroom, though she did not participate herself. The other women did not use online chatrooms for nutrition information, and a few indicated their skepticism toward these websites. For example, Maryam explained that she would look for, “reputable websites as opposed to a discussion page where a bunch of people were reporting their experience.” It was important to most of these women that the answers they found were based on research and not just someone’s opinion.

Timing

Although one woman started looking for nutrition information online when she was trying to conceive, the others used the internet only after becoming pregnant. Most participants tended to access the internet near the beginning of their pregnancies, as evidenced by this statement: “I would say when I first got pregnant I kind of went online to see generally whether or not there was any immediate changes in my diet” (Rebecca). While the internet was used most frequently at the beginning of pregnancy, participants also discussed how they looked
online throughout their pregnancies as questions or problems emerged. As Ariella said, “and so I did searching a little bit online at the beginning, but then also I guess as issues came up so as my iron started dropping or as you know when I got the cholestasis diagnosis”. Other women searched online later in pregnancy for information on weight gain and energy intake, uncommon foods consumed during the holidays, and foods that were safe to eat later in pregnancy. For most participants therefore, the internet was an important resource early in pregnancy, but continued to be used throughout pregnancy as well.

**Sources of Information**

The participants reported using the internet for a variety of nutrition-related topics, however some topics emerged more frequently. The most common topics searched for online were: iron, protein, calcium and dairy, energy requirements, and serving sizes. Two women described how they found information online indicating that iron intake should be increased during pregnancy. Two different women searched for advice on how to increase their iron after one found out she had low iron levels and one was diagnosed with iron deficiency anemia. Nadine explained, “I had anemia so I would use [the internet] to find out foods that had higher iron content and then just find different recipes that could allow me to ingest more iron throughout my pregnancy”.

Protein was another important research topic for two participants who were not consuming animal protein during their pregnancies. Rebecca, a vegetarian, discussed how she used the internet to find information about protein:

“I looked online to kind of get ideas of different protein sources specific to vegetarian diets that they recommended for pregnancy diet...especially just to get a better understanding as well I think of any sort of increased needs in the amount of protein.”
Two participants also researched online how many calories were necessary to consume throughout their pregnancies, and three participants searched for information on calcium and dairy intake, as they read that calcium should be increased during pregnancy and wanted to know which foods to consume to meet these increased requirements.

While all the women interviewed looked online for nutrition information, they all used at least one other source in addition to the internet. These sources included books, brochures, and phone apps, as well as consulting with health care practitioners, family and friends. This subset of women from the survey also consulted midwives and books most frequently next to the internet. Four women indicated that they had read books relating to nutrition and pregnancy, and two specified that they read books before becoming pregnant or early on in their pregnancies. As stated by Maryam: “I guess probably books...just kind of prior to becoming pregnant...I had looked at ‘What to Expect Before You’re Expecting’ which had some nutrition suggestions”.

Maryam considered books to be a trustworthy source of nutrition information. She went on to say:

“The cookbooks were just really early on and really chose those because those would be checked and would often times have a doctor associated with them before they could be published. So I trusted the information.”

Jodie also read a book which debunked common pregnancy myths. She explained that “it was written by a lady that had done some research regarding validity behind some things where they tell you ‘you can’t eat this or you can eat this during pregnancy’”. Jodie trusted the information in this book because the information was backed by research.

Four women consulted their midwives for nutrition information. Three of these women reported concerns with receiving nutrition advice from their midwives, including infrequent
visits and a lack of personalized support. These concerns will be discussed in the Lack of Support section below.

Family members and friends provided some nutrition information to about half of the women interviewed. Some women found their family and friends to be useful sources of nutrition information, such as Jodie whose family members were educated in health care:

“I would also ask my aunt [who] is a doctor. So, I did refer to her for some information...and my husband is training to be a nurse. Sometimes I think I also referred to him or some information that he had during schooling.”

Francesca, however, did not feel that her family or friends were helpful when it came to prenatal nutrition information. She commented, “I can’t really say anybody that I talked to was overly educated on the topic.” The usefulness of family and friends seemed to vary depending on their knowledge and educational background.

Pregnancy apps on cell phones were another source of nutrition information used by three of the participants. Two of these participants specifically mentioned using the Ovia app (Ovia Health). This app mainly provides information about babies’ growth and development, but it also provided these women with some recipes and food safety information. The app also provides guidelines for food group and nutrient intake and allows women to track their diets during pregnancy to see if they are meeting their requirements.

In addition, two participants talked to their family doctors about nutrition during their pregnancy. Both these women explained how they would ask for their doctor’s opinions on information they found online, as explained in this excerpt from Jodie:

“If I found contradictory information, then I would then probably refer to, you know, either my doctor or as I said my family member who is a doctor...to try and confirm the contradictory information and find out what was actually accurate.”
Women’s Reflections on their Experiences Seeking Prenatal Nutrition Information

Convenience

The participants consulted a variety of sources to find pregnancy-related nutrition information, however these sources had some drawbacks which led them to seek information online. The most common reason for using the internet mentioned by all the participants was convenience. A couple participants discussed the convenience of accessing food safety information online when eating out or grocery shopping using their cell phones. Other participants explained how they would look for information online because it was the fastest way to find an answer.

The participants described a few different scenarios when they used the internet while they were out, such as in grocery stores and restaurants. For example, Maryam said: “I know there are lots of concerns around fish and mercury levels... so just double checking a particular kind of fish that are really easy to check on the phone like when you’re at a restaurant. Like oh wait a minute! Is this okay to eat?” Nadine also researched food safety information when she ate out at restaurants or other people’s homes. The ability to check the safety of foods quickly on one’s phone made these women more comfortable and confident eating away from home during their pregnancies. Maryam and Nadine also accessed the internet on their phones when they were at the grocery store. For example, Maryam researched the safety of herbal teas before purchasing them:

“I had thought herbal teas were fine only then to be out with my sister and a colleague of hers said, ‘oh actually that’s one you should avoid!’... and so again, standing in line in the aisle at the grocery store googling quickly, ‘oh yes, is this good for pregnancy or not?’”

Nadine researched whether she should consume Caesar salad dressing while at the grocery store as well. She described the benefit of finding information immediately online:
“So with my midwife sometimes they could take 24 hours or a little bit longer...to get an answer back and most of the time like if I was in the grocery store I wouldn’t wanna wait three days find out...if I could have Caesar salad dressing whereas if you just google it the answers right there.” (Nadine)

Two other participants also discussed how the internet saved them time. Rebecca explained that she liked looking online because “it’s easier to fit it in [her] day” than to go see her midwife every time she had a nutrition-related question. Jodie also found that finding information online fit her busy lifestyle, saying:

“...I could do it when I needed to so when I was still at work and other things like that. You’re trying to juggle time frames so being a teacher trying to get to anything during business hours is not the easiest thing in the world.”

Jodie lives in a rural community so her doctor’s office and other community resources were not close to home. For this reason, she found the internet was “the easiest way to gather information...in [her] community.” The benefit of accessing information anytime, anywhere, was a major advantage of the internet over other sources of nutrition information among this population.

**Lack of Support**

As indicated previously, three women felt that their health care providers (ie. family physician, midwife, obstetrician) did not provide any or adequate nutrition information, and for this reason they turned to the internet. Ariella commented on the lack of support she received from her physician when she first became pregnant:

“I was pretty surprised at how nobody tells you anything like when you’re-I was imagining you’d get pregnant and your doctor would give you a whole bunch of pamphlets and like know how to eat and which foods to avoid...but none of that really happens. You’re kind of left to your own devices...and so I did searching a little bit online...at the beginning.”

Ariella was also diagnosed with obstetric cholestasis (OC) later in her pregnancy, a condition where bile does not flow adequately out of the liver, leading to a build up of bile acids and
causing extreme itchiness (American Liver Foundation, 2016). The cause of OC is unknown and there is no cure except giving birth. There is, however, some evidence that certain dietary changes, such as reducing fat consumption, can help alleviate the symptoms. Ariella felt that her health care providers did not supply her with enough up-to-date nutritional advice regarding this condition:

“I felt like my midwives and also the obstetrician I was referred to they didn’t have very much information about it especially nutritional information...‘cause they I guess usually go by general guidelines...but if there’s more recent literature they aren’t always up-to-date with it so I...kind of had to search that on my own.”

Another participant looked to her midwife for nutrition information but also did not find her answers very helpful, as evidenced by this comment:

“I would email my midwife to ask if I had any questions but a lot of the times their answers were more either generic based on the answers from Health Canada...or just kind of saying that it’s a personal choice or a personal decision.” (Nadine)

Both Nadine and Ariella felt that their midwife or Obstetrician’s answers were too general, leading them to do their own research online. Finally, Rebecca explained how she was seeing her midwife once a month and this simply was not frequently enough to answer all her nutrition-related questions.

**Trust**

Most of the women interviewed seemed to be confident in finding credible information online. Three participants explained how they would look for research articles or websites that cited research articles. Some other websites the participants found nutrition information on were: Baby Centre, Government of Canada websites (including Canada’s Food Guide), The Bump, What to Expect When You’re Expecting, websites by Dietetic Associations, the Canadian Cardiovascular Society and Web MD. Some participants recognized, however, that choosing
credible websites may be more difficult for other people. For instance, Jodie noted that, “if you didn’t know how to filter your sources, then it could be a lot more confusing.” This view was shared by Maryam who said, “you have to do your research and you have to know a little bit more in order to be able to make that distinction online.” Maryam went on to suggest that women should read a few books prior to seeking information online. Francesca agreed that the internet should not be the first source of prenatal nutrition information, saying: “I always recommend first talking to your OB or midwife”, further emphasizing the participants’ weariness of the internet.

The participants often spoke about how they would look for answers from more than one source before accepting it as truth, suggesting that they had trouble believing any one source. Two participants also explained how they would look at more than one website on the same topic, such as Rebecca who said, “I like to be able to look at multiple different sources so it’s been a really quick and efficient way to look at different sources to try to see whether or not there’s consistency between them”. These women obviously did not feel confident trusting information from just one website.

In addition, a couple women used the internet to confirm information from apps, family and friends. For instance, when talking about receiving nutrition information from the Ovia app on her phone, Jodie explained that it was American-based and therefore she “would usually go off and go check on the internet for Canadian information or some other source to confirm that.” Jodie used what she found online to supplement the information provided by the app. Maryam also used the internet to verify information that she received from family members and friends, saying “I guess or something that someone said that I was able to confirm online and say ‘Oh I better avoid that.’” Maryam was also told by an acquaintance that a certain herbal tea was not
safe to consume and she checked online to confirm this, further demonstrating her skepticism toward advice provided by other people.

As discussed in the previous section, Ariella and Nadine did not receive sufficient advice from their health care providers and went online to find more detailed and current information. Conversely, two other participants discussed how they would confirm the information they found online with doctors or midwives. For example, Jodie said: “if I found contradictory information then I would probably refer to either my doctor or as I said my family member who is a doctor to try and confirm the contradictory information and find out what was actually accurate.” Maryam also specified that she would confirm with her health care provider when she found contradictory information on the internet. These two women seemed to trust their doctors to help them make decisions.

**Frustration**

All the participants found their experiences searching online to be positive overall, but four women indicated that they felt frustrated at least once when searching for prenatal nutrition information. Frustration was connected to the negative attitudes and over-cautioning found online, not being able to find information on certain topics, and navigation issues. For example, one participant expressed her frustration with finding out that more and more foods were off limits during her pregnancy when she said, “oh great! Another thing that pregnant women are probably not supposed to have!” (Maryam). Maryam also felt that the opinions expressed online were often overly cautious. She commented: “there are risks with a lot of different foods but if you cut everything out then you aren’t going to be getting proper nutrition.” Maryam worried that the negative attitudes would scare some women into avoiding foods that could be beneficial for them and their baby.
The participants were usually able to find the nutrition information they were looking for online, but there were a few exceptions. One participant found that more information was American-based and was unable to find information on some Canadian products. Another participant wanted to research different types of prenatal vitamins and could not find much help with this online. A vegetarian woman had trouble finding suggestions for increasing protein during pregnancy that did not include animal protein. She found that she was reading through numerous websites and “digging through a lot of information that didn’t apply to [her] and [her] diet” (Rebecca). Ariella also had difficulty finding nutrition information specific to her needs. When researching how diet and nutrition could impact cholestasis she commented that she sometimes felt frustrated due to “how little there was known about it” and the “lack of clarity around what’s helpful and what isn’t.” The prenatal nutrition information found online seems to be aimed at the general population, making it harder for people with uncommon diets or conditions to find nutrition suggestions for their pregnancy.

Finally, Nadine shared her frustration with going on websites on her phone saying, “the one thing I found was on my phone that some of the websites were locked and you couldn’t scroll through the information.” Since Nadine primarily used her phone to access the internet, she simply avoided those websites that she could not navigate on a mobile device.

Confusion

The participants all agreed that for the most part the nutrition information they found online was clear and easy to understand. Some of the women, however, noted that they came across some confusing or contradictory information. Discrepancies often occurred when it came to amounts of nutrients or serving sizes. For instance, “one [website] might say you could have two cups of coffee and somebody else might be like oh, well it’s more like three cups of coffee”
(Jodie). This could make it difficult for the women to decide what recommendations they should follow. Rebecca also found that some of the suggested serving sizes for plant-based proteins were unrealistic:

"Sometimes the serving sizes that they talk about are a little bit strange...like I’ve seen some websites for instance where they’ll tell you these are the different servings sizes for proteins, for vegetarian ones double it and I’m looking at it thinking that’s a really huge amount of yogurt to eat or almonds to eat."

In addition, sometimes the recommendations were not specific enough which made them difficult to apply. Nadine comments on this lack of clarity saying:

"even further in my pregnancy I was looking up what my calorie intake should be...and what that would look like, like if it was just adding another yogurt or how much milk do you really need to drink."

Although Nadine found out how much to increase her calories, she was unsure about what she should consume to meet her increased requirements.

**Worry**

Five women used the internet to find which foods they should avoid during pregnancy. Two of these women mentioned feeling concerned that they might eat something bad for their baby, while another woman was worried about providing her baby with enough nutrients without consuming meat. Maryam discussed how she was most worried about her food choices near the beginning of her pregnancy when there was a greater chance of losing the baby, but then felt more relaxed later:

"...there are things you should avoid early on because of concerns that you know getting food poisoning could cause miscarriage and then more questions of okay, are there some things that I can actually have because things are okay and I’m less worried."

Nadine became worried she might eat something bad by accident because some websites recommended ingredients to avoid during pregnancy but did not specify in which foods they are
found. Her concern is expressed in this example about egg yolks: “unless you looked at the package and you could find out that there was frozen yolk in Caesar salad dressing you probably would still eat it and not really realize that’s probably something you should avoid.”

Furthermore, one participant became more worried about her dietary choices when she could not find much information online pertaining to a vegetarian diet:

“...you see so many things recommending all of these meat sources sometimes it kind of can get you to question yourself or make you concerned you know...that you’re not going to meet your weight gain targets” (Rebecca)

Because it was hard for Rebecca to find information about consuming plant sources of protein while pregnant, she felt increased anxiety around eating during her pregnancy.

**Self-Confidence**

Four participants explained that they had some knowledge about consuming a safe and healthy diet while pregnant from their own education, family members, or books they had read. The information they found online, therefore, did not drastically change their beliefs about eating and nutrition during pregnancy. For instance, one participant said: “in my undergrad I did one nutrition course where we talked about nutrition during pregnancy so I kinda had...some general understanding already...going into it” (Ariella) and another participant explained: “I have a nursing background so I...kind of know a little bit about what I’m supposed to be eating.” (Francesca) These women mainly used the internet to ask questions specific to their nutritional needs, not for general information on healthy eating.

Three participants also discussed how they trusted themselves to make dietary decisions during their pregnancy. Francesca explained that her family and friends did not know much about nutrition and pregnancy “so that’s why [she] kind of stuck to [her] own knowledge and information.” Jodie also felt confident making her own choices. When she came across
contradictory information she said: “I usually just either referred to my other experts and then made the personal position on what I thought I was going to do and did that.” Similarly, Maryam used her own judgement when dealing with contradictory information:

“I guess I could find contradictory pieces and would confirm with my health care provider…but there was always something that you’d think, okay that’s a bit more information that I can put into the process and I think I can make a pretty informed decision from that.”

These women looked for nutrition information from multiple sources but ultimately made their own decisions based on what they thought was best for them.

**Positive Change**

Although the women’s beliefs about nutrition during pregnancy were not greatly altered by what they read online, most of them used the information they found online to make changes to their diets. Four participants explained how they increased their intake of iron, calcium and protein due to information they read online. Nadine, who was researching iron-rich foods, made another discovery while searching for this information:

“I found that it said that if you had foods high in iron with vitamin C at the same time that it helps absorb it more so that would be something else that I had kind of done more research on and was able to change.” (Nadine)

Due to her research, Nadine was able to make another change to her diet that helped her body absorb more iron. Moreover, Ariella made a more drastic change to her diet when she found research online suggesting that a plant-based diet may help with obstetric cholestasis. Since Ariella’s midwife and obstetrician were not very knowledgeable about how nutrition may impact cholestasis, the internet was a key resource in helping her make dietary changes.

Four women also researched which foods to avoid while pregnant and consequently removed these foods from their diet. For example, Nadine found out online that she should not consume raw egg yolk while pregnant and went on to research which foods contained raw egg
yolks so she could remove these items from her diet. Other food items that were avoided by the participants were some types of fish, some types of herbal teas, soft cheeses, alcohol, and large quantities of caffeine.

In contrast, Jodie explained: “caffeine I thought should be just completely cut out...but I learned that it was okay to probably have a cup or something a day.” Jodie had heard in the past through friends and family that caffeine should be completely avoided during pregnancy but through her online research she found out it was safe and therefore she did not remove all caffeine from her diet.

**Ideas for Improvement**

The women were asked to indicate the changes they would like to see to pregnancy-related nutrition information found online, and their suggestions stemmed from some of the problems outlined above. Three women commented that they would like the prenatal nutrition information online to be better organized and more inclusive. Jodie suggested, “one database where all that information could be all linked together in one spot could make things easier and handier for people to find everything.” Rebecca, who had trouble finding information specific to a vegetarian diet, thought it would be helpful “if some of those websites were organized based on the diversity of women’s dietary needs.” Similarly, Ariella thought the nutrition information should be arranged based on different complications or conditions that women may have during pregnancy. She suggested a website where women would indicate “if you have any complications for your pregnancy and how that might impact your nutritional needs.” Both Rebecca and Ariella needed more personalized access to information. They felt that the prenatal nutrition information available online was aimed at pregnant women in general and often failed to include those with special dietary needs. This is evidenced in the statement, “most sites only
cover the basics that apply to everybody” (Ariella). These women were eventually able to find some nutritional advice specific to their needs, but could they have saved time and reduced their frustration if the information had been better organized.

Selecting credible sources and trusting information found online was a challenge that was discussed by a few women. Jodie thought that places for women to share their stories and experiences were beneficial to some people, but felt it was important that women can also find scholarly sources. When she suggested a database containing all the information on nutrition during pregnancy, she also suggested that this information first be deemed credible “so you don’t have to search it, specifically finding it on numerous different websites all over the place.” Such a space could assist women who do not have the knowledge or skills to filter through websites on their own. Maryam also felt that all the unreliable information available online was a huge issue but thought this would be difficult to fix since “the internet is the wild west” and anyone can post information online. Instead of changing the information she believed that it should be the responsibility of health care providers to “make sure that clients have good digital literacy skills.” Whether it is a change in the information available or in people’s abilities to access information, these women believe something needs to be done to aid other pregnant women in finding accurate nutrition advice.

Finally, three women felt there could be more advice online about which foods are good to consume during pregnancy and suggested serving sizes of these foods. Francesca would like to see, “something that shows serving sizes and portion control and how much food is in a so-called serving”, as she believed many women do not have a good understanding of recommended serving sizes. Nadine also commented that “[the internet] just said eat healthy” and she “would have preferred that it was more specific...so actually telling you what foods and
“I think we need to be a little more nuanced about how we speak about that because there are positive things that come from it, from certain types [of fish] and so to figure out which are the good the things we should be adding into our diet and the things we should be avoiding.”
Discussion

Introduction

This is the first Canadian study to explore women’s nutrition information-seeking behaviours during pregnancy and to specifically ask about their experiences seeking this information online. Overall, the participants felt that the internet was a useful source of prenatal nutrition information. They were confident in narrowing down search engine results by choosing well-known websites or information that was backed by research. These women sought nutrition information mostly near the beginning of their pregnancies, but also periodically throughout their pregnancies. They reported convenience as the main reason for using the internet to find this information. Seeking information online was not always a positive experience, however, and sometimes led to frustration, confusion and worry. Nonetheless, some participants were confident in taking all the advice they received and making their own decisions about what to eat. Other sources of nutrition information were discussed as well. Health care providers typically did not provide enough nutritional support. Books were often viewed as the most trustworthy source, while nutrition advice found online or received from health care providers, family, friends and apps often needed to be confirmed elsewhere. These findings are comparable with other research on information-seeking behaviours of pregnant women but also provide some novel insights.

Online Sources

The participants in this study discussed the convenience of finding information online as a major motivator for using the internet. Bert et al. (2013) also found that speed and ease of use were some of the main reasons women sought pregnancy information online. With more women in the workforce today than previously, making a trip to see a health professional or gather
printed materials is difficult for women to fit into their schedules. The internet is therefore a useful source because women can access information online while at work or outside of work hours.

A couple women commented on the convenience of accessing prenatal nutrition information on the internet using their mobile devices. These women looked up food safety information on their phones while in a grocery store, restaurant or friend’s house. This method of accessing information instilled feelings of comfort and confidence in these women, as they could make informed choices while away from home. No other sources can be accessed as quickly and in so many locations, making this a benefit exclusive to the internet.

The participants’ primary method of searching for prenatal nutrition information online was through Google searches. Three previous studies in the U.S. and Italy also found that almost all their participants used internet search engines to find pregnancy information (Bert et al., 2013; Huberty et al., 2013; Song et al., 2012). The women in the present study would filter the search results by looking for well-known websites, government websites, or scholarly articles. Similarly, pregnant women in the U.S. reported looking for pregnancy information on government websites, research articles, well-known websites, such as BabyCenter, and websites written by health professionals, such as WebMD (Bert et al., 2013; Song et al., 2012). Some women from both of these American studies participated in online discussions relating to pregnancy. Contrastingly, none of the women in the current study reported being involved in online discussions about nutrition during pregnancy. Only nutrition-related topics were asked about in the present study, while women in other studies discussed general pregnancy-related topics online, such as fertility (Song et al., 2012).
The nutrition-related topics searched for most frequently by this group of women during their pregnancies were iron, protein, calcium and dairy, energy requirements, and serving sizes. Only one other study in the Netherlands (Szwajcer et al., 2008) has asked women which nutrition topics they looked for online while pregnant. They found that women searched for information on raw meats, cheeses and fresh food most often, however these topics were chosen from a set list of topics presented in a questionnaire. The present study used qualitative methods, which likely elicited a more accurate range of topics since participants were not limited in their choices.

Many women also searched for information on which foods to avoid while pregnant. A couple of participants became worried they might eat something that could harm their baby after reading about it on the internet. Other studies have shown that worry and anxiety are associated with seeking general pregnancy information on the internet. A multinational study of internet use in pregnancy (which included participants from the UK, Australia, New Zealand, the U.S and Canada) found that anxiety was a recurring theme and was often linked to reading too much negative information (Lagan, Sinclair, & Kernohan, 2011). A Swedish study also found that two thirds of their participants experienced feelings of worry after they read pregnancy-related information online (Bjelke, Martinsson, Lendahls, & Oscarsson, 2016). A key finding from the present study was that women felt internet sources placed a greater focus on food avoidances and a smaller focus on what women should be eating. The negatives attitudes found online caused some participants to worry about their eating habits. One participant who felt worried about what she consumed also expressed her frustration with the negative attitudes found online toward eating and pregnancy. These results suggest that while it is important women know which foods to avoid, an emphasis on food avoidances is undesirable, as it can lead to negative emotions of frustration and worry in pregnant women.
The interviews also highlighted that there is a lack of diversity in the prenatal nutrition information on the internet. Women who followed unconventional diets, such as vegetarianism, or who had health conditions that impacted their nutritional requirements became frustrated and worried about their diets when they could not find enough advice online specific to their needs. The negative messages found online and the lack of diversity in dietary recommendations are unique findings to this study, as there is not much research on the content of prenatal nutrition information available online.

Regardless of these drawbacks, all the participants were able to use some prenatal nutrition information they found online to make changes to their eating habits. Previous research has found that online pregnancy information aids women in making decisions and changing their lifestyles (Bert et al., 2013; Lagan et al., 2011). Researchers in the U.S. found that pregnant women were more confident deciding what to eat after doing research online than they were prior to their research (Huberty et al., 2013), but they did not ask what specific changes the women made to their diets. This study is the first to find that the internet played a key role in helping women increase their intake of certain nutrients and plant-based foods, avoid unsafe foods and maintain a healthy diet throughout pregnancy.

**Consulting with Health Professionals**

Some women in the present study were skeptical about online sources of nutrition information, although most were confident in finding credible websites. Previous research in Italy and Sweden and the multinational study (described previously) found that most women consider the internet to be a reliable source of pregnancy information (Bert et al., 2013; Lagan et al., 2011; Larsson, 2009). Other studies in the U.S. and Canada found that most women are skeptical of pregnancy information found online (Bernhardt & Felter, 2004; Dhillon,
Albersheim, Alsaad, Pargass, & Zupancic, 2003). Research results from China have reported that most women consider online sources of prenatal health information to be reliable, but not until they confirm the information with another source (Gao et al., 2013). This is similar to research in the Netherlands (Szwajcer et al., 2005), which reported that pregnant women often discussed nutrition with midwives when contradictory or incomplete information was found through another source. A few women in the present study also confirmed with their health care providers when they found contradictory information online. These women seemed to trust their health care providers’ opinions. Half of the participants did not discuss the details of the nutrition information found online with their health care provider. Other studies in China and the U.S have also found that many women do not discuss the information they find online with their health care providers (Gao et al., 2013; Huberty et al., 2013), yet almost all women in the American study by Huberty et al. (2013) believed that health care professionals should provide recommendations to pregnant women about where to find pregnancy information online. One women in the present study also strongly believed that health care providers should play a greater role in assisting patients with finding accurate information online.

**Other Information Sources**

In addition to the internet, women consulted books, brochures, phone apps, health care practitioners, family and friends for pregnancy-related nutrition information. A couple of women indicated that they had read books before becoming pregnant or near the beginning of their pregnancies. This differs from research by Szwajcer et al. (2005; 2008) which found that women trying to conceive or in their first trimester often sought nutrition information online versus in books due to the anonymous nature of the internet. Similar to the current study, however, the
women in these European studies also believed that information from books was more trustworthy.

Half of the women interviewed said they received prenatal nutrition information from apps on their phones. Other studies in the U.S. and Australia have shown that the majority of women (63% and 73%, respectively) use pregnancy apps when they are expecting, most often for information on fetal development (Demirci, Cohen, Parker, Holmes, & Bogen, 2016; Lupton & Pedersen, 2016). Lupton and Pedersen (2016) found that a third of the women in their study used pregnancy apps to keep track of their diet or weight gain during pregnancy but their survey did not ask if they received nutrition advice from the apps. The present study is the first to show that women use pregnancy apps as a source of nutrition information.

Some women consulted their midwives for nutrition advice but were disappointed with the information they received. They found that midwives did not provide the personalized nutrition advice that they were hoping to receive. Women in the Netherlands also reported that midwives were not helpful when it came to providing nutrition information (Szwajcer et al., 2005). These European women found general nutrition recommendations on their own prior to consulting with midwives and thus were looking for more specific nutrition advice from their midwives but they too did not receive it.

Studies in the Netherlands also show that doctors and obstetricians are not rated as top sources for prenatal nutrition information (Szwajcer et al., 2005; Szwajcer et al., 2008). Women in the U.S. were also disappointed with the health-related pregnancy information provided by their doctors and obstetricians and consequently turned to the internet for answers (Song et al., 2012). A couple women in the present study reported that their doctor or obstetrician did not provide adequate nutritional advice, leading them to do their own research online. This aligns
with research by White et al. (2006) and MacDonald et al. (2011) which showed that prenatal education by health professionals in Canada is lacking regarding nutrition and weight gain. Doctors and obstetricians are commonly consulted for prenatal nutrition advice, especially for pregnant women who do not have regular access to the internet (Lewallen, 2004; Shieh et al., 2009), but evidently do not always provide enough assistance in this area.

After consulting numerous sources, some women in the current study explained how they trusted themselves to make the final call on nutrition-related decisions during their pregnancy. Other studies have reported that women consider themselves important resources of pregnancy information, but these are typically women who have been pregnant before (Lewallen, 2004; Szwajcer et al., 2008), whereas the women in the present study were all pregnant for the first time. It is possible that the confidence these women had in themselves to make nutrition-related decisions is associated with their higher socio-economic status. Research has shown that women with higher education and incomes are more likely to make their own decisions (Hossain, 1998) and participate in more health-promoting behaviours (Bilgili & Ayaz, 2009; Li, Darling, Maurice, Barker, & Grummer-Strawn, 2005; Lim, Sung, & Joo, 2010; Wyatt et al., 2000). Self-confidence is an important quality for pregnant women to have because they are often faced with many choices regarding their health and diet and need to be able to decide what will be best for them.
Chapter 6: Conclusions & Recommendations

Strengths & Limitations

Sample Population

Recruitment for the surveys took place through a variety of places, including community health centres, public health centres, CPNPs, midwifery practices, online pregnancy forums, and Facebook groups, but there was a lack of diversity among the sample population. Specifically, the sample consisted of mainly Caucasian/European married women with high educations and incomes. Most responses for the survey were recorded when advertisements were posted online, which could have led to a sample of more frequent internet users.

Because some of the participants were still pregnant at the time of the survey and interviews they were not able to provide answers based on their entire pregnancy. This can also be viewed as a strength, however, as recruiting participants who were pregnant or less than three months post-partum reduced the likelihood of recall bias.

Unfortunately, only six participants were recruited from the survey to take part in an interview. The interview participants were from a range of urban and rural places across Ontario, however, which meant that their access to prenatal resources differed. They also consulted with different health care professionals. Since the participants’ resources and use of health care professionals differed the interviews captured a range of experiences seeking prenatal nutrition information.

Data Collection & Analysis

The survey allowed for collection of data from a large number of women and although it cannot be generalized to all women in Ontario or Canada it provides a good understanding of where and when women are looking for prenatal nutrition information. The survey did not allow
participants to provide context to their answers, but this is why a subgroup of women was interviewed. The open-ended questions allowed the participants to share detailed information. They were also invited to add in any comments or concerns at the end that were not addressed throughout the interview. One-on-one interviews were appropriate because each participant could discuss their own unique experiences.

Conducting interviews over the phone has limitations, as the interviewer cannot interpret facial cues or body language. Telephone interviews were also beneficial to this research, however, because it allowed for collection of data from a wider geographical area. One-on-one interviews were also appropriate for this research because they gave the women privacy to discuss details of their pregnancy.

The interview data did not reach saturation, but the women discussed many recurring themes. Their experiences cannot be generalized to the larger population of pregnant women in Ontario, but they bring light to how the internet is used to find prenatal nutrition information and some of the issues women face seeking this information.

This was the first study to examine women’s nutrition information-seeking behaviours during pregnancy using both a quantitative and qualitative perspective. This mixed-method approach allowed for the collection of factual data from a large number of women, followed by more detailed accounts by a subset of these women, which led to a comprehensive picture of women’s experiences seeking prenatal nutrition information.

Recommendations

This research study revealed important issues associated with searching online along with some gaps in nutrition education for pregnant women. To address these concerns, follow-up
actions for the provision of prenatal nutrition education and directions for future research have been identified.

**Information Seeking**

The sample of women in this study was very homogeneous, with high incomes and education levels. As mentioned in the discussion, studies on women with lower incomes in the U.S. found that they consulted different sources for pregnancy information. Future research should attempt to include populations with lower socioeconomic status to determine if there are differences in the types of sources used by these women in Canada.

This sample of women frequently consulted books for pregnancy-related nutrition information. While many women reported difficulty with trusting information from the internet, apps, friends, family and health care professionals, books were viewed as a trustworthy source. Women should be encouraged to continue reading books as an initial resource for prenatal nutrition recommendations to provide them with a solid foundation of trustworthy nutrition information.

Although the internet was the top source for prenatal nutrition information, some women expressed uncertainty about the information available online. This was one of the few studies to ask women what specific nutrition topics they looked for online. More research with a larger sample of women should be conducted to determine which nutrition topics women are seeking information on most often during pregnancy, and the quality of this information on the internet should be analyzed to ensure it is accurate and up-to-date.

The participants indicated that they were seeking nutrition information throughout their entire pregnancies. It is therefore important that women have sufficient nutritional support at each stage of pregnancy, whether this be from health care providers or through written materials.
Moreover, most of the participants did not seek nutrition information prior to becoming pregnant. Recent studies show associations between women’s preconception nutrition and weight status and fetal growth and development (Grieger, Grzeskowiak, & Clifton, 2014; King, 2016; Weisman et al., 2011). Hence, efforts should be made to encourage women to think about their nutrition and make necessary changes prior to becoming pregnant. This conversation may need to be initiated by health care professionals, since most women are not seeking this information on their own in places such as books or the internet.

**Online Resources**

The participants identified a need for simplified access to credible information online. One possible way to address this issue would be the creation of a space on the internet for prenatal nutrition information where each source must undergo a review process before being included. Such a space could improve women’s trust in the material they read. This is important because research has shown that women who have more faith in the information they read are more likely to make changes to their behaviour (Bert et al., 2013).

Bert and colleagues (2013) also found that the women in their study who participated in online discussions were more likely to change their health-related behaviours during pregnancy. None of the women who were interviewed discussed their nutrition or dietary needs with other women online. It may be beneficial, however, to encourage women to participate in online discussions about nutrition during pregnancy as it may encourage them to make healthy changes to their diets.

To promote healthful behaviour change, authors of online resources should adopt a more positive approach when making prenatal nutrition advice, whereby they not only caution women against certain foods but they also provide recommendations of foods and meals that are safe for
pregnant women to consume. Other females have indicated a preference for positive health promotion messages over negatively worded messages (Ranney et al., 2014), and Bull et al. (2001) found that encouraging written materials are associated with more behaviour change, further emphasizing the importance of positive messages.

In addition, Bull et al. (2001) found that when written materials are tailored to individuals they are more likely to change their behaviour. The participants expressed a desire for more individualized dietary recommendations online, which would include suggestions for women with different dietary patterns and pregnancy complications that may affect their nutritional needs. Increasing the diversity in prenatal nutrition recommendations could also alleviate feelings of frustration and worry, as these negative emotions sometimes emerged when women could not find information specific to their needs. Future research should also investigate whether online dietary advice for pregnant women is culturally diverse, as the women in the present study were mostly Caucasian.

The small number of women interviewed made it difficult to determine overall which factors (eg, types of websites, time of seeking) may have played in role in helping women change their dietary behaviours. Future studies should concentrate on uncovering which components of online resources help women to change their eating habits both before and during pregnancy, as this is the ultimate purpose of providing women with information on prenatal nutrition.

**Professional and Social Support**

Some participants felt that their health care professionals, specifically midwives, family physicians and obstetricians, did not provide enough personalized nutritional support. Current education for midwives in Ontario does not include any courses specific to prenatal nutrition,
however nutrition is covered in other courses and graduates are expected to have extensive nutrition knowledge (N. Bennett, personal communication, October 30, 2017). Perhaps midwifery education needs to include a greater focus on the range of diets and conditions that can impact an expectant mother’s nutritional needs. It is unclear how much nutrition education is provided in Canadian medical schools, however some participants did not receive adequate nutrition advice from their physicians and obstetricians. Physicians, therefore, may also require more nutrition education in medical school and more training in providing nutrition counselling. They may also need to provide more opportunities during prenatal visits to discussion dietary practices with their patients. Another possibility would be to include Registered Dietitians more frequently in routine prenatal care practice. Research in Ontario has found that although most Community Health Centres and Family Health Teams have a dietitian, the dietitian is not always involved in prenatal care (Coady, 2015). Dietitians are, however, more frequently involved in individual and group education that is targeted at vulnerable populations (City of Toronto, 2017). Increased involvement of dietitians could help fill this gap in nutrition education, as dietitians are specifically trained to provide nutrition counselling and guidance while taking into account each person’s individual situation (Dietitians of Canada, 2017).

Women should be encouraged to discuss the retrieval and content of online information with a health care professional or a friend/family member to increase their trust in the information they read, resolve discrepancies and decrease worry. As indicated by the interviews, finding credible information online can be challenging. Health professionals should guide their patients in their online searches to ensure they are seeking accurate and current nutrition advice. Such guidance could help women find information that they trust, which, as explained earlier, is associated with changes in behaviour (Bert et al., 2013). Speaking with a health care professional
also helped women in the current study and in past research (Szwajcer et al., 2005) determine what to do when they found contradictory information online, and Bjelke et al. (2016) found that speaking with a midwife, friend or family member can decrease feelings of worry caused by reading pregnancy-related information online. Women should be encouraged to discuss nutrition information found online with their health care providers, and health care providers should be open to discussing this information with their patients.
Summary

This research describes women’s current information-seeking behaviours in Ontario in relation to prenatal nutrition advice, and provides details on their experiences seeking this information. This study highlights the use of the internet as a main source of prenatal nutrition information. Challenges relating to seeking prenatal nutrition advice were identified along with recommendations to improve access to and provision of this information.

Pregnancy was identified as a time when women are seeking information on prenatal nutrition. This study identified a gap in information-seeking, however, as most women did not seek nutrition information during the preconception period. Women should be encouraged to adopt healthy eating behaviours prior to conception as their nutrition during this time may impact the health of their future baby.

The internet was found to be the preferred source for pregnancy-related nutrition information, mainly due to its convenience. It was the first study to elicit some details on the content of prenatal nutrition information available online. Some concerns were identified including difficulty finding information on specific diets and conditions, contradictory information, and negatively phrased messages, which led to feelings of frustration, confusion and worry. To address these concerns, women require simplified access to credible information online, more diversity in dietary recommendations available online and a more positive approach toward eating and pregnancy.

Women often collaborated with midwives, obstetricians or family physicians in addition to using online resources, but some women reported inadequate nutritional support from their health care providers. This suggests that prenatal care needs to focus more heavily on nutrition,
whether this be through increased education of midwives and doctors or through greater inclusion of dietitians in routine prenatal care.

Regardless of the issues identified, some women felt confident making their own dietary choices. This was one of few studies to show that women made positive changes to their diets after reading prenatal nutrition information online and shows promising results for using the internet to promote positive dietary changes.

This research adds to the current literature by providing a more detailed understanding of women’s personal experiences seeking prenatal nutrition information. The findings can be used to improve the quality of pregnancy-related nutrition information found online and to provide all health professionals with a better understanding of women’s needs for prenatal nutrition education. These changes will help promote positive dietary changes in women that could have profound effects on the health of mothers and their babies.
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Appendix A: Research Questions

Questions for the Online Survey:

1. What sources are pregnant women in Ontario using to find pregnancy-related nutrition information, as assessed using an online survey?
2. When are pregnant women in Ontario accessing pregnancy-related nutrition information, as assessed by an online survey?

Questions for the Interviews:

1. What are the experiences of primiparous pregnant women in Ontario with using internet sources of pregnancy-related nutrition information, as assessed by a semi-structured interview?
   a) How, when and why are these women accessing internet sources of pregnancy-related nutrition information?
   b) How well do women understand the pregnancy-related nutrition information they read on the internet?
   c) How do women feel when reading this information?
   d) How did accessing these resources change women’s thinking and behaviour?
   e) What components of the information do women consider to be helpful for promoting understanding/decision-making/behaviour change?
2. Do primiparous pregnant women in Ontario feel that internet sources of pregnancy-related nutrition information are meeting their needs, as assessed by a semi-structured interview?
3. How do primiparous pregnant women in Ontario think that internet sources of pregnancy-related nutrition information could be improved, as assessed by a semi-structured interview?
Appendix B: Online Questionnaire & Information Letter

Section 1: Study Information & Consent

This online survey is the first part of a research study being conducted by a Masters of Science student at the University of Guelph. The purpose of this study is to better understand the experiences of pregnant women in Ontario with seeking nutrition information. Your responses to this survey will provide insight on what sources pregnant use to find nutrition information, and when they are searching for this information.

The survey should take approximately 10 minutes to complete. You will be asked 5 survey questions, followed by collection of some demographic information. There are no known or anticipated risks involved with participating in this survey. Your decision to participate or not participate will have no impact on your relationship with or services provided by the organization through which you heard about this study. Participation is voluntary and you may decide to withdraw at any point by closing your browser. You may also skip any questions that you do not wish to answer, without any consequences. You will only be re-contacted if you wish to take part in an interview at a later time or wish to receive a summary of the research findings, in which case you may leave your email address in the space provided on the survey. Your responses will only be sent to the researcher when you click “submit” at the end of the survey. After submission of the survey there will be no way to withdraw your answers because no identifying information will be linked to your responses.

Upon completion, you will receive a list of credible online nutrition information sources for pregnancy. This study will also benefit pregnancy research in Canada by providing information about the types of sources pregnant women in Ontario are using to find pregnancy-related nutrition information, and when they are looking for this information; this information is not currently available in Canada. In addition, it is hoped that the information obtained through this study will be used to improve the information available to pregnant women in Ontario.

This survey is anonymous, meaning at no time will any identifier be associated with the data you provide. Your email address and demographic information will be collected using a separate, unlinked survey to ensure the confidentiality of your identity. The research team will not release any information which identifies you when disseminating the final results. However, because data collection occurs via the internet, complete confidentiality of the data cannot be guaranteed. If you use public computers to fill out a survey, erase the history, empty the cache, and close the browser to help keep your information secure.

This project has been reviewed by the University of Guelph Research Ethics Board for compliance with federal guidelines for research involving human participants. If you have any questions regarding your rights and welfare as a research participant in this study (REB #16OC023), please contact: Director, Research Ethics; University of Guelph; reb@uoguelph.ca; 519-824-4120 ext. 56606. You do not waive any legal rights by agreeing to take part in this study. You may also contact: Alexandra Holt, student researcher, Department of Family Relations and Applied Nutrition, University of Guelph; holta@uoguelph.ca, or contact: Dr. Hannah Tait Neufeld, principal investigator, Department of Family Relations and Applied Nutrition, University of Guelph; hannahtn@uoguelph.ca.
If you have read the above information and consent to participate, please click “I agree” below to begin the survey, or click “I do not agree” to exit. You may print out this page for future reference if you wish, by clicking “print” below.

☐ I agree  
☐ I do not agree

Section 2: Survey Questions

1. Please indicate if this is your first pregnancy or if you have previously been pregnant

☐ This is my first pregnancy

☐ I have been pregnant before

2. How far along are you in your pregnancy?

☐ 0-1 month

☐ > 1 month – 2 months

☐ > 2 months – 3 months

☐ > 3 months – 4 months

☐ > 4 months – 5 months

☐ > 5 months – 6 months

☐ > 6 months – 7 months

☐ > 7 months – 8 months

☐ > 8 months – 9 months

☐ Over 9 months (past due date)

3. Where have you looked for nutrition information relating to pregnancy? (Check all that apply)

☐ The internet

☐ Books

☐ Magazines
☐ Family doctor

☐ Midwife

☐ Family

☐ Friends

☐ Brochures

☐ Nine-month calendars

☐ Other (Please specify): ____________________________

☐ I have not looked for nutrition information relating to pregnancy

4. Where did you look for pregnancy-related nutrition information most often? (Only check one box)

☐ The internet

☐ Books

☐ Magazines

☐ Family doctor

☐ Midwife

☐ Family

☐ Friends

☐ Brochures

☐ Nine-month calendars

☐ Other (Please specify): ____________________________

☐ I have not looked for nutrition information relating to pregnancy

5. When have you looked for nutrition information relating to pregnancy? (check all that apply)
Before becoming pregnant

- During the first trimester of my pregnancy (0-3 months)
- During the second trimester of my pregnancy (3-6 months)
- During the 3rd trimester of my pregnancy (6-9 months)
- I have not yet looked for nutrition information relating to pregnancy

6. When have you looked for nutrition information relating to pregnancy most often?

- Before becoming pregnant
- During the first trimester of my pregnancy (1-13 weeks pregnant)
- During the second trimester of my pregnancy (14-26 weeks pregnant)
- During the 3rd trimester of my pregnancy (27 or more weeks pregnant)
- I have not yet looked for nutrition information relating to pregnancy

Section 3: Demographic Information

1. How old are you?

- 18-25
- 26-35
- 36-45
- 46-55
- 56+

2. Which of the following best describes your ethnic background? (Check all that apply)

- First Nations/Métis/Inuit
- European
- African
☐ Southeast Asian

☐ South Asian

☐ Latin American

☐ Middle Eastern

☐ Other (please specify) ________________________________

3. Which of the following best describes your marital status?

☐ Never legally married

☐ Legally married (and not separated)

☐ Separated, but still legally married

☐ Divorced

☐ Widowed

☐ Common-law married

4. Which of the following best describes your HIGHEST level of education?

☐ Some high school

☐ Completed high school

☐ Some college/university

☐ Apprenticeship training and trades

☐ Completed college/university

☐ Some graduate education

☐ Completed graduate education

☐ Professional degrees

5. What is your annual household income?
Section 4: Recruitment for Interviews

The researcher would like to conduct telephone interviews with 12-15 women who are pregnant for the first time to learn more about their experiences with using the internet to find pregnancy-related nutrition information. If you are interested in participating or learning more about this opportunity, please leave your contact information below.

Note: This contact information will be kept separate from these survey answers to protect your identity.

Email: ________________________________

Section 5: Thank you & Debriefing

Thank you for taking the time to complete this survey. The responses from this survey will be compiled to determine which sources pregnant women are using most often for nutrition information, and when they tend to look for this information. Your responses will help to guide the next part of the research project, which will explore women’s experiences using the internet to find pregnancy-related nutrition information. You have made a valuable contribution to research on prenatal nutrition.

If you would like to receive a summary of the research findings from this survey, please check the box below and leave your email address

☐ I would like to receive the results from this survey
Email: ________________________________

The following is a list of credible online sources of nutrition information for pregnant women:


Thanks again 😊
Appendix C: Interview Guide and Consent Script

Introduction & Study Information

Hello, may I please speak to [name of participant]? Hi, this is Alexandra Holt calling from the University of Guelph. I’m calling for the interview we scheduled to talk briefly about your experiences with looking up pregnancy information online. Is this a good time for you? (Great or when would be a good time to call back?). Thank you for taking the time to do this, I really appreciate it. If you get another phone call or something comes up at any time during the interview just let me know and we can pause and finish at another time.

Did you receive an email outlining the purpose of the study and what to expect from the interview? I will take a few minutes to go over the main points again briefly:

- The purpose of the interviews is to gain a better understanding of women’s experiences using the internet to find pregnancy-related nutrition information.
- The interview is expected to last approximately 30 minutes to an hour, depending on the length of your answers.
- The interview will be audio recorded so the information can be reviewed later.
- Your participation in this interview is completely voluntarily. You can choose to withdraw at any time during the interview without any consequences, and you can skip any questions that you do not wish to answer.
- If you choose to withdraw from the interview, the recording of your responses will be destroyed upon request.
- There are no known or anticipated risks to participating in this study.
- During analysis, a pseudonym or another name of your choosing will be used in place of your real name. Any identifying information will be kept in a master list, separate from the data you provide; all information will be kept on an encrypted and password protected laptop, and all recordings of interviews will be deleted in the fall of 2017.
- Every effort will be made to ensure the confidentiality of identity of participants.

Do you have any questions before we begin? (Begin recording). Do you agree to participate? Alright then we will start.

Demographic Questions:

I’m going to begin by asking you a few questions about yourself.

**Question 1:** Can you tell me what year you were born?

**Question 2:** Can you tell me a little bit about your family’s background?

**Question 3:** What area of Ontario do you currently live in? (Probes: Northern, Eastern, Southwestern, etc.)
Question 4: Can you tell me the highest level of schooling/education that you have completed? (Probes: high school, college/university, graduate school, etc.)

Question 5: Can you tell me what your approximate annual household income would be?

Question 6: How would you describe your relationship status? (Probes: married, single, common-law, etc.)

Great thank you. Now we will move on to the pregnancy-related questions.

Interview Questions

Introduction Question: So how is the pregnancy going so far?

Question 1: How far along are you in your pregnancy now?

Question 2: Can you tell me about how you went about finding nutrition information during your pregnancy? (Probes: physician, midwife, family, friends, books, internet, brochures, etc.)

Question 3: Have you used the internet to find pregnancy-related nutrition information? Can you give me some examples of when you used the internet to find this information? (Probes: ask about timing if they do not mention it – before pregnancy, 1st, 2nd, 3rd trimester).

Question 4: How/where did you find pregnancy-related nutrition information on the internet? (Probes: Search engine, hospital website, government website, chat room, etc. – ask for specific websites if they don’t say)

Question 5: Why did you decide to use the internet to find this information? (Probes: Anonymity, speed, ease of access, cost, etc.)

Question 6: How would you describe your experiences using the internet to find this information? (Probes: Were you able to find what you were looking for? Did it align with what you heard from other sources?)

Question 7: Was the information you found on the Internet clear and easy to understand? Why? Did you find the websites user friendly? What made them easy or hard to use? (Probes: any big medical words, links to more information, easy to navigate).

Question 8: Do you have any other family members or friends that are pregnant? Would you recommend the internet as a good source of nutrition information to them? (Probe: any specific websites or topics?)

Question 9: Did you find that doing searches for nutrition-related information on the internet has brought up any emotions for you? If so, can you describe those experiences?
**Question 10:** Did the information you found on the internet change your previous thoughts or beliefs about eating and nutrition during pregnancy? If yes, in what way?

**Question 11:** Did anything you came across on the internet change the way you ate during pregnancy? If yes, can you give me a few examples?

**Question 12:** If you could make changes to the nutrition information found on the internet that is available to pregnant women what would you do? (Probes: Readability, pictures, examples, definitions of words, references to other sources, etc.)

**Closing questions:** Is there anything we haven’t touched on today that you would like to tell me about? Do you have any questions for me?

**Debriefing:** Thank you very much for taking the time to complete this interview. If you have any questions or concerns that come up later don’t hesitate to contact me, or if you are interested in receiving a summary of the research findings, please send me an email and I would be happy to provide you with that when the study is completed.
Appendix D: Research Ethics Board Approval

The members of the University of Guelph Research Ethics Board have examined the protocol which describes the participation of the human participants in the above-named research project and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement, 2nd Edition.

The REB requires that researchers:
- Adhere to the protocol as last reviewed and approved by the REB.
- Receive approval from the REB for any modifications before they can be implemented.
- Report any unexpected events or incidental findings to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants, and the continuation of the protocol.
- Are responsible for ascertaining and complying with all applicable legal and regulatory requirements with respect to consent and the protection of privacy of participants in the jurisdiction of the research project.

The Principal Investigator must:
- Ensure that the ethical guidelines and approvals of facilities or institutions involved in the research are obtained and filed with the REB prior to the initiation of any research protocols.
- Submit a Status Report to the REB upon completion of the project. If the research is a multi-year project, a status report must be submitted annually prior to the expiry date. Failure to submit an annual status report will lead to your study being suspended and potentially terminated.

The approval for this protocol terminates on the EXPIRY DATE, or the term of your appointment or employment at the University of Guelph whichever comes first.

Signature: ____________________________ Date: November 25, 2016

Stephen P. Lewis
Chair, Research Ethics Board-General
Certificate of Completion

This document certifies that

Alexandra Holt

has completed the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE)

Date of Issue: 6 October, 2016
Are you currently pregnant?  
Over the age of 18?  
A resident of Ontario?

Then maybe you would like to take part in a questionnaire on the information seeking behaviours of pregnant women! The information gathered will be used to gain a better understanding of when and where women look for nutrition information related to pregnancy, in hopes of improving the information that is available.

The survey should take no longer than **10 minutes** to complete.

For more information and to complete the survey, go to:  
[http://tinyurl.com/prenatalnutritionstudy](http://tinyurl.com/prenatalnutritionstudy)

If you would like more information please contact: Alexandra Holt, student researcher, department of Family Relations and Applied Nutrition, University of Guelph; [holta@uoguelph.ca](mailto:holta@uoguelph.ca)

**THANK YOU 😊**

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This project has been reviewed by the University of Guelph Research Ethics Board for compliance with federal guidelines for research involving human participants (REB#16-12-749)

Please note: Your decision to participate or not participate in the study will have no bearing on your relationship with or services provided by this organization.