Gestational weight gain, physical activity, and nutrition counselling practices of prenatal health care providers: What influences practice?

by

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Abstract

Appropriate gestational weight gain is important for maternal and child health. Data from a recent Alberta cohort showed 49% of pregnant women gained weight in excess of Health Canada guidelines. Regional studies have shown low rates of gestational weight gain counselling by health care providers, including general practitioners, obstetricians, midwives, nurse practitioners and registered nurses. Research is needed to determine how to support health care providers to enhance gestational weight gain counselling practices. The purpose of this study was to understand current gestational weight gain counselling practices, and the influences on health care providers' practices. This mixed method study included semi-structured interviews and an online survey. Interviews were conducted by telephone with prenatal health care providers from Alberta and British Columbia, transcribed verbatim and analyzed using qualitative content analysis. The survey questionnaire was distributed nationally to prenatal health care providers. Responses were compared by health care provider discipline using one-way analysis of variance (ANOVA), and multiple linear regression examined influences on practices. Data were collected concurrently, analyzed separately, and integrated. Interview participants (n=23) had a range of practices for gestational weight gain counselling. Typically, weight gain information was provided early in pregnancy, but not discussed again unless there was a concern. Among survey respondents (n=508) few routinely provided women with individualized weight gain advice (21%), rate of weight gain (16%), or discussed the risks of inappropriate weight gain to mother and baby (20% and 19%). More routinely discussed physical activity (46%) and food requirements (28%); midwives did these two activities more frequently than all other disciplines ($p<0.001$). Midwives interviewed noted a focus on overall wellness instead of weight, and had longer appointments for in-depth counselling. Regression results found that the priority level

that health care providers place on gestational weight gain had the largest influence on providing weight gain advice and discussing the risks ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of gestational weight gain to length of appointments, compensation methods for health care providers, knowledge of health care providers, and the midwifery versus medical model of care. In conclusion, interventions for health care providers to enhance gestational weight gain counselling practices should consider the range of factors that influence the priority level health care providers place on gestational weight gain counselling.

Preface

This thesis is an original work by Jillian Morris. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Adaptation and evaluation of a counselling intervention to promote healthy weight gain and healthy eating in pregnancy", No. Pro00045899, May 8, 2014. No part of this thesis has been previously published.

This study was designed by Dr. Rhonda Bell and Hara Nikolopoulos. Hara Nikolopoulos recruited participants for the qualitative component of this study and conducted the interviews alongside myself. Melisa Spaling contributed to the qualitative analysis, along with Dr. Rhonda Bell and Hara Nikolopoulos.

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I would like to thank my parents, who always support me in whatever path I choose to take, as well as my friends, who have tolerated not seeing me for long stretches of time. And of course, this is for Jay, my optimist and number one fan.

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Abbreviations

GWG	Gestational weight gain
BMI	Body Mass Index
US	United States
IOM	Institute of Medicine
SOGC	Society of Obstetricians and Gynaecologists of Canada
UK	United Kingdom
NICE	National Institute for Health and Care Excellence
PARMed-X	Physical Activity Readiness Medical Examination for Pregnancy
RN	Registered Nurse
VIF	Variance Inflation Factor
PCN	Primary Care Network

Chapter 1: Introduction

1.1 The importance of gestational weight gain

1.1.1 What is gestational weight gain?

Gestational weight gain (GWG) is a normal and important part of a healthy pregnancy, influenced by changes in physiological functions that occur during gestation. Accretion of tissue in the uterus and breast, formation of the placenta, expansion of blood volume, and the growth of the fetus all contribute to this increase in maternal weight (Hytten & Chamberlain, 1991). The pattern for the rate of GWG is typically described as "sigmoidal", with relatively little weight gain in the first trimester, an acceleration of weight gain in the second trimester, and tapering off near the time of delivery (Hytten & Chamberlain, 1991). Excess GWG is typically accumulated as adipose tissue (Melzer & Schutz, 2010).

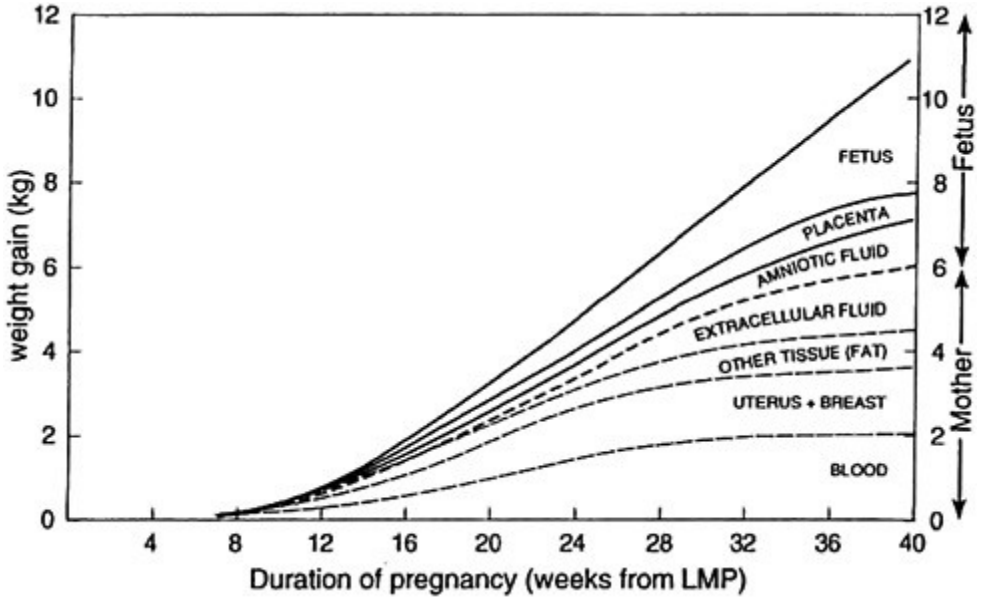

Figure 1.1 Components of gestational weight gain. Source: Pitkin, R. (1976) Nutritional support in obstetrics and gynecology. *Clinical Obstetrics and Gynecology* 19(3): 489–513. Reprinted with permission.

1.1.2 Health impact of inappropriate gestational weight gain

Although GWG is an important part of pregnancy, too much or too little weight gain has a negative impact on the short and long term health of mother and child. Inadequate GWG is

associated with an increased risk of preterm delivery, a small-for-gestational age infant, or a low birth-weight infant, which all carry long-term health risks for the child (Viswanathan et al., 2008). For excess GWG, immediate concerns for the infant include macrosomia (typically defined as birthweight > 4500 g), increased risk of Caesarean section and shoulder dystocia, as well as increased neonatal morbidity and mortality (Viswanathan et al., 2008). In the long term, the child is at risk for an altered growth trajectory that may lead to obesity (Adamo et al., 2012). For mothers, excess GWG increases the risk of gestational diabetes mellitus and hypertensive disorders in pregnancy, and this of special concern for excessive gain early in pregnancy (Carreno et al., 2012; Thorsdottir, Torfadottir, Birgisdottir, & Geirsson, 2002). Excess gain also increases the risk of postpartum weight retention, which may leave a woman at an increased Body Mass Index (BMI) to begin her next pregnancy (Viswanathan et al., 2008). Elevated pre-pregnancy BMI is an independent predictor of offspring's short and long-term health outcomes, including the risk of childhood and adolescent obesity (Adamo, Ferraro, & Brett, 2012; Kuhle, Allen, & Veugelers, 2010). The cycle of excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to increased risk in each subsequent pregnancy (Gilmore, Klempel-Donchenko, & Redman, 2015). Thus, excess GWG has an intergenerational effect, as it is a risk factor for obesity in the mother, as well as the child (Adamo et al., 2012; Melzer & Schutz, 2010).

Dzakpasu et al (2015) analyzed data from the Canadian Maternity Experiences Survey to determine the contribution of pre-pregnancy BMI and GWG to the prevalence of pre-term birth, small- and large-for-gestational age infants. This was a stratified random sample of women who had a live singleton birth in the three months prior to the 2006 Canadian census. For Dzakpasu et al's study, responses from 5,930 women with complete data were weighted to create a nationally representative sample. The population attributable fractions were calculated, which is a measure of the proportional reduction in adverse outcomes which would occur if exposure to the risk factors were reduced to an alternative ideal population (World Health Organization, 2016). Inadequate GWG was calculated to have contributed to 9.2% of small for gestational age births in Canada, while excess gestational weight contributed to 15.9% of large for gestational age births. Excess GWG also contributed to 18.2% of pre-term births, which was greater than the contribution of prenatal smoking. This study demonstrates the importance of appropriate

GWG as a potential modifiable risk factor that can improve outcomes for a significant proportion of births in Canada.

The impetus to intervene in pregnancy for the health of the next generation is rooted in the "Developmental Origins of Health and Disease" hypothesis pioneered by Dr. David Barker. This hypothesis suggests that the environment in utero, including the influence of nutrition and weight gain, can "program" adult disease risk (McMillen et al., 2008). This is supported by evidence from observational studies and animal models (Hochner et al., 2012; Hrolfsdottir et al., 2015; Ojha, Saroha, Symonds, & Budge, 2013). There is a demonstrated link between maternal undernutrition, low birth weight, and metabolic syndrome in adulthood (Ravelli et al., 1998). Animal models of overnutrition have also demonstrated a link between excessive GWG, fetal adiposity, and later offspring adiposity and metabolic disease (McMillen et al., 2008; Ojha et al., 2013). Therefore, there is evidence that the nutrition and weight status of the mother prior to and during pregnancy are critical for the health of the child through adulthood.

1.1.3 Contribution of diet and physical activity to gestational weight gain

Although it is important to acknowledge that there is a complex web of factors contributing to GWG, diet and physical activity play important and potentially modifiable roles, which contribute benefits beyond weight outcomes (Ferraro, Gaudet, & Adamo, 2012). Both dietary intake as well as physical activity levels have been shown to significantly contribute to GWG while controlling for other psychosocial and biomedical variables (Olson & Strawderman, 2003). Pregnant women who consume more servings of food or a greater amount of calories are more likely to gain more weight (Althuizen, van Poppel, Seidell, & van Mechelen, 2009; Deierlein, Siega-Riz, & Herring, 2008). Women who are more physically active are more likely to gain weight within recommendations, while those who do not participate in physical activity are more likely to gain excessively (Cohen, Plourde, & Koski, 2010). A recent Cochrane systematic review concluded that there is high quality evidence that diet and physical activity interventions reduce excessive GWG, and may also reduce Caesarean deliveries and maternal hypertension (Muktabhant, Lawrie, Lumbiganon, & Laopaiboon, 2015).

1.2 Guidelines for gestational weight gain

1.2.1 Institute of Medicine and National Research Council

The Institute of Medicine (IOM) and National Research Council in the United States (US) conducted a review of the evidence, and revised its GWG guidance in 2009 (Institute of Medicine and National Research Council, 2009). The weight gain ranges provided in their recommendations (Table 1.1) were associated with minimized risks of postpartum weight retention, unplanned Caesarean delivery, birth size (large or small for gestational age), preterm birth, and childhood obesity, as addressed in the review. The authors noted that there was a lack of evidence to support specific weight gain recommendations for women with morbid obesity (BMI ≥ 35) prior to pregnancy. One key difference between the 1990 guidelines and the 2009 guidelines was the adoption of the World Health Organization ranges for the pre-pregnancy BMI classifications (Rasmussen, Catalano, & Yaktine, 2009). This resulted in more women being classified as overweight or obese, which meant a lower total weight gain target than under the earlier guidelines.

Table 1.1 Institute of Medicine guidelines for weight gain in pregnancy.

Pre-pregnancy BMI (kg/m^2)	**Total Weight Gain (kg)**	**Weekly Weight Gain during 2nd and 3rd trimester (kg/wk)**
Underweight (<18.5)	12.5 - 18	0.5
Normal (18.5 - 24.9)	11.5 - 16	0.4
Overweight (24.9 – 29.9)	7 - 11.5	0.3
Obese (>30)	5 - 9	0.2

After releasing these revised recommendations, the committee also developed consensus recommendations for implementation of the guidelines by health care providers. These recommendations included (Institute of Medicine and National Research Council, 2013):

- Inform women of the guidelines;
- Offer nutrition and physical activity counselling;
- Record pre-pregnancy height, weight and BMI;
- Chart women's weight gain throughout pregnancy; and
- Share results with women so that they are aware of their progress.

1.2.2 Canadian guidelines for gestational weight gain

Health Canada adopted the IOM guidelines in 2010 (Health Canada, 2010). Health Canada's guidance for GWG also included recommendations for practice, largely influenced by the IOM's report. This included recommendations to provide women with a weight gain target based on pre-pregnancy BMI early in pregnancy, advise women that an extra 2-3 servings from Canada's Food Guide in the second and third trimester are all that is needed to meet caloric requirements, advise women on the benefits of physical activity, and assist women to find support and identify strategies to consistently perform these behaviours. Health Canada also provided tools to support tracking of GWG, as per the IOM's recommendations for implementation (available at: http://www.hc-sc.gc.ca/fn-an/nutrition/prenatal/ewba-mbsa-eng.php).

Of note, another important organization for guidelines in maternity care, the Society of Obstetricians and Gynaecologists of Canada (SOGC), recommends that obese women (BMI ≥30 kg/m^2) gain 7 kg, rather than the IOM's guidance of 5-9 kg, but does not provide justification for this (Davies, Maxwell, & McLeod, 2010).

1.2.3 Guidelines from other countries

A survey of key informants from 66 countries (including Hong Kong and Scotland) found that 33 countries had GWG guidelines, created by national and regional governments, health care professional organizations (e.g. society of obstetricians/gynecologists or dietitians), or partnerships between these areas (Scott et al., 2014). Many developed countries beyond Canada and the US also refer to the IOM guidelines to shape their recommendations, including Australia, Denmark, Ireland, Sweden, and Latvia (Schumann, Brinsden, & Lobstein, 2014). However, there may be multiple conflicting recommendations within the same country (Minakami et al., 2011; Schumann et al., 2014). Much like the Canadian guidelines, 24 countries included in Scott

et al's (2014) survey recommended that health care providers counsel women on physical activity during pregnancy, and 34 recommended the same regarding a healthy diet.

There are some key differences between nationally recommended practices in Canada, the US, the United Kingdom (UK), and Australia that are important for the interpretation of the literature on health care provider counselling practices (reviewed in the next chapter) as much of the international literature in this area comes from these three countries. In the UK, the National Institute for Health and Care Evidence (NICE; formerly the National Institute of Health and Clinical Excellence) provides guidelines for weight management before, during and after pregnancy (National Institute of Health and Clinical Excellence, 2010). When developing this guidance, the committee considered the adoption of the IOM guidelines, but concluded: "the recommendations were not validated by intervention studies. Without evidence from large-scale trials, it is not clear whether or not adhering to the recommended ranges lowers the risk of adverse outcomes for mothers and their babies. In addition, the guidelines were developed for the US population and it is not known whether or not they would apply to other populations with a different ethnic composition" (National Institute of Health and Clinical Excellence, 2010). Although regular weight measurement was a part of routine prenatal care up until the release of these guidelines, NICE now advises against repeated weight measurement and the provision of a weight gain target, due to the concern of psychological distress for women, and the lack of evidence of clinical benefit. The UK currently does not have national guidelines for the amount of weight women should gain in pregnancy. Australia's Department of Health adopted the IOM guidelines for its national antenatal care guidance in 2013, but also recommends against repeated weight measurements unless clinically necessary (Australian Government Department of Health, 2013). A small number of countries beyond the UK and Australia have similar guidance, citing a lack of evidence for the benefit of routine weighing, or the potential for weight measurement to cause psychological distress (Scott et al., 2014).

1.2.4 Guidelines for physical activity and healthy eating in pregnancy

The importance of individualized advice for physical activity and healthy eating is mentioned in many of the GWG guidelines cited earlier. Canada also has specific guidelines for these two areas in order to support health care providers to provide evidence based recommendations.

SOGC partnered with the Canadian Society for Exercise Physiology to review the evidence and develop physical activity guidelines for pregnancy (Davies, Wolfe, Mottola, & MacKinnon, 2003). These guidelines encourage aerobic and strength training activities for all pregnant women who do not have contraindications, regardless if women were sedentary or active prior to pregnancy. Contraindications to physical activity include hypertensive disorders of pregnancy, rupture of membranes, and persistent second and third trimester bleeding. The guidelines provide information on the amount, type, and intensity of activity that is appropriate for various pre-pregnancy fitness levels, including target heart rate zones. While previously sedentary women are recommended to start gradually, a goal of four 30 minute aerobic sessions per week is recommended. This information has been incorporated into the Physical Activity Readiness Medical Examination for Pregnancy, a tool designed to assist health care providers with assessing women's physiologic suitability for being physically active, and help them to provide individualized exercise recommendations (Canadian Society for Exercise Physiology, 2013).

Health Canada released prenatal nutrition guidelines for health professionals in 2009, which covered general healthy eating recommendations using Canada's Food Guide, as well as nutrient specific recommendations for iron, folate, and omega 3 fatty acids (Health Canada, 2009a; Health Canada, 2009b; Health Canada, 2009c; Health Canada, 2009d). Generally, Health Canada recommends that health care providers advise pregnant women to consume an additional 2-3 servings from any of the food groups described in Canada's Food Guide in their second and third trimesters to meet their additional energy needs of 350-450 calories. The guidelines also recommend that all pregnant women take a multivitamin containing iron and folic acid.

1.3 Trends in weight gain, physical activity and dietary intake in pregnancy

Many women in Canada and Alberta do not meet Health Canada guidelines for weight gain in pregnancy. Kowal et al (2012) conducted an analysis of weight gain data from the Canadian Maternity Experiences Survey to compare it with the current GWG guidelines. This was the same stratified random sample of women outlined in Dzakpasu et al's (2015) study described earlier. The survey collected self-reported data on pre-pregnancy weight, height, and GWG. Nearly half (48.7%) of women gained in excess of the guidelines for their pre-pregnancy BMI

category, and this was even more pronounced for overweight (67.6%) and obese (60%) women. Similar results were found in a longitudinal, prospective cohort of high socioeconomic status women in Alberta that collected measured weights up to three times during pregnancy (Begum, Colman, McCargar, & Bell, 2012). Total weight gain was calculated by subtracting the highest weight in pregnancy from pre-pregnancy weight; both weights were self-reported. Forty-six percent of normal weight women exceeded the guidelines, while 30% of underweight, 80% of overweight, and 80% of obese women gained in excess of the guidelines. It is clear that excessive GWG is an issue that may affect women across all pre-pregnancy BMI categories.

There is also regional evidence to suggest that women in Canada are not meeting physical activity recommendations during pregnancy. Gaston and Vamos (2013) examined Ontario's provincial data collected from 2005-2008 in the Canadian Community Health Survey, a national cross-sectional survey of self-reported health data. Components of this survey are conducted annually, and the survey utilizes a multistage stratified cluster design to gather health data to represent the 136 health regions defined by Statistics Canada. The authors analyzed leisure time physical activity levels (defined as any physical activity outside of work) reported by 623 pregnant women living in Ontario and compared it to national physical activity recommendations. The authors found that only 23.3% of women met the guidelines. More detail was found in a cohort of 1737 women in Halifax, who provided self-reported physical activity levels in early pregnancy using a validated questionnaire (Fell, Joseph, Armson, & Dodds, 2009). Although 71.3% participated in sports or exercise in the year before pregnancy, less than half (47.4%) did this in early pregnancy. The authors concluded that early pregnancy is a time where women decrease their physical activity. Cohen et al (2010) had similar findings in a study of 81 pregnant women in Montreal and Ottawa. Women were eligible to participate in the study if they were greater than 12 weeks gestation, and could participate safely in physical activity as per the Physical Activity Readiness Medical Examination for Pregnancy. The authors assessed physical activity in two manners. First, the Pregnancy Physical Activity Questionnaire was used to calculate the metabolic equivalents (MET) expended in one week (the energy needed to perform the activities). As well, pedometers were provided to participants, and they were asked to self-record the number steps taken daily for a week. The amount of physical activity recommended in the national guidelines was translated into metabolic equivalents for

comparison. Approximately 30% of women achieved more than 7500 steps per day, which was considered "active". The average metabolic equivalents expended was 6.3 MET, less than the 8.5 MET that would be expended according to the guidelines.

As with physical activity, regional Canadian evidence suggests that pregnant women are not meeting dietary recommendations. A validated food frequency questionnaire was used to collect dietary data from 2313 pregnant women in London, Ontario (Fowler, Evers, & Campbell, 2012). Only 3.5% consumed the recommended number of servings from all four food groups of Canada's Food Guide, but averaged four daily servings of "other" foods that do not appear on the guide. Similar findings were discovered when using the Healthy Eating Index to assess Edmonton women's diets (Pick, Edwards, Moreau, & Ryan, 2005). The authors gathered four day food records from 52 healthy pregnant women between 20 and 38 weeks gestation, and used them to calculate the Healthy Eating Index, a validated measure of diet quality and adherence to the US dietary guidelines. Women with a medical diagnosis that would alter their dietary intake or physical activity, including a diagnosis of impaired glucose tolerance or gestational diabetes mellitus, were excluded from this study. Just 21% of women in this study had a Healthy Eating Index score considered "good", while 79% "needed improvement".

In summary, there appears to be room for improvement when it comes to pregnant women's optimal GWG, physical activity, and dietary intake in comparison to Canadian guidelines.

1.4 Prenatal health care service delivery in Canada

Typically, women visit their health care provider for an initial appointment after confirming they are pregnant, after which they will have an appointment every four weeks until the 28 weeks gestation, every two to three weeks until 36 weeks gestation, and every week until delivery (American Academy of Pediatrics & American College of Obstetricians and Gynecologists, 2007). In the representative sample taken for the Canadian Maternity Experiences Survey, 94.9% of pregnant women initiated care in the first trimester of their pregnancy, and had, on average, 12.9 visits with a health care provider (Public Health Agency of Canada, 2009).

There are a variety of models for prenatal care delivery, and several different health care provider disciplines who provide prenatal care. Over the course of her pregnancy, a woman may see a single provider, or a see group of providers who provide shared care for patients. Furthermore, women may begin care with one health care provider, and transfer their care to another provider prior to delivery. While approximately half of general practitioners in the 2007 National Physician Survey reported some involvement in prenatal or postpartum care, only 11.1% attended deliveries (College of Family Physicians of Canada, 2009). This means that women receive some prenatal care from their general practitioner before being transferred to a different provider who will attend the delivery (College of Family Physicians of Canada, 2009). In the Canadian Maternity Experiences Survey, women reported that they received most of their prenatal care from obstetrician/gynecologists (58.1%; referred to as obstetricians in this thesis) or general practitioners/family physicians (34.2%; referred to as general practitioners in this thesis) (Canadian Institute of Health Information, 2004). Others received care from midwives (6.1%), registered nurses and/or nurse practitioners (0.6%). Most births were attended by an obstetrician (Canadian Institute of Health Information, 2004).

A woman's choice of prenatal health care provider may be influenced by regional differences in availability and funding. There has been an overall reduction in deliveries by general practitioners in recent years, and this is more prominent in urban centres (College of Family Physicians of Canada, 2009). The gap has generally been filled by obstetricians, and to a lesser extent, midwives (College of Family Physicians of Canada, 2009). Midwifery care is regulated and publicly funded in most provinces/territories, with the exception of Newfoundland, New Brunswick, Prince Edward Island, and the Yukon Territory (Canadian Association of Midwives, 2016a). However, most midwifery regulatory bodies report that demand for midwifery outstrips supply, and women who desire midwifery services may be unable to access them (Canadian Association of Midwives, 2016a). Receiving prenatal care from a nurse or nurse practitioner may be more common in areas with a lack of physician availability; it was more commonly reported in the Canadian Maternity Experiences Survey by women in the Territories, with 58.5% of women in Nunavut and 30.8% in the Northwest Territories reporting this (Public Health Agency of Canada, 2009).

The training and scope of practice for these health care provider disciplines are necessarily different. General practitioners are physicians trained in the provision of comprehensive care for people of all ages (College of Family Physicians of Canada, 2016). As such, they have a wide breadth of knowledge rather than specialized knowledge, although many elect to take specialized training to enhance skills, including in the area of obstetrics (College of Family Physicians of Canada, 2016). As described earlier, some general practitioners elect not to provide prenatal care, or provide prenatal care but do not attend deliveries. Obstetricians are physicians with advanced training in women's reproductive health, and can manage high risk pregnancies and perform surgical procedures for labour and delivery (Society of Obstetricians and Gynaecologists of Canada, 2009). Obstetricians may be a consultant to a primary prenatal care provider for a high risk pregnancy, or be the primary care provider for a high or low risk pregnancy (Society of Obstetricians and Gynaecologists of Canada, 2009). In most provinces/territories, midwives are regulated health professionals who have completed a Bachelor's degree. Midwives provide independent primary care during pregnancy, labour and delivery, and postpartum for low-risk women, and consult with medical specialists when needed (Canadian Association of Midwives, 2016b)

While they do not provide sole care at delivery, registered nurses and nurse practitioners may provide prenatal care. Registered nurses are regulated health professionals who have completed a Bachelor's degree, although this is not mandatory in Quebec (Canadian Nurses Association, 2016a). In primary care settings, they typically work in partnership with physicians, and are often responsible for assessment, screening, education and lifestyle support (Canadian Family Practice Nurses Association, 2016). Nurse practitioners are registered nurses with advanced education and an expanded scope of practice, enabling them to independently order and interpret diagnostic tests, write prescriptions, and perform certain procedures (Canadian Nurses Association, 2016b). They may also work in collaboration with physicians and other health professionals.

1.4.1 An opportunity for intervention?

Pregnancy can be seen as a "teachable moment", when women are interested in making healthy lifestyle changes to benefit their unborn child, and experience a change in social role to one of

"mother" (Phelan, 2010). Women's willingness to make lifestyle changes in pregnancy was demonstrated in the Southampton Women's Survey, a large prospective cohort in the UK that assessed women's lifestyles prior to pregnancy and during pregnancy (Crozier et al., 2009). The authors found that women significantly reduced smoking, alcohol consumption, and caffeine consumption, as per key prenatal health guidelines.

Lifestyle changes to prevent excess GWG during this time have the added benefit of promoting the health of two individuals, and potentially breaking the intergenerational cycle of excess weight (Adamo et al., 2012). Healthy pregnant women have frequent interactions with the health care system, as mentioned earlier. As well, women trust the advice of their health care provider, and report them to be a useful source of pregnancy-related information (Public Health Agency of Canada, 2009; Tovar et al., 2011). Women seek information on physical activity, nutrition and GWG, and would like to receive it from a health care provider (Ferraro, Rutherford, Keely, Dubois, & Adamo, 2011; Szwajcer, Hiddink, Koelen, & van Woerkum, 2005; Willcox et al., 2015). Thus, routine prenatal care may present an opportunity to intervene to promote optimal GWG, physical activity, and nutrition.

1.5 Research objectives

ENRICH is a multi-pronged research program with the overall goal to improve maternal health in pregnancy and postpartum by promoting optimal dietary intake and weight management. The research program, under which this thesis falls, aims to gather and synthesize information that will help inform strategies to promote healthy weights in pregnancy and postpartum that are appropriate for women in Alberta. In particular, this thesis is focussed on gathering information on routine primary prenatal care for pregnant women. The overall goal of this thesis is to characterize the current practices of health care providers in this area, and determine the needs, gaps and opportunities in health service delivery that could be addressed to promote appropriate GWG for all women.

The research objectives of this thesis are:

1. To characterize the counselling practices of health care providers in relation to GWG, physical activity and nutrition, and compare this by health care provider discipline;

2. To characterize different types of health care providers' self-reported adequacy of knowledge in GWG, physical activity and nutrition, and related practice guidelines;
3. To examine health care providers' self-reported access to resources and programs for referral related to GWG;
4. To explore and compare health care providers' perceptions of GWG as a priority in a typical prenatal visit;
5. To examine health care providers' perception of their role, and other health care providers roles, in GWG counselling; and
6. To examine the influence of the following on current GWG counselling practices: adequacy of knowledge, access to resources, priority level of GWG, and perception of role in GWG counselling.

There are many terms used in the literature in relation to GWG counselling. For the purposes of this thesis, GWG counselling includes all of the recommended practices from Health Canada (Section 1.1.2). Specific terms that may be included under the umbrella of GWG counselling include GWG "advice" or "discussions".

Chapter 2: Literature Review

This chapter is a review of the literature regarding the GWG counselling practices of health care providers, as well as the barriers and facilitators that influence counselling practices. The specific counselling practices covered in this review are based on the IOM's recommendations for the implementation of their GWG guidelines, as well as Health Canada's GWG guidelines for health professionals (Health Canada, 2010; Institute of Medicine and National Research Council, 2013). The current literature describing Canadian health care providers' practices in these areas is reviewed and studies of health care providers' practices from other countries are included where available and appropriate. This is followed by a review of the barriers and facilitators to GWG counselling in a health care setting. Lastly, the literature on what is known about the impact of GWG counselling on women's actual weight gain, as well as interventions to improve GWG counselling, are reviewed.

2.1 Gestational weight gain counselling practices of health care providers

Many studies from several countries have examined the GWG counselling practices of health care providers, either by asking the health care providers themselves, or by asking women to recall the GWG counselling they received from their health care provider. Although few of these studies are Canadian, they are referred to multiple times throughout this literature review and are therefore outlined here in some detail.

Four of the key Canadian studies in this area were conducted by the same research group in Hamilton, Ontario (Lutsiv et al., 2012; McDonald, Machold, Marshall, & Kingston, 2014; McDonald et al., 2011; McDonald et al., 2012). Of these, two used data from the same survey of pregnant women, the third surveyed health care providers from the same clinics that the previous two studies recruited from (Lutsiv et al., 2012), and the fourth was a chart audit (McDonald et al., 2014). McDonald et al (2011) and McDonald et al (2012) distributed a hard-copy survey to patients receiving care from general practitioners, obstetricians, midwives and/or nurse practitioners at four clinics in Hamilton, Ontario, by approaching women in the waiting room and inviting them to participate. Eligible women had a singleton pregnancy, could read and

write in English sufficiently well to complete the survey, and had attended at least one visit with their health care provider. This survey had a very high response rate, at 93.6%, which indicates limited non-response bias. Non-response bias refers to the error that is introduced when there are differences between those who respond to a survey, and those who do not (Fink, 2003). A final sample of 310 women was included in McDonald et al's (2011) publication, while 308 of these women reported which discipline of health care provider had provided the majority of their care and were included in McDonald et al's (2012) analysis. Health care providers from the same four clinics were also recruited for a hard-copy or online survey in Lutsiv et al's (2012) study. Forty-two obstetricians, general practitioners, midwives, and other health care providers including nurses and nurse practitioners completed the survey. In all of these studies, the primary outcomes being measured were the proportion of women who were counselled at all about GWG, and the proportion of women who were counselled according to IOM/Health Canada guidelines. The same principal researcher also conducted a review of 300 consecutive charts of women who had a live singleton birth between January and March 2012 at McMaster University Health Centre in Hamilton, Ontario (McDonald et al., 2014). The purpose of the chart review was to evaluate documentation of standard prenatal care and to specifically evaluate the documentation of weight-related care for obese pregnant women. Care for obese pregnant women regarding GWG was compared to the Society of Obstetricians and Gynecologists of clinical practice guidelines for obesity in pregnancy (Davies et al., 2010).

In addition to the studies conducted in Hamilton, Ontario, another Canadian study of importance for this literature review was a survey of health care providers sent to members of SOGC (Ferraro, Boehm, Gaudet, & Adamo, 2013). One hundred and seventy-four general practitioners, obstetricians, midwives, maternal-fetal medicine specialists, and registered nurses responded to the survey. The outcomes investigated by this survey were health care providers' ability to identify the IOM/Health Canada guidelines for GWG for obese women, as well as their counselling practices and self-perceived adequacy of knowledge related to GWG, physical activity, and nutrition. Although SOGC is a national organization, the demographic characteristics of respondents were not reported, thus it is not clear whether this study is nationally representative of the population surveyed.

Lastly, a study by Cohen et al (2010) recruited 81 women from Ottawa and Montreal in their second (n=40) or third trimester (n=41) of pregnancy. The authors conducted a study visit which included measuring women's weight, and asking them if they received GWG advice from their health care provider. The measured weight was used to calculate an average weekly rate of weight gain, which was calculated as: current measured weight minus self-reported pre-pregnancy weight, divided by the weeks of gestation minus twelve weeks (for the first trimester of pregnancy). This was compared to the IOM's recommendation for a weekly rate of weight gain for the second and third trimesters. However, it should be noted that the recommended weekly rate of weight gain from the IOM/Health Canada is a simple calculation of the total recommended GWG target divided by the number of weeks in the second and third trimester (Institute of Medicine and National Research Council, 2009). This implies a linear pattern of weight gain, while typically women gain weight over the course of pregnancy in a sigmoidal pattern (Hytten & Chamberlain, 1991). Therefore, it is possible that those exceeding the recommended rate of weight gain, particularly if they were in their second trimester, would "level off" their weight gain later in their pregnancy and ultimately gain weight within the guidelines.

These studies form the basis for what is currently known about Canadian health care providers' and women's perceptions of GWG counselling. They are reviewed below to provide a more detailed picture of current GWG counselling practices in Canada, and are supplemented with studies from other areas of the world. This section is divided to cover the major recommendations from the IOM and Health Canada: inform all women of the total and weekly rate of weight gain that is appropriate for their pre-pregnancy BMI; discuss why weight gain is important (risks and benefits); provide physical activity and nutrition counselling; and record women's weight throughout pregnancy and share the results with them (Health Canada, 2010; Institute of Medicine and National Research Council, 2013).

2.1.1 Providing a gestational weight gain target and rate of gestational weight gain

Surveys of gestational weight gain advice reported by women and health care providers

One of the more common research questions addressed in the area of GWG counselling is the frequency with which health care providers provide weight gain advice in the form of a weight

gain target, which is the total amount or range of amounts that a woman is recommended to gain over the course of her pregnancy. Data have been gathered from the viewpoint of women and health care providers.

This area has been examined in all of the Canadian studies previously described. In McDonald et al's (2011) study of 308 women in Hamilton, 47% of women reported GWG was discussed at all, 28.5% reported that their health care provider had provided them with a specific GWG target, and 12% were provided a target within the IOM recommendations (McDonald et al., 2011). Cohen et al (2010) asked the 81 pregnant women from Ottawa and Montreal who were participating in their study if they received weight gain advice, and what the source was. Approximately 36% of women in the study (n=29) reported receiving weight gain advice from their physician or other type of health care provider. The apparently low rates of weight gain advice recalled by women are in contrast to higher rates of the provision of weight gain advice reported by health care providers. Lutsiv et al (2012) surveyed 42 health care providers (general practitioners, obstetricians, midwives, nurse practitioners and nurses) from the same Hamilton clinics that McDonald et al (2011; 2012) surveyed women in. Health care providers were asked if they provide pregnant women with weight gain advice; ninety-five percent said they recommend a specific weight gain target to women.

In a larger survey, Ferraro et al (2013) collected responses from 174 members of SOGC. SOGC members encompass the same disciplines as the health care providers in Lutsiv et al's (2012) survey along with maternal-fetal medicine specialists. Similar to Lutsiv et al's (2012) survey, in Ferraro et al's (2013) survey 85% reported counselling women on GWG in some capacity (147 out of 173 who answered the question). As noted earlier, the SOGC mailing list reaches members across Canada; however, the authors did not report the locations of survey respondents, and as such, the national representativeness of the sample cannot be assessed. This study also did not report any other professional characteristics of respondents, such as years in practice or the proportion of total patients who are pregnant women, which could potentially impact responses. Ferraro et al's (2013) survey had a response rate of 15%, and if the survey respondents had a higher interest in GWG than the "average" practitioner, than the reported rates of GWG counselling may be inflated. This could, in part, explain some of the difference

between results from Ferraro et al and McDonald et al's (2014) review of 300 charts in a Hamilton tertiary care hospital. McDonald reported that only 13.7% had a documented recommendation for GWG, although it should be noted that there is no specific place to record this information on the Ontario antenatal record (Ontario Ministry of Health and Long-term Care and the Ontario Medical Association, 2005).

Multiple studies from other areas of the world have also examined the extent to which health care providers recommend a GWG target to women. Although results from surveys of women in pregnancy or postpartum have reported that 12-90.5% of them do not recall having received *any* GWG advice from their health care provider, most studies report that approximately 30-40% of women do not recall any GWG advice from their health care provider, while the remainder do recall receiving GWG advice (Althuizen et al., 2009; Arinze, Karp, & Gesell, 2015; Brawarsky et al., 2005; Brown & Avery, 2012; Cogswell, Scanlon, Fein, & Schieve, 1999; Ferrari & Siega-Riz, 2013; Liu, Whitaker, Yu, Chao, & Lu, 2016; Moore Simas et al., 2013; Olson & Strawderman, 2003; Phelan et al., 2011; Smid, Dorman, & Boggess, 2015; Stotland, Tsoh, & Gerbert, 2012; Stotland et al., 2005; Tovar et al., 2011; Wang, Arroyo, Druker, Sankey, & Rosal, 2015; Waring et al., 2014; Willcox et al., 2015; Wrotniak et al., 2015). All except three of these studies were conducted in the US, and the majority collected data prior to the release of the revised IOM guidelines in 2009. The study with the highest proportion of women not recalling any weight gain advice (90.5%) was a survey of pregnant women in Australia who, on average, would have had at least two appointments with their doctor and/or midwife prior to data collection (Willcox et al., 2015). A total of 1032 pregnant women were mailed a questionnaire after their first prenatal appointment, and 35.7% responded (n=368). While this study found a very large proportion of women (90.5%) who did not recall receiving a GWG target, it is problematic in that the study was conducted prior to the release of national recommendations for weight gain in pregnancy in Australia, including the adoption of the IOM guidelines. Therefore, it is likely that many health care providers were not providing women with weight gain advice, as there was no national guidance recommending that they do so.

Surveys of health care providers' self-reported practices are less numerous than those surveying women. In one survey by Power et al (2006), 900 obstetricians in the US were asked about their

counselling practices for weight management before and during pregnancy. Approximately 86% reported counselling their patients about weight gain in pregnancy most of the time or often, which is similar to the rates reported in the Canadian surveys (Ferraro et al, 2013; Lutsiv et al, 2012).

These findings pose an interesting question: if health care providers are reportedly providing weight gain advice, why is it that women do not recall it? One possibility is the presence of non-response bias in the surveys of health care providers. As outlined earlier in regards to Ferraro et al (2013), this could result in an inflated number of health care providers who report that they provide GWG advice, because the sample consists of interested participants who provide GWG advice, while non-responders do not (Fink, 2003). Furthermore, the sampling frame from both Lutsiv et al's (2012) and Ferraro et al's (2013) study was limited, as Lutsiv et al recruited from four Hamilton prenatal clinics, while Ferraro et al recruited from members of the SOGC mailing list. A probability sample is one that is representative of the population being studied and in this type of sampling procedure every member of the target population has a chance of being sampled (Fink, 2003). It is unlikely that either of these samples are representative of Canadian health care providers. McDonald et al's (2011; 2012) sample of women had little non-response bias, as over 93% of women who were approached to participate agreed to do so; however, it may not be nationally representative due to the limited sampling frame within the four Hamilton clinics.

Another possible reason for the discrepancy between women's and health care providers' reports is the timing of data collection relative to the time of the provision of GWG advice. Women's recall of specific information provided during their prenatal care may not be optimal, as this is an intense period of change in a woman's life. Thus, postpartum collection of data may contribute to a lack of recall of a specifically recommended weight gain target. Women who were surveyed immediately after or close to their first prenatal visit may not have received GWG advice because health care providers discuss GWG at a later appointment; thus, studies that capture data immediately after the first prenatal appointment may be too early. Stotland et al (2012) conducted a secondary analysis of an ethnically diverse cohort of women (n=311) who were enrolled in a prenatal counselling intervention. The objective of the study was to examine the

characteristics of patients that were associated with an increased likelihood of receiving GWG advice. The authors found that an increased gestational age at the time of data collection was associated with an increased likelihood of recalling a GWG discussion with a health care provider (>20 weeks gestation compared to <20 weeks, Odds Ratio 1.95, p=0.014), implying that GWG advice is more likely to be provided after 20 weeks gestation. However, while investigations conducted in early pregnancy have a high proportion of women reporting no weight gain advice, investigations conducted in late pregnancy and postpartum have also found a significant proportion of women who do not recall any weight gain advice (Arinze et al., 2015; Phelan et al., 2011; Waring et al., 2014; Wrotniak et al., 2015). In an example conducted in early pregnancy, Phelan et al (2011) examined data from women enrolled in the lifestyle intervention trial to prevent excess GWG called "Fit for Delivery". Participants (n=401) were recruited from six obstetric offices in Rhode Island between 10-16 weeks gestation, and had attended at least one prenatal care appointment with a health care provider. Women in this study were asked if a health care provider advised them on how much to gain in pregnancy, and only 41.7% reported that this was this case. In an example conducted in late pregnancy, Waring et al (2014) surveyed women (n=171) recruited during routine prenatal care in Massachusetts between 37-42 weeks gestation to see if they recalled receiving advice on how much weight to gain. Thirty-three percent did not recall receiving any advice. Wrotniak et al (2014) asked women the same question immediately postpartum by recruiting women (n=134) from two postpartum recovery rooms in New York. Nearly 33% of this sample reported that they did not receive any information about how much weight to gain in pregnancy. Thus, regardless of what stage of pregnancy women are asked, there was a consistent percentage who did not recall receiving any advice.

Another key factor that could partly explain the discrepancy between women's and health care provider's reports of weight gain advice may be variability in the proportion of women with whom health care providers discuss GWG. While some studies such as Ferraro et al's (2013) present the data as dichotomous (provide advice or not) and seems to assume advice is given (or not) to all women, the proportion of pregnant patients with whom health care providers undertake this practice is important to consider. Lutsiv et al (2012) found that 5% of health care providers reported "Always" providing a GWG recommendation, and 37% reported doing this

"Often". Power et al's (2006) survey of US obstetricians reported 57.9% provided GWG advice "most of the time", and 28% did this "often". Thus, it is possible that the higher rates of providing a GWG target compared to patient's reports is because health care providers do not do this with *all* of their pregnant patients.

Lastly, the provision of prenatal care in Canada is complex, and there may be multiple health care providers involved in a woman's care, as outlined in Chapter 1 of this thesis. This may mean that providing GWG advice is considered to be within one health care provider's role, and not another's. The literature on this subject is discussed further in section 2.2.6 of this chapter. It is possible that women may have reported their experiences with a physician only, rather than an allied health care provider such as a nurse or nurse practitioner. The wording of the questions in McDonald et al's (2011; 2012) survey allowed for the variation in type of health care provider who may be providing GWG advice ("Has your doctor, midwife or nurse made a recommendation about how much weight you should gain during pregnancy (total amount of weight)?"). Cohen et al (2010) captured a variety of possible health care provider disciplines by specifically asking women if they received GWG advice from a physician, and/or another health professional. As such, it is seems likely that these questions captured women's recollections of GWG advice, or lack thereof, from a variety of health care provider disciplines.

Some researchers have hypothesized that the provision of weight gain advice occurs more or less frequently depending on women's pre-pregnancy BMI. In McDonald et al's (2014) audit of 300 pregnant women's charts in Hamilton, there were no significant differences in the documentation of providing a weight gain recommendation by pre-pregnancy BMI. However, in Lutsiv et al's (2012) survey of health care providers in Hamilton, only 60% of health care providers said they provide a specific weight gain recommendation to women of all weight categories. This has been explored via surveys and qualitative study designs in the international literature, although results are contradictory. Surveys of women's recall of receiving GWG advice in the UK (n=59) and the US (n=311) have found no difference in the recall of weight gain advice by pre-pregnancy weight status (Brown & Avery, 2012; Stotland et al., 2012). Qualitative interviews conducted by Wang et al (2015) with 62 pregnant Latina women revealed that obese women indicated receiving advice more frequently than did normal weight women. Whitaker et al

(2016) interviewed physicians, residents, and a nurse practitioner from two obstetric clinics in the US and reported that some would only provide a weight gain target to women who were overweight or obese to begin their pregnancy. These two qualitative studies suggest indicate that obese women may be more likely to receive weight gain advice than women from other pre-pregnancy BMI groups. In contrast, in Waring et al's (2014) survey of 171 women, 45% of obese women did *not* recall receiving weight gain advice from their health care provider, as compared to 29% of normal weight and 26% of overweight women. Wrotniak et al's (2015) survey of 134 women had very similar findings. Taken as a whole, it is unclear whether women's pre-pregnancy BMI is related to whether or not health care providers provide GWG advice.

Another possible contributor to these observations could relate to the quality of the interaction between women and their health care provider and whether the discussion is sufficiently detailed for women identify and retain the information. This question is explored below.

Qualitative studies of gestational weight gain advice

No qualitative studies of Canadian health care providers' GWG counselling practices have been published to date, although studies exploring the quality of the discussion and the experiences of women and health care providers in regards to GWG counselling have been conducted in the US, UK, and Australia. Olander et al (2011) conducted focus groups with prenatal and postpartum women in one area of the UK. The authors reported that women indicated that their health care provider did not provide information on GWG, which left them to rely on the Internet; they also noted that women assumed their midwife would tell them if their GWG was a concern. Whitaker et al (2016) conducted individual interviews with pregnant women at 20-30 weeks gestation, as well as with health care providers (physicians, residents, and a nurse practitioner) from two obstetric clinics in the US. Interestingly, the authors found congruency between women's and health care providers' descriptions of GWG advice. While the majority of women discussed GWG in some way with their health care provider, nearly half of women did not recall being provided a specific weight gain target. Similarly, while all health care providers reported discussing GWG with all women in some way, not all health care providers provided all women with a specific weight gain recommendation. Studies by Stotland et al (2010) and Chang et al

(2013) of general practitioners, obstetricians and nurse-midwives in two areas of the US found that health care providers do not have a routine approach to GWG, and may not focus on weight in their prenatal appointments. Some health care providers specifically indicated that they do not provide women with a GWG target (Stotland et al., 2010). In contrast, a qualitative study of physicians and nurse-midwives from the Boston area reported that health care providers typically *did* provide women with a target GWG recommendation, but this may not be congruent with IOM guidelines (Oken et al., 2013). This is discussed in the next section.

Congruency of advice with Institute of Medicine guidelines

In the Canadian studies described earlier, the congruence between health care providers' GWG advice and the IOM/Health Canada guidelines was also assessed. Lutsiv et al (2012) asked Ontario health care providers to report the GWG target they provided to pregnant women, and found that 80% reported recommendations that fell within IOM guidelines, while 10% of recommendations were above the guidelines and 10% were below. GWG recommendations were less frequently congruent with Health Canada guidelines for underweight women (53%) as compared to the other BMI categories (approximately 90% congruent). Ferraro et al (2013)'s larger survey (n=174) that asked the same question found that 69% of respondents recommended a specific weight target to obese women that was at or below IOM recommendations, but the authors did not report the health care providers' recommendations for other BMI categories.

When the congruency of GWG advice with IOM guidelines has been examined in international studies, 42-85% of women who recalled receiving GWG advice reported receiving a target within these recommendations (Althuizen et al., 2009; Brawarsky et al., 2005; Liu et al., 2016; Olson & Strawderman, 2003; Phelan et al., 2011; Stotland et al., 2005; Waring et al., 2014; Wrotniak et al., 2015). One of the largest of these studies was conducted in San Francisco, and was a prospective cohort of 1100 women who completed questionnaires three times during pregnancy (Brawarsky et al., 2005). One of the questionnaires, administered at 32-36 weeks gestation, asked women if they received advice about GWG from a physician, and if yes, how much weight they were told to gain. Total GWG was calculated by subtracting pre-pregnancy weight from the last measured weight prior to delivery. Approximately half (47.5%) of the women participating reported receiving GWG advice that was congruent with the 1990 IOM

guidelines (which were current at the time of data collection), while 10.8% reported receiving advice in excess of the guidelines, and 6.5% reported receiving advice that was below the guidelines. Thirty-five percent did not recall any GWG advice. Two recent studies conducted in the US examined the congruency of advice with the 2009 IOM guidelines. Specifically, Waring et al (2014) surveyed women (n=149) in late pregnancy who were attending a single medical centre in Massachusetts. Women were asked whether or not a health care provider had told how much weight to gain in pregnancy, and if so, how much. Survey data was complemented with information extracted from the women's medical charts. In a similar study, Wrotniak et al (2015) surveyed 134 postpartum women in two hospitals in western New York State. Both studies found that approximately half of women who recalled receiving advice reported an amount within the guidelines. Of note, when women recalled receiving GWG advice that is not congruent with the IOM guidelines, 10-42% recalled a recommendation that is above, rather than below guidelines (Althuizen et al., 2009; Brawarsky et al., 2005; Liu et al., 2016; Olson & Strawderman, 2003; Phelan et al., 2011; Stotland et al., 2005; Waring et al., 2014; Wrotniak et al., 2015).

There is evidence that the accuracy of weight gain advice varies by pre-pregnancy BMI, with more overweight and obese women recalling guideline-incongruent advice. In Wrotniak et al's (2015) survey of postpartum women in western New York state, healthy weight women (86.8%) were more likely to report being provided with guideline-congruent advice than women who were overweight (12.5%) or obese (26.3%; $p<0.001$). The authors did not provide the actual weight gain recommendations (pounds or kilograms) that women reported. Cohen et al's (2010) study of 81 women in Ottawa and Montreal included a question asking women if they received weight gain advice, and what amount they were told to gain. The authors noted that the majority of women, regardless of pre-pregnancy BMI, reported being told to gain 25-35 pounds, which is the recommendation for normal weight women. One interpretation of these results is that health care providers may provide the same recommendation to all pregnant women regardless of pre-pregnancy BMI. In the study by Waring et al's (2014), half of the overweight women reported being advised to gain 25-35 pounds, the recommendation for normal weight women, and 63% of obese women reported being told to gain 15-25 pounds, which is the recommendation for overweight women. Incorrect weight gain targets may also arise from a lack of calculation or

knowledge of pre-pregnancy BMI, as this study reported that 68% of overweight women stated that they were classified with a normal pre-pregnancy weight by their health care provider. The authors of this study suggested that health care providers may be relying on visual appraisal, rather than a calculated pre-pregnancy BMI.

Surveys of health care providers' self-reported practices seem to confirm that the IOM guidelines may not be widely used in practice. Although Ferraro et al (2013) reported that the majority of the 174 health care providers participating in their survey could accurately identify GWG recommendations, 31.2% provided obese women with a recommendation greater than the maximum of the IOM's range. A national survey of US obstetricians (n=250) found that 42% always used pre-pregnancy BMI to modify their advice, which suggests that most obstetricians would likely recommend a GWG target range higher than the IOM guidelines (Boothe-LaRoche, Belay, & Sharma, 2014). Other surveys of health care providers in the US and Australia confirm that the IOM guidelines are not widely incorporated into practice (Power et al., 2006; Stewart, Wallace, & Allan, 2012).

The quantitative data outlined above is supported by qualitative studies from the perspective of health care providers, since they also suggest a low of use of the IOM guidelines in practice. Duthie et al's (2013) conducted interviews with obstetricians in the midwestern US and reported that while obstetricians were generally aware of the IOM guidelines and desired their patients to gain within these guidelines, they varied in their approach to providing these guidelines to women. Some obstetricians in the interviews indicated they provided a GWG recommendation early in pregnancy, while others prioritized other topics as more important than GWG in early pregnancy. Chang et al's (2013) and Oken et al's (2013) studies using interviews with various health care provider disciplines in the US found that few health care providers used the IOM guidelines in providing GWG advice to women. Fieldwick et al (2014) found that some New Zealand midwives relied on visual assessment to determine GWG advice, rather than calculating pre-pregnancy BMI. National guidance in New Zealand recommends that health care providers use the IOM guidelines in their practice.

It seems clear that there are significant inconsistencies with respect to what GWG advice is given, when this advice is given, and whether it corresponds with recommendations outlined by the IOM. This may be particularly true for women who are overweight or obese to begin their pregnancies. Studies conducted thus far have not addressed the extent to which women may be mis-recalling or misinterpreting discussions about GWG with their health care provider, but this could add to the inconsistencies describe in the literature thus far.

Differences in provision of a gestational weight gain target between health care provider disciplines

Some researchers have explored the differences in the provision of a weight gain target between health care provider disciplines. Ferraro et al (2013) found differences in self-reported GWG counselling when comparing health care provider disciplines. While 93.5% of midwives and 93.1% of general practitioners reported some form of counselling on GWG, 73% of maternal-fetal medicine specialists said the same. This could potentially be explained by the differences in patient populations, as midwives and general practitioners typically see low-risk pregnancies, while maternal-fetal medicine specialists concentrate on high-risk pregnancies and therefore may place lower priority on discussing GWG. The same study also noted significant differences in the GWG targets recommended for normal weight women as reported by midwives and maternal-fetal medicine specialists; on average, midwives recommended 1.46 kg more weight gain than maternal-fetal medicine specialists ($p=0.028$). As well, 60% of the midwives surveyed recommended a weight gain target for obese women that was greater than the upper limit of the IOM guidelines, as compared to 33.3% of general practitioners and 22.5% of obstetricians. Lutsiv et al's (2012) smaller survey in Ontario did not find significant differences between obstetricians, general practitioners, midwives, and other health care providers' self-reported provision of a GWG target. However, McDonald et al's (2012) survey of women from the same clinics in Ontario found that patients of midwives were more likely to recall being given a weight gain target as compared to patients of general practitioners, obstetricians or other providers ($p=0.049$). There were no significant differences between disciplines in the proportion of those recalling being given a target congruent with IOM recommendations. Of note, the women receiving midwifery care reported higher education, were more likely to be middle income, and were more likely to have a stable partner, which may have an influence on their recall of their

health care provider's advice. Taken together, there is a suggestion that there may be differences between health care provider disciplines in the frequency of providing GWG advice to women, as well as the amount of weight that they recommend for women to gain over the course of their pregnancy. However, further evidence is needed from larger and more representative surveys, and an exploration of the reasons behind *why* there is a difference in practice should be undertaken.

When turning to the literature to determine if other countries have found differences in GWG counselling practices between health care provider disciplines, there is little additional evidence available except for two studies from the US. Wrotniak et al's (2015) survey of women in western New York noted that the majority of women who were provided a weight gain target received it from their obstetrician/gynecologist (73%), followed by nurses/nurse practitioners (15%), nutritionists (3%), or their primary care provider (2%). These results may be a reflection of health care service delivery, as not all pregnant women who participated in the survey may have accessed allied health services such as nursing or nutrition. Wang et al's (2015) study with pregnant Latinas in Massachusetts who were at or beyond 22 weeks gestation found that only one-third recalled advice from their obstetric provider, while the majority received weight gain advice from a nutritionist. Of importance, more than 94% of participants in this study had at least one appointment with a nutritionist by the time of data collection. Although the authors did not present data on the number of women in their study who participated in the Women, Infants and Children (WIC) program, due to the demographics of the sample it is possible that many of the participants had access to nutrition counselling through WIC, whereas the general population of pregnant women may not readily access nutrition services. WIC is a specialized program offered by the US federal government that includes supplemental foods, nutrition counselling, and health care referrals for low-income pregnant and breastfeeding women and their young children (United States Department of Agriculture Food and Nutrition Service, 2016). WIC participants may also be eligible for the Supplemental Nutrition Assistance Program (SNAP), commonly referred to as "food stamps", which is open to all low-income individuals. Given this, it is possible that the participants in this study had more access to nutrition counselling than the general population, which resulted in an inflated number receiving weight gain advice from a nutritionist. In summary, these studies may only provide information about

which health care provider disciplines pregnant women are most likely to access, rather than true differences between disciplines in the provision of a GWG recommendation.

Discussing the appropriate rate of gestational weight gain

There is a gap in the literature regarding the provision of advice on an appropriate rate of weight gain. In Boothe-LaRoche's (2014) survey of 250 US obstetrician/gynecologists, 65% reported always counseling about appropriate rate of GWG, but this study did not examine the congruency of advice with IOM guidelines. Further research is needed to determine if health care providers discuss the appropriate rate of weight gain with their pregnant patients/clients.

2.1.2 Discussing the risks of inappropriate weight gain

The Canadian studies outlined previously also looked at health care providers' discussion of the risks of inappropriate weight gain, which are reviewed in Chapter 1 of this thesis. McDonald et al (2011) found that out of the 310 women surveyed, 25.5% reported that they were told of the risks of excess GWG, and 22.3% were told of the risks of inadequate GWG. There were no differences between patients of each health care provider discipline when compared in the authors' subsequent study (McDonald et al., 2012). Conversely, over 80% of the 42 health care providers surveyed from the same Ontario clinics reported discussing the risks of excess GWG, again with no significant differences between health care provider disciplines (Lutsiv et al., 2012). However, the authors noted that none of the respondents indicated that they did this "always", and the majority said they did this "seldom" or "about half the time". This may indicate that the discrepancy between women's and health care providers' reports is because health care providers do not discuss the risks of inappropriate weight gain with *all* pregnant women.

As there is no other Canadian literature on discussing the risks of inappropriate weight gain, international studies can be looked at to provide more information. Macleod et al (2013) surveyed 78 midwives from one area in the UK about their practices in weight management for obese pregnant women; 42% said they frequently or always discussed the risks of inappropriate weight gain with their obese patients. Stotland et al (2010) conducted focus groups with 52

health care providers of various disciplines (obstetricians, midwives, and nurse practitioners) in San Francisco, and found that some health care providers did not discuss the risks of inappropriate weight gain, as this was seen to be a "scare tactic" that might affect the rapport built with women. Others took a direct approach, explaining the risks of excessive weight gain on both the mother and the baby. Although the evidence is sparse in this area, it appears from the accounts of both women and the health care providers themselves that not all pregnant women will receive information from their health care provider regarding the risks of inappropriate GWG.

2.1.3 Discussing physical activity and nutrition

The Canadian surveys of women and health care providers by McDonald et al (2011), Lutsiv et al (2012), and Ferraro et al (2013) outlined earlier also examined the provision of physical activity and nutrition information to pregnant women. McDonald et al (2011) found that 17.9% of the total sample of women reported being told to increase the calories they consume by a particular amount, but 38% of those who indicated they were told to increase calories could not recall what the amount was. In contrast, 96.8% reported being advised to take a prenatal vitamin. There is, once again, a discrepancy between the proportion of women who report receiving physical activity and nutrition information from their health care provider, and the proportion of health care providers who report providing it. Eighty-one percent of health care providers from the same clinics in Ontario reported that they advise women to increase calories by a particular amount, and 92% said they discuss exercise with their pregnant patients (Lutsiv et al., 2012). The only area of agreement was regarding advice to take prenatal vitamins, with 100% of health care providers reporting that they did this. The reasons for this are not clear, but could include the fact that a recommendation to take a vitamin supplement is a simple message for health care providers to give, and it is expected and easy for women to remember. This may explain the agreement between women's and health care providers' reports. Ferraro et al (2013) found similarly high rates of physical activity and nutrition counselling reported by health care providers, at approximately 86% for nutrition and 82% for physical activity counselling. The discrepancy between women's and health care providers' reports of GWG counselling may also be due to the lack of depth of the counselling, as indicated by women's lack of recollection of the specific additional calories advised by their health care provider. Another possible explanation is

that health care providers do not provide physical activity and nutrition information to *every pregnant woman*. In McDonald et al's (2014) audit of 300 pregnant women's charts from a Hamilton tertiary care centre, only 13.3% had documentation about discussing exercise. In the Ontario antenatal record, exercise is listed alongside other health subjects in a checklist titled "Discussion topics" (Ontario Ministry of Health and Long-term Care and the Ontario Medical Association, 2005). The authors assessed the proportion of charts that had this marked off, but did not assess documentation about nutrition counselling. It is unclear whether these results reflect inaccurate documentation of discussing exercise or that health care providers are not discussing exercise with all pregnant women. In a study specific to physical activity counselling in pregnancy, Schmidt et al (2016) surveyed health care providers who were members of the SOGC. Of the 194 respondents, roughly a quarter (26.2%) of them used the Physical Activity Readiness Medical Examination for Pregnancy to screen for contraindications and provide women with an exercise prescription. These results may overestimate the percentage of health care providers who use this tool, as this survey had a modest response rate (15.2%) and survey respondents may have had a particular interest in this area. However, the results of this survey add helpful information, as the survey specifically asked about the provision of an exercise prescription, rather than general questions about discussing physical activity. These findings indicate that few health care providers provide specific, tailored exercise recommendations to women. From these Canadian studies, a general pattern appears: women and health care providers have different views on how frequently physical activity and nutrition discussions occur, but similar descriptions of the content. Typically, general advice is given, such as a recommendation to take a prenatal vitamin, but specific and tailored advice is not.

Studies of women's perspectives from other areas of the world confirm the notion of general recommendations rather than individualized counselling. Duthie et al (2013) conducted qualitative interviews with both obstetricians and first time pregnant women between 29 and 40 weeks gestation, both at the same clinic, in the Midwestern US. The key message from their work was that the obstetricians reported providing physical activity and nutrition advice to women, but women said this was very general or not provided at all. De Jersey et al (2013) conducted a prospective cohort study of 582 Australian pregnant women, and asked them about the frequency of their health care provider's provision of physical activity and nutrition advice

when the women were at 16 weeks of gestation. About two-thirds of women (64%) said their health care provider sometimes or always encouraged them to eat healthy foods, 43% of women said their health care provider asked about the food they eat, and 29% were given advice about the amount of food to eat. Results were similar for physical activity, with more reporting encouragement (47%), than asking about current physical activity habits (39%), or offering advice about how to include physical activity (23%). When asked the same questions again at 36 weeks, there was no substantial change, although the statistical significance of this was not reported (de Jersey et al., 2013). This study suggests that easy messages, such as encouragement, are more common than assessing current habits and providing tailored advice; this persists throughout the course of pregnancy.

The provision of physical activity and nutrition information may also occur using a print handout. This was examined in a unique study that was conducted by Szwajcer et al (2009) in the Netherlands. The authors wanted to explore the provision of nutrition information by midwives via print resources as well as verbally. To do this, the authors audio-recorded the initial antenatal visit with a midwife for 12 first-time pregnant women, and then interviewed the women twice afterwards. All participants in this study received the same prenatal nutrition brochure, produced by the Dutch Dairy Association. The authors observed that the midwives' advice regarding nutrition was very general, and there was more focus on empathy and reassurance. They also observed that the nutrition brochure was provided as part of a package of other information materials but was not reviewed with the women. When the women were interviewed after the study, they reported that they already knew the nutrition information provided by the midwife by the time their first antenatal appointment came around (approximately 12 weeks gestation). However, they appreciated being able to speak with a midwife about nutrition, and preferred the verbal information to the handout. The use of print handouts to provide nutrition and physical activity information may be common in other areas of the world as well. Brown & Avery (2012) surveyed 59 women in the UK using closed- and open-ended questions. Women were asked an open-ended question regarding where they received physical activity and nutrition information from during pregnancy. Of those who said they received information from a health care provider, the most frequent "advice" reported was that they were given a print handout. The authors noted that many participants indicated that the

advice they received was not detailed. In summary, from women's perspectives, physical activity and nutrition information provided during pregnancy lacks detail, and may be provided as a print handout only.

Health care providers themselves reported a variety of practices in regards to physical activity and nutrition counselling in other international studies; some reported giving very general advice, and others reported assessing women's current lifestyle habits in depth. In Macleod et al's (2013) survey of UK midwives (n=78), 15% reported providing tailored physical activity and nutrition advice based on women's current physical activity levels and diet. Likewise, Fieldwick et al's (2014) focus groups of New Zealand midwives found that most reported discussing physical activity and nutrition, although some would conduct an in depth assessment of women's current diets. Similar findings came from Stotland et al's (2010) focus groups obstetrician, nurse-midwives, and nurse practitioners in San Francisco, as some health care providers reported that they assisted women by helping them set realistic lifestyle goals. However, based on the reports from women, it is possible that health care providers who provide this sort of detailed physical activity and nutrition counselling are in the minority. Further research in this area is needed to determine if this is the case.

In summary, there are multiple studies conducted in Canada and abroad that indicate that while general physical activity and nutrition messages may be discussed, and a print handout provided, individualized physical activity and nutrition information is not regularly provided to pregnant women. Furthermore, it appears that these discussions do not routinely occur with every pregnant woman.

Differences in the provision of physical activity and nutrition counselling between health care provider disciplines

There is little in the Canadian literature regarding differences in the physical activity and nutrition counselling practices between health care provider disciplines; however, from the evidence available, it appears there may be some differences. McDonald et al's (2012) survey of 308 women in Hamilton compared the physical activity and nutrition counselling women reported receiving by the health care provider discipline that women reported as their primary

provider. The authors found no significant differences between patients of general practitioners, obstetricians, midwives or other providers in their recall of discussing extra caloric requirements or prenatal vitamins (p=0.073 and 0.294, respectively). However, patients of midwives more frequently reported having discussed exercise (69.3%) than patients of general practitioners (48.8%) and obstetricians (39.1%; p=0.001). Interestingly, when the charts of 300 Hamilton women of were audited, patients with exclusive midwifery care were noted to have more frequently checked off "discussed physical activity" in the antenatal record (McDonald et al., 2014). Ferraro et al's (2013) survey of 174 Canadian health care providers also found that midwives and general practitioners reported counselling on physical activity more frequently (96.9% and 93.1%) than obstetricians (79.1%) and registered nurses (60%; p=0.006). However, in this case there was also a significant difference in nutrition counselling, with general practitioners and midwives making nutrition recommendations more often (96.6% and 96.9%) than obstetricians (81.4%) and registered nurses (80%; p=0.03). It should be noted that the sample size from each discipline was small to modest, with five registered nurse respondents, and 29 and 32 general practitioners and midwives, respectively. This makes it difficult to draw generalized conclusions about differences in Canadian health care provider practices. In a US survey of 188 health care providers, general practitioners less frequently reported providing individualized physical activity counselling (33%) as compared to nurse-midwives (65%) (Leiferman, Gutilla, Paulson, & Pivarnik, 2012). This may not be translatable to the Canadian context due to differences in health care systems. In summary, there is some evidence that midwives more frequently counsel their patients on physical activity and nutrition than health care providers from other disciplines, but this area requires further exploration.

2.1.4 Weight assessment

Calculation and recording of pre-pregnancy body mass index

Health Canada and the IOM recommend calculating and recording each woman's pre-pregnancy BMI since this is the basis for a GWG target range. In McDonald et al's (2014) audit of 300 women's charts in Ontario, the authors found that 53% of charts had BMI documented, while 40% had pre-pregnancy height and weight recorded without BMI being calculated. There were no differences in documentation by pre-pregnancy BMI (p=0.71). This appears similar to the

literature reviewed earlier, where the reports of both women and health care providers suggest that many health care providers do not use pre-pregnancy BMI when providing a GWG target.

Comparing this to international studies, a random review of 477 charts of women who delivered at an academic care centre in Massachusetts found that only 5.8% had pre-pregnancy BMI documented (Moore Simas et al., 2010). In contrast, a qualitative study by Macleod et al (2013) found 79% of UK midwives reported calculating BMI at the initial appointment, and Schmied et al (2011) noted that New Zealand midwives reported that BMI is typically used for the determination of obesity in pregnancy. Overall, there is likely room for improvement in the regularity with which health care providers calculate and record pre-pregnancy BMI.

Measuring weight at prenatal visits

Anecdotally it seems that many pregnant women in Canada are weighed at each prenatal visit with a health care provider, although this practice has not been rigorously studied. Lutsiv et al's (2012) survey of 42 Ontario health care providers found that 83% reported routinely weighing women at the first visit, and approximately two-thirds would weigh women at each following visit. McDonald et al (2014) found 92.3% of the 300 charts of pregnant women in Hamilton that the authors audited had a recorded weight at every visit, and there were no differences by pre-pregnancy BMI ($p=0.88$). Thus, both studies demonstrated that health care providers regularly weigh women at prenatal visits. Neither study presented data on the differences in weight measurement by health care provider discipline, which potentially could exist as there is some evidence suggesting differences in practices between disciplines regarding providing GWG advice and discussing physical activity and nutrition (outlined earlier).

Studies examining the practice of measuring women's weight that were conducted in areas that have not adopted the IOM guidelines must be interpreted carefully, as some countries have national guidance that specifically states not to weigh women at each visit unless clinically relevant. Studies from the UK, New Zealand and Australia have found that few women and health care providers report regular weight measurement, as is consistent with their national guidelines (Brown & Avery, (2012); Olander et al., (2011); Schmied et al., (2011).

2.1.5 Timing of gestational weight gain counselling

There is some evidence that GWG counselling may be provided too late in pregnancy for women to take action. The only Canadian study to look at the timing of weight gain counselling was Lutsiv et al's (2012) survey of 42 health care providers in Hamilton, which reported that approximately one-fifth thought that the first prenatal visit (at a median of 10 weeks gestation) was too early in pregnancy counsel women about GWG, and another fifth thought this was too late to have an optimal impact on GWG.

Qualitative studies from the US provide more insight into this issue. Both Stotland et al (2010) and Chang et al (2013) found that there was typically a "reactive" approach by health care providers, where GWG was discussed at subsequent appointments in more detail only once excess weight had already been gained. Duthie et al (2013) found that obstetricians varied in the timing of their GWG discussions, with some initiating a conversation early, and others doing so after a few visits. Oken et al (2013) reported variation in health care provider practices, from discussing weight gain at each visit, to discussing it only at the first visit, to not discussing at all. However, they also noted that health care providers discussed GWG more frequently when women were overweight or obese. This "reactive" approach fits with women's accounts of receiving GWG advice when they are further along in their pregnancies, suggesting that advice is provided later in pregnancy (Stotland et al., 2012).

The timing of advice is important, as the safety of weight loss in pregnancy has not been established; therefore, it is necessary to prevent excess weight gain before it occurs (Health Canada, 2010). Studies of examining women's perspectives have found that women feel that nutrition advice should be provided in the first trimester (Szwajcer et al., 2009; Wennberg, Lundqvist, Högberg, Sandström, & Hamberg, 2013). In Smid et al's (2015) study of pregnant Latinas in the US, most participants had access to a nutritionist, but found their appointment to be too late in pregnancy to be helpful. Given this, it appears that there is a need for health care providers to address GWG, physical activity, and nutrition earlier in pregnancy.

2.1.6 Summary

There is substantial international evidence that a total GWG target is not provided to a significant proportion of pregnant women, and limited Canadian data supports this. Of those that do provide this type of advice, there is evidence that a significant proportion of health care providers provide women with a total weight gain target that is not congruent with Health Canada and IOM guidelines. The literature suggests that some health care providers do not assess and record pre-pregnancy BMI, which may contribute to the lack of congruency of advice with the IOM GWG guidelines. Similarly, few health care providers appear to discuss the risks of inappropriate weight gain. The literature also suggests that physical activity and nutrition are discussed very generally or not at all, with minimal advice that is individualized for the woman; however, midwives might counsel in this area more frequently. The depth of the discussion has not been examined, due to the general nature of the survey questions and lack of Canadian qualitative studies. The timing of GWG, physical activity, and nutrition advice may occur too late in pregnancy to take action, or is "reactive" to a woman already gaining weight excessively. There is a gap in the literature on the differences in weight assessment practices of each health care provider discipline, which is needed to understand what supports each health care provider discipline would benefit from to enhance their GWG counselling practices. Much of the Canadian literature is from one area of Ontario, or surveyed respondents through a single nationwide organization but the geographic distribution of respondents was not reported. No Canadian qualitative studies on women's or health care providers' views of GWG counselling interactions were discovered for this literature review, and are warranted to provide depth and context to the current GWG counselling practices reported by health care providers.

It is important to note that much of the research in this area is cross-sectional and typically used self-reported data from women or health care providers. Cross-sectional surveys provide a "snap shot" of a situation, which must be considered when interpreting the results. As with all information generated from surveys, the data collected is subject to recall and social desirability bias. The majority of international studies reviewed have been conducted in the US, UK, and Australia, and these countries differ in clinical practice guidelines and health service delivery, which impacts the generalizability of results to a Canadian context (as noted throughout this literature review). For example, the UK does not have GWG guidelines, and the UK and Australia do not recommend routine weighing of pregnant women unless clinically necessary.

Furthermore, midwifery care is common in the UK, Australia and New Zealand, as compared to the US and Canada. Thus, studies from these countries must be interpreted in this context, as the practices of health care providers may be incongruent with Canadian and US national guidance, but completely congruent with their own, and differences in practices by health care provider disciplines are in a different health service delivery context.

2.2 Influences on gestational weight gain counselling: barriers and facilitators

The literature suggests a need for changes in GWG counselling practices of health care providers to better align with IOM/Health Canada GWG guidelines, but there is little guidance available on how to improve this. Heslehurst et al (2014) conducted a systematic review and meta-synthesis of the determinants of health care providers' practices in pregnancy weight management. This review included survey and qualitative research studies (1990-2012) that gathered the perspectives of health care providers. To synthesize the information, the authors coded the key findings of each study based on the Theoretical Domains Framework. This is an integrative framework developed from a synthesis of psychological theories that is used to apply theoretical approaches to behaviour change interventions, in particular for clinical practice change for health care providers (Cane, O'Connor, & Michie, 2012). The purpose of the meta-synthesis was to identify relevant areas to target for an intervention in health care providers' prenatal weight management practices. Heslehurst et al's (2014) findings are highly relevant to this literature review and are referred to throughout the following sections. Overall, the meta-synthesis found that the three most frequently cited barriers and facilitators to prenatal weight management practices were: health care provider knowledge about GWG, physical activity, nutrition and their related clinical practice guidelines; health care provider beliefs about consequences of discussing GWG (e.g., that the sensitivity of discussing or measuring women's weight would cause psychological harm to women); and environmental context and resources, which included physical resources such as print handouts, as well as programming, funding, and the organizational environment, among other things. These three domains, alongside other areas of importance found in the literature, are reviewed in the following sections.

2.2.1 Sensitivity of discussing gestational weight gain

Heselehurst et al's (2014) meta-synthesis found that the domain of "beliefs about consequences" was one of the most frequently cited influences on GWG counselling practices, as included studies frequently found that discussing or measuring women's weight was sensitive from the perspective of health care providers. The only Canadian study to address the sensitivity of discussing GWG was Lutsiv et al's (2012) survey of 42 health care providers from Ontario, which reported that one-fifth of health care providers reported not weighing women or discussing weight because they did not want to make the patient feel uncomfortable. Qualitative studies from the US, UK, Australia and New Zealand have repeatedly found that health care providers report that pregnant women respond emotionally to discussions about weight. One example is a study from Stotland et al (2010), who conducted focus groups of obstetricians, nurse practitioners, and nurse-midwives from the San Francisco area. The authors aimed to gather health care providers' attitudes and practices regarding weight gain, nutrition, and physical activity counselling during pregnancy. In every focus group, participants cited a fear of broaching the subject of weight with pregnant women. Health care providers felt that women would react negatively to this discussion, such as feeling offended, angry, sad, or ashamed. Maintaining rapport with women was important, as health care providers reported that an inappropriate discussion of weight might lead to women leaving their care to find another, more sensitive health care provider. Many of the health care providers noted their own struggles with weight management, and used this to relate to the experiences of their pregnant patients.

Stotland et al's (2010) results are similar to qualitative findings from other researchers. Namely, other studies have found that health care providers had apprehension with initiating a discussion about weight gain with pregnant women (Heslehurst et al., 2013; Macleod et al., 2013; Willcox et al., 2012). There was also fear from health care providers that weighing women too frequently, or discussing weight too often, would cause distress for women, such as depression, anger, or embarrassment (Fieldwick et al., 2014; Haruna et al., 2010; Olander et al., 2011; Willcox et al., 2012). Health care providers reported difficulty in communicating in a way that avoided harm, and did not want to stigmatize or blame women (Fieldwick et al., 2014; Heslehurst et al., 2013; Willcox et al., 2012). In particular for studies of midwives, there was a reported desire to maintain rapport and a positive relationship (Heslehurst et al., 2013; Lindqvist,

Mogren, Eurenius, Edvardsson, & Persson, 2014; Macleod et al., 2013; Olander et al., 2011). Studies have reported that a health care provider's own weight status influences their comfort with discussing GWG, either in a positive way where they could relate to women experiencing weight management struggles, or in a negative way where they felt as if they were unable to give weight management advice due to their own weight status (Heslehurst et al., 2013; Schmied et al., 2011). Guidelines for how to discuss weight with pregnant women were seen as a gap in one study of midwives in New Zealand (Fieldwick et al., 2014).

The discomfort on the part of the health care provider influenced how they approached GWG in practice. Chang et al (2013) interviewed general practitioners, obstetricians, and nurse-midwives regarding their GWG counselling practices, participants noted that they avoid the subject. Oken et al (2013) interviewed nurse-midwives and physicians from a group practice in Massachusetts regarding the same subject, and found that health care providers would avoid beginning or ending an appointment on the topic, as it was seen to be a negative discussion. One health care provider in Stotland et al's (2010) focus groups reported purposely providing an inflated weight target so that women were not anxious about their weight gain, while another health care provider in the same study avoided routine weight measurement if a woman appeared anxious. In Heslehurst et al's (2014) meta-synthesis, the authors suggested that the sensitivity of the topic was related to health care providers' confidence in their skills to communicate in a sensitive manner, which is reviewed in section 2.2.5.

In summary, there is limited Canadian data examining health care providers' perceptions of GWG counselling as a sensitive topic. Evidence from studies in the US, UK, Australia and New Zealand suggest that this may be a barrier to GWG counselling for some health care providers and this should be explored further among Canadian health care providers.

2.2.2 Knowledge of gestational weight gain and related topics

Another influence on GWG counselling practices that has been identified is knowledge in the areas of GWG, physical activity, and nutrition. Two Canadian surveys have asked health care providers about their self-perceived adequacy of knowledge in these areas. In Ferraro et al's (2013) survey of 174 health care providers, the majority felt they had adequate knowledge in

GWG (91%), physical activity (90%) and nutrition (72%). However, this still leaves a small proportion of health care providers who indicate that their knowledge is inadequate, although this study does not provide sufficient detail as to what aspects of these topic areas health care providers feel tneed improved knowledge. Lutsiv et al's (2012) regional survey of 42 health care providers found that 49% of respondents felt they would be better able to counsel their patients on weight gain and nutrition if they had more knowledge in these areas. This suggests that knowledge is a barrier to adequate GWG counselling for some health care providers.

Also in the survey by Lustiv et al (2012), nearly all respondents reported that they understood that there are risks of excessive GWG to both mother and baby. However, the survey did not assess health care providers' knowledge of the risks to mother and baby, so it is possible that this is an area for further knowledge development. Nutrition may be an area for improved knowledge as the survey found that 24% of respondents did not recall how many additional calories they recommend for women to consume in pregnancy; this could imply a gap in knowledge. Given that 20% of survey respondents reported recommending weight gain targets that were incongruent with the IOM/Health Canada guidelines, it is possible that health care providers may lack knowledge of these national guidelines. This was similar to Ferraro et al's (2013) findings, as over 30% of respondents to that survey reporting recommending a weight gain target to obese women that was in excess of the guidelines. However, neither survey specifically queried its participants on their knowledge of the guidelines; rather, they asked what recommendations they provide. As such, it is possible that the health care providers had knowledge of the guidelines, but chose not to use them. Of note, Heslehurst et al's (2014) meta-synthesis found that local or national guidelines for GWG were generally reported as a facilitator to prenatal weight management practices, as long as health care providers bought-in and agreed with the guidance.

Knowledge of physical activity and nutrition practice guidelines are also important to note as potential influences on practice. In Schmidt et al's (2016) survey of 198 Canadian health care providers, roughly half (55.5%) used the Joint SOGC and Canadian Society for Exercise Physiology guidelines for prenatal exercise. On the hand, nearly three-quarters (74%) did not use the Physical Activity Readiness Medical Examination for Pregnancy, for the most part

because they were unaware of it (57.5%). As noted earlier, it is possible that these respondents may have had a pre-existing interest and knowledge physical activity in pregnancy specifically. The extent of health care provider knowledge of these two key physical activity guidelines is unknown but may be quite low. No studies specific to health care providers' knowledge of Health Canada's prenatal nutrition guidelines for health professionals were found for this literature review.

Heslehurst et al's (2014) meta-synthesis also identified lack of knowledge as a barrier to GWG counselling. Several studies have reported that health care providers perceive their knowledge in nutrition in relation to GWG management as inadequate, and reported that the diet advice they provided was based on health care providers' personal knowledge, rather than reputable sources (Haruna et al., 2010; Heslehurst et al., 2013; Stotland et al., 2010). Maternal obesity is another area in which health care providers report that their knowledge is lacking. Macleod et al (2012) surveyed of 78 midwives in one area of the UK, and found that less than 7% were confident or very confident in their knowledge of maternal obesity.

International surveys and qualitative studies have also examined health care providers' knowledge in practice guidelines for GWG, physical activity, and nutrition. Moore Simas et al (2013) surveyed resident physicians in obstetrics and family medicine (n=660) to assess their knowledge of the 2009 IOM GWG guidelines. Less than 6% of respondents chose the correct ranges for GWG as per the guidelines. However, this survey was distributed only 7 months after the release of the guidelines, and it is possible that the survey respondents may not have been informed of the revisions at that time. Regarding physical activity guidelines, Leiferman et al (2012) surveyed 188 obstetricians, nurse-midwives, and general practitioners across the US regarding their knowledge and practices in physical activity counselling for pregnant women. Forty-eight percent were unfamiliar with US national physical activity guidelines, and the minority (40.4%) were confident that the physical activity information they provided to pregnant patients was in line with this guidance. Lack of knowledge may reflect a reported lack of formal training in the areas of GWG, maternal obesity, physical activity and nutrition, as found in some international qualitative studies (Oken et al., 2013; Stotland et al., 2010). In Power et al's (2006) survey of 900 US obstetricians regarding their counselling practices for weight management

before and during pregnancy, only 2.8% indicated that their training in maternal obesity was comprehensive, and 36.4% indicated that their training was inadequate or non-existent. Leiferman et al's (2012) survey also found that 17% of health care providers reported no professional training in prenatal physical activity counselling, and of those who did receive training, 69% said it was "fair" or "poor".

There is sparse literature available examining the differences in knowledge between health care provider disciplines. Interestingly, Ferraro et al's (2013) survey of Canadian health care providers found significant differences in health care providers' self-reported adequacy of knowledge in nutrition, with general practitioners more frequently agreeing that they had adequate knowledge (93.1%) than obstetricians (69.8%) and midwives (71.9%; p=0.003). This is of interest, as more health care providers in this survey reported providing nutrition counselling than reported adequate knowledge in nutrition. The survey did not find differences in knowledge of GWG or physical activity. Lutsiv et al's (2012) smaller, regional survey found no significant differences between disciplines regarding perception of risks of excessive GWG to mother and baby. This suggests that there are no differences in knowledge of the risks of excessive GWG, but this was not directly assessed. Taken together, there is very little known about the differences in knowledge between health care provider disciplines, and more research is needed given the fact that many pregnant women receive care from a number of different health care providers during the course of pregnancy.

2.2.3 Availability of resources to support gestational weight gain counselling

The environmental context and resources domain of the Theoretical Domains Framework was frequently identified in the studies included in Heslehurst et al's (2014) meta-synthesis of barriers and facilitators to weight management in pregnancy. However, there is little from the Canadian literature to determine how this is area may influence the practices of health care providers. One study that did report on this was Lutsiv et al's (2012) survey of 42 health care providers in Hamilton, which found that more than 75% of respondents sought a tool, in the form of a handout or a website, which would calculate a woman's weekly rate of weight gain as well as her total weight gain. This type of resource has been reported to be a facilitator to GWG counselling in international studies, which cite resources such as BMI calculator wheels (a

resource that allows the health care provider to adjust the wheel to a woman's height and weight to display her BMI), graphs where women can chart their weight gain, and electronic medical record prompts that automatically calculate weight gain as helpful tools that have been used in practice (Furness et al., 2011; Oken et al., 2013; Stotland et al., 2010). Other international studies have noted that health care providers desire written and online resources to provide to women, specifically for GWG, maternal obesity, physical activity, and nutrition (Chang et al., 2013; Macleod et al., 2013; van der Pligt, Campbell, Willcox, Opie, & Denney-Wilson, 2011). For example, van der Pligt et al (2011) interviewed 28 general practitioners from across Australia in regards to their views on how they can be supported to promote appropriate GWG for women. When asked if print or Internet resources were a useful means of sharing physical activity and nutrition information, most participants reported that at least one of these methods would be useful for them.

Beyond print and electronic resources, there may be a gap in supportive services to refer women to; in particular, access to a dietitian. Whether or not Canadian health care providers have access to a dietitian for their pregnant patients has not been specifically studied. However, Lutsiv et al's (2012) survey of Hamilton health care providers found that 62% would refer to a dietitian if a patient had gained weight excessively, and 69% did the same for those who gained weight inadequately. The health care providers who did not refer to a dietitian in these instances may have preferred not to, or may have lacked access to a dietitian. In Ontario, many general practitioners are part of a Family Health Team, which often includes one or more dietitians (Ontario Ministry of Health and Long-term Care, 2016). It is possible that more general practitioners would therefore access a dietitian to assist women with weight management; however, this has not been examined. Several international studies have also noted a need for improved access to dietitian services as perceived by health care providers, and reported long wait times that were not conducive to GWG management (Fieldwick et al., 2014; Schmied et al., 2011; van der Pligt et al., 2011). In a US study, there was an additional barrier of lack of insurance coverage to access dietitian services (Chang et al., 2013). Beyond dietitians, Heslehurst et al's (2014) meta-synthesis additionally found that physical activity services for pregnant women were a frequently reported gap across studies. In addition to the reports of a lack of resources, there also may be a lack of knowledge of resources available, which was self-

identified in studies of health care providers in the UK and US (Heslehurst et al., 2013; Leiferman et al., 2012). In Leiferman et al's (2012) survey of 188 obstetricians, nurse-midwives, and general practitioners from across the US, 10.5% indicated that their lack of knowledge of available resources was a barrier to their physical activity counselling. While this is a small percentage, it indicates that better information sharing and networking among service providers may be required to reduce barriers to GWG counselling for some health care providers.

2.2.4 Time available in a typical appointment

Also falling under the domain of environmental context and resources is the time constraints in prenatal appointments, which is a barrier to GWG counselling that was frequently cited in Heslehurst et al's (2014) meta-synthesis, as well as other studies. In Lutsiv et al's (2012) survey of health care providers in Hamilton, 46% of health care providers reported they would be able to better counsel their patients on GWG if they had more time. From international studies, time also appears to be a barrier. Kominiarek et al (2015) conducted focus groups with 36 physicians and nurse-midwives at an academic health centre in the US, and found that a frequently cited challenge by health care providers was the inability to tackle a complex issue such as GWG within the time of a standard prenatal appointment. The participants suggested longer, or an increased number of appointments. Herring et al (2010) surveyed 58 obstetricians, nurse practitioners, and nurse-midwives at a single practice in Massachusetts regarding their knowledge and practice patterns related to obesity in pregnancy. The authors found that less than half (48%) of respondents indicated that they had sufficient time to counsel women about the risks of obesity in pregnancy. Of note, this survey had a relatively high response rate (58%), indicating that the responses were fairly representative of all health care providers in this setting. The first prenatal appointment in particular has been noted to include a large amount of information sharing, which makes it difficult to cover all possible topics of importance, such as GWG (Macleod et al., 2013; Olander et al., 2011). This is important, as GWG information is recommended to be shared early in pregnancy (Institute of Medicine and National Research Council, 2013). Health care providers have reported pressure to fit more topics into the same length of visit (Lindqvist et al., 2014).

Although midwives in international studies report time constraints in their prenatal appointments, Canadian midwives typically have longer appointments than general practitioners or obstetricians. McDonald et al (2012) suggested this could be a possible reason for why more patients of midwives recalled being provided a weight gain target as compared to patients under obstetrician care, but there is a lack of literature examining this possibility.

2.2.5 Skills and confidence in counselling ability

A key skill that health care providers in several studies reported a need for improvement in is the ability to communicate effectively when addressing the sensitive topic of weight (Furness et al., 2011; Heslehurst et al., 2013; Schmied et al., 2011; Willcox et al., 2012). Approaching the discussion in a compassionate and positive manner was seen to be a facilitator to GWG discussions (Stotland et al., 2010). Health care providers may lack confidence that their counselling is effective in promoting behaviour change. In Chang et al's (2013) interviews with a variety of health care provider disciplines in the US, participants had little confidence in their counselling ability, and felt that women were more influenced by other factors, such as culture, than by their health care provider. Macleod et al's (2013) survey of 78 midwives in the UK found that only 19% were confident or very confident in their ability to discuss weight with obese pregnant women. Herring et al (2010) surveyed 58 health care providers at one practice in Massachusetts, and used multiple linear regression to determine the influence of knowledge and attitudes on counselling practices for obese pregnant women. The authors created a "guideline adherence score" by counting the number of recommended practices that each respondent reported following (a score out of a possible 8 points). When controlling for female sex, BMI, body satisfaction, and the belief that obese pregnant patients can make changes to avoid pregnancy complications, survey respondents who were confident in their knowledge about counselling (as compared to not confident in their knowledge about counselling) were more likely to achieve a higher guideline adherence score ($\beta = 1.0$, $p=0.05$). While this is a small sample from a single area in the US, it suggests that confidence in counselling ability may influence health care provider behaviours, even when controlling for other factors.

2.2.6 Perception of health care providers' own role, and other health care providers' roles, in gestational weight gain counselling

Due to the complexity of prenatal care provision in Canada, there may be a number of health care providers involved in a pregnant women's care. Therefore, it is possible that a barrier to GWG counselling is the perception of a health care provider that GWG counselling is not within his or her role; rather, it would fall under the role of another health care provider involved in the woman's care. The area of perception of role in GWG counselling has been minimally studied. Ferraro et al (2013) addressed this by asking health care providers (n=174) who they felt should be providing GWG information to women. Almost all respondents (98.6%) reported that women's primary prenatal health care provider (e.g., general practitioner, obstetrician, or midwife) was responsible for providing this information, while fewer saw allied health care providers (82.8%) or public health (63.1%) as responsible for this information. There were no differences in responses between health care provider disciplines.

Internationally, role perception and GWG counselling has also not been well studied. Heslehurst et al's (2014) meta-synthesis of health care providers' barriers and facilitators to weight management in pregnancy identified that health care providers' social and professional role was a domain of the Theoretical Domains Framework that was the least frequently cited as an influence on practice in the included studies. However, one qualitative study of midwives included in the meta-synthesis indicated that midwives considered weight management in pregnancy to be within their role, but also saw a role for other health care providers to assist with this, as midwives' only provide care during pregnancy and weight management requires a long-term strategy (Heslehurst et al., 2013).

2.2.7 Priority level of gestational weight gain

Considering GWG to be a low priority in the context of a prenatal appointment is a potential barrier to counselling. This has not been studied in the Canadian context, but has been examined internationally. Chang et al (2013) provided qualitative interview participants (obstetricians, general practitioners, and nurse-midwives) with a list of 11 prenatal care issues, including appropriate weight gain, and asked health care providers how they would prioritize them. A few participants chose their top issues and stated that the rest were unimportant, and appropriate

weight gain was not included as a top issue. Others ranked the issues from highest to lowest, and the highest ranking for GWG was 4, while the rest of the health care providers ranked it 7 or lower out of 11. Some participants commented that discussing weight was lowest on the priority list, or that they usually do not discuss the topic at all. A noted strength of this study was that the authors sampled health care providers who had no previous knowledge of the area of focus for the research; this meant that it was unlikely that the participants had a pre-existing interest in this area, and may be more representative of the general population of health care providers. Willcox et al's (2012) focus groups with Australian midwives also found that many did not consider GWG to be an important health issue. Further research into the priority level that Canadian health care providers place on the topic is warranted.

2.3 Impact of gestational weight gain counselling on women's actual weight gain

Despite the multitude of studies examining the provision of weight gain advice, there are fewer examining the impact of this advice on actual GWG outcomes. One such study was conducted in Canada. Cohen et al's (2010) conducted a study of 81 women from Ottawa and Montreal. This included a study visit where women were weighed, and asked if they received GWG advice from their health care provider. This measured weight was used to calculate a weekly rate of weight gain, which was the current weight minus self-reported pre-pregnancy weight, divided by the gestational weeks minus twelve weeks (for the first trimester of pregnancy). This was based on the IOM's guidance of a weekly rate of weight gain for the second and third trimesters only. In logistic regression analysis of the data from 60 women, when controlling for sociodemographic variables, pre-pregnancy BMI, physical activity and dietary intake, recalling GWG advice was not significantly associated with achieving a weekly rate of GWG within the guidelines ($p=0.16$). However, as cited at the beginning of this literature review, the weekly rate of weight gain is an average, and implies linear pattern of weight gain as opposed to sigmoidal (Institute of Medicine and National Research Council, 2009; Institute of Medicine and National Research Council, 2013). Additional analyses that use women's total GWG in the logistic regression models could add important information in this area.

Studies from the US that have found an association between the provision of GWG advice and guideline-concordant weight gain were published prior to 2000. As such, one used the 1990

IOM recommendations, while the others were published prior to these recommendations, which make the applicability of the results to the present day situation unclear (Cogswell et al., 1999; Taffel, Keppel, & Jones, 1993; Taffel & Keppel, 1986). More recent studies have not found such clear results. Some studies have found no significant association between health care provider advice and actual gain (Ferrari & Siega-Riz, 2013; Wrotniak et al., 2015). Ferrari & Siega-Riz (2013) used data from a prospective cohort study of 1454 women where participants self-reported if they received health care provider advice about GWG at a telephone interview at 27-30 weeks gestation, and total GWG was extracted from women's medical charts. This study utilized the 1990 IOM guidelines to assess appropriateness of GWG. Using a generalized linear model, the authors reported that receiving advice about GWG did not result in a reduced risk of excessive GWG when controlling for maternal race and pre-pregnancy BMI (Odds Ratio 1.01, 95% Confidence Interval 0.97, 1.06). Wrotniak et al (2015) conducted a cross-sectional study of 134 women who were interviewed in the recovery rooms of two maternity hospitals. Pre-pregnancy height and weight (used to calculate pre-pregnancy BMI) was gathered from the participants chart when available (n=106) or self-reported when not available (n=28), as well as women's weight at delivery. This study utilized the 2009 IOM guidelines to assess the appropriateness of GWG. Chi-square tests were used to determine if there were differences in the proportion of women achieving appropriate GWG when comparing women who reported receiving advice from their health care providers to those who did not. The authors found no significant differences (p=0.8). While this analysis is smaller and less sophisticated than the multivariate analysis in Ferrari & Siega-Riz's study, it suggests that there is not a straight forward relationship between provider advice and achieving appropriate weight gain.

Importantly, there have been associations between *incorrect* advice (e.g. not concordant with IOM guidelines) and inappropriate weight gain. Herring et al (2012) examined the predictors of excessive GWG in a low-income prospective cohort of 94 pregnant women. Total GWG was calculated as the last measured weight before delivery minus first measured weight in pregnancy (which was measured at <14 weeks gestation). Participants were asked to report the total amount of weight gain that their health care provider recommended. Multivariable logistic regression results indicated that those who recalled advice incongruent with IOM guidelines were more likely to gain weight in excess of the 2009 IOM guidelines while controlling for multiple

sociodemographic and medical factors (Odds Ratio 5.88, 95% Confidence Interval 1.04-33.32). Similar findings were reported in an ethnically diverse cohort of 3402 women (Liu et al., 2016). Weight gain information was taken from women's medical records, and women were asked to report how much weight their health care provider told them to gain. When adjusted for sociodemographic characteristics, women who reported receiving health care provider advice above the 1990 IOM guidelines were twice as likely to exceed guidelines (Odds Ratio 2.0, 95% Confidence Interval 1.4–2.9). The authors conducted a sensitivity analysis using the 2009 IOM guidelines and reported similar results, but the data was not shown in the manuscript. Brawarsky et al (2005) examined data from 1100 women who were part of a longitudinal cohort study. Participants completed telephone interviews, and weight gain data was retrieved from the participant's medical charts. Seventy-one percent of those who recalled physician advice to gain above the IOM guidelines actually gained weight in excess of the guidelines, as compared to 55% of women who recalled correct advice.

GWG advice may influence women's personal goals for their own weight gain. Several studies have found that women who receive GWG advice are more likely to have guideline-concordant personal weight gain goals (Arinze et al., 2015; Tovar et al., 2011). Again, the accuracy of the advice influences the outcome, as women who received inaccurate advice from their health care provider were more likely to have a guideline-discordant goal (Park et al., 2015; Stotland et al., 2005). This was demonstrated in a study by Park et al (2015), which was a secondary analysis of data that was collected for McDonald et al's (2011; 2012) studies. Women in Hamilton (n=310) were asked about much weight they planned to gain in their pregnancy, and the authors compared this to pre-pregnancy BMI based on self-reported weight and height. When adjusting for age, pre-pregnancy BMI, and the consumption of more than one glass of pop or juice per day, women who reported receiving a recommendation from a health care provider to gain weight above the guidelines were more likely to have a planned weight gain above the guidelines (Odds Ratio 5.46; 95% Confidence Interval 1.56, 19.05). While women's personal goals for weight gain have been associated with actual weight gain (Cogswell et al., 1999), it is clear that there is a complex relationship between health care provider advice, women's goals for their weight gain, and actual GWG. More research is needed to determine how health care provider advice and women's personal weight gain goals influence actual weight gain.

A limitation of most of these studies is the reliance on recalled advice, although it can be argued that this is important measure in itself as women need to recall the advice they receive if it will be of use to them. More research is needed to determine the most effective approach to counsel women to help them achieve guideline-congruent GWG.

2.4 Interventions to improve gestational weight gain counselling by health care providers

There have been few interventions published to date that aim to improve GWG counselling practices of health care providers. The only Canadian intervention study to improve GWG counselling was conducted by McDonald et al (2015), who developed a knowledge translation tool to increase the number of women who were counselled correctly about GWG. The online tool allowed clinic staff to enter a woman's height and pre-pregnancy weight to produce a personalized weight gain graph. The graph was printed in duplicate, with one copy in the medical chart and one kept with the woman. Women in their first trimester of pregnancy were recruited from the same Hamilton clinics that McDonald et al (2011; 2012) and Park et al (2015) used for their data set. In fact, data from these previous studies were used as a historical control group for comparison. The women were asked to complete a survey to evaluate the counselling they received in regards to GWG, as well as their knowledge in this area. Women in the knowledge translation tool group were more likely to report receiving a weight gain target from their health care provider (60.5%) as compared to the historical controls (29.2%; $p<0.001$). Furthermore, women in the knowledge translation tool group were more likely to report that their health care provider discussed the risks of inappropriate weight gain, physical activity and/or nutrition ($p<0.001$). These differences remained significant when controlling for variables such as maternal age, ethnicity, education, income, smoking, and pre-pregnancy BMI. The women also had increased knowledge about the risks of inappropriate GWG, but did not differ from controls in the congruency of their own plans for GWG as compared to IOM guidelines. As well, only 51.6% reported being given a weight gain target within the IOM guidelines, which did not differ from historical controls. Thus, this simple intervention increases GWG counselling and women's knowledge, but further exploration is needed to determine why only half of women

recall advice congruent with the guidelines, and why their plans for weight gain may not be congruent with the guidelines.

Jackson et al (2011) conducted a randomized clinical trial in the San Francisco Bay Area to determine if an interactive counselling tool, titled "Video Doctor", would be effective in tandem with traditional counselling to increase the number of women being counselled on GWG, physical activity and nutrition. The "Video Doctor" gathered baseline assessment information from women, and provided a printout for both women and health care providers that included cues for tailored counselling messages. It also included a video component where an actor provides the counselling messages to simulate an "ideal" counselling interaction. The control group received usual care. In a diverse sample of 287 women who completed the study, significantly more women in the "Video Doctor" group reported discussing GWG (76% versus 59%), physical activity (77% versus 55%), and nutrition (81% versus 51%) with their health care provider than the controls ($p<0.01$ for all three comparisons). As well, significantly more women had knowledge of the correct amount of weight to gain (65% versus 44%; $p=0.001$). However, the proportion of women gaining in excess of IOM guidelines did not differ between groups.

Lindberg et al (2014) evaluated the effectiveness of an alert system within the electronic medical record (EMR) to remind prenatal health care providers to discuss GWG. The alert automatically calculated each patient's total weight gain goal based on pre-pregnancy BMI, and prompted the provider to counsel the patient. The primary outcome of this study was the change in IOM guideline-concordant weight gain counselling provided to pregnant women before and after implementation of the alert system in the EMR. Data were collected via retrospective chart reviews of women whose care occurred pre- and post-intervention. After the intervention was initiated, significant increases were seen in the rate of guideline-concordant GWG counselling (2.6% to 51%; $p<0.001$). Improvement was seen across all health care provider types, including obstetricians, family physicians, and midwives. However, while this study demonstrated improvements in counselling, it did not measure women's actual weight gain.

In summary, simple tools have been shown to improve the proportion of women who are counselled about GWG. However, the association between improved GWG counselling and actual weight gain requires further exploration. It is clear from the various barriers to counselling that have been found in the literature that a comprehensive approach will be needed to increase the quality of GWG counselling for women, and ultimately support healthy lifestyle changes for women.

2.5 Summary

There is consensus in the literature that there is a need for an improvement in GWG counselling for women, including providing individualized weight gain recommendations that are congruent with national guidelines, discussing the risks of inappropriate weight gain, and discussing physical activity and nutrition. There is limited information about differences by health care provider discipline. As much of the Canadian research in this area is from relatively small studies and conducted in specific regions of the country, further research is needed into the practices of Canadian health care providers from across the country. In particular, qualitative research is needed to provide context to quantitative data and could add to the exploration into the differences in practices by health care provider discipline.

There have been numerous barriers to GWG counselling identified in the international literature. However, this has not been addressed thoroughly in the Canadian literature. In order to develop interventions to support health care providers to promote guideline-concordant GWG, the practices of Canadian health care providers, and the influences on these practices, needs to be examined in a comprehensive manner.

Chapter 3: Methods

3.1 Mixed methods study design

3.1.1 Mixed methods research

Mixed methods research is the rigorous collection and analysis of both qualitative and quantitative data, and is well suited for research questions that call for real-life contextual understandings and multi-level influences (Creswell, Klassen, Plano Clark, & Smith, 2011). This is the case for the study of health services, where the complexity of the research topic lends well to a mixed methods research design. The complexity of health services research arises from the multiple exposures that impact the quality of health care and ultimately the health of the population, such as financing systems, organizational structures, and the behaviours of both the health care provider and the patient (Lohr & Steinwachs, 2002). The purpose of mixed methods research is to expand the breadth and depth of understanding, as well as to corroborate evidence from one method to the other (Creswell et al., 2011). Quantitative methods can assess the relationships between variables, providing measureable data, and allow the comparison of groups (Castro, Kellison, Boyd, & Kopak, 2010). Qualitative research, on the other hand, provides an in-depth understanding of areas that are difficult to measure, and explores the meaning and understanding of constructs (Castro et al., 2010). The quantitative data provides information on the pervasiveness of a phenomena, while the qualitative data gives the "why" and "how" (Creswell et al., 2011). In health services research, mixed methods can examine the "macro" level of health service delivery, and contextualize it with information at the individual level (Creswell et al., 2011).

Mixed methods studies can contribute to methodological triangulation, which refers to employing multiple methods to collect the desired data (Bowling, 2014; Patton, 2002). Triangulation is the collection of different but complementary data on the same topic to best understand the research problem (Bowling, 2014). This also helps with verification, as the findings from each method can be used to support or refute the other. The integration of quantitative and qualitative data maximizes the strengths of each data type (Creswell et al., 2011).

3.1.2 Study design

Mixed methods research can be designed in several ways, depending on the research question to be answered. One method may have more focus than the other, or data collection for each type can be done sequentially to inform the next step (Creswell et al., 2011). This study employed a concurrent design (Figure 3.1), where quantitative and qualitative data were collected simultaneously, analyzed separately, then merged and integrated (Creswell et al., 2011). This enhances the rigour of the findings, as the results from each type of approach can be confirmed against the other (Zhang & Creswell, 2013). Both the qualitative and quantitative data were given equal weight in the design and analysis of this study. When designing a mixed methods study of this type, the quantitative and qualitative data collection instruments should follow similar lines so that data merging is possible (Fetters, Curry, & Creswell, 2013).

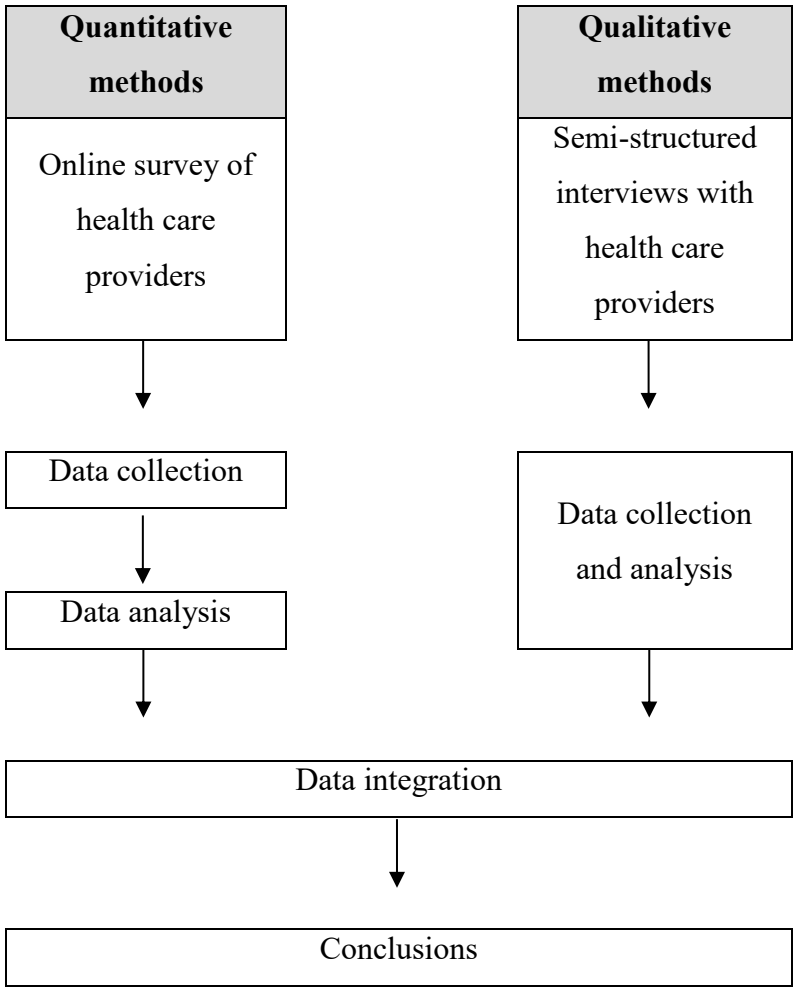

Figure 3.1. Concurrent mixed methods study design.

3.1.3 Ethical considerations

Ethics approval was obtained from the Health Research Ethics Board at the University of Alberta. Interview participants were provided the study information sheet and consent form prior to the interview, and given the opportunity to ask questions prior to giving their verbal consent, which was audio recorded. Participants were advised that they could decline to answer any question, that they may choose to withdraw their data from the study within two weeks of their interview, and that they would not be identified when presenting the results of this research. Survey respondents were provided the study information sheet when following the web link to the survey, and informed that completion of the survey implied their consent to participate. Respondents were able to decline to answer any question on the survey. Data were collected and stored using secure software hosted at the University of Alberta Faculty of Medicine and Dentistry. Participants were able to voluntarily provide their email address for the purposes of follow up; however, identifiable information was not included in the data analysis.

3.2 Qualitative methods

3.2.1 Semi-structured telephone interviews

In order to facilitate an in-depth exploration of the experiences and opinions of health care providers, the qualitative portion of this study utilized semi-structured interviews in a qualitative descriptive study design. Qualitative descriptive studies stay closer to the data than other qualitative study designs, and aim to accurately describe the research question of interest (Sandelowski, 2000). Sandelowski (2000) notes that while no qualitative study design is free from interpretation, designs such as grounded theory focus more on interpretation by the researcher, while a qualitative descriptive design should result in findings that resonate with multiple different researchers who have their own interpretations; it is as close to the "facts" from the data as possible. Interviews are a useful tool for gathering information about feelings, intentions, and past behaviours that cannot be observed (Patton, 2002). Qualitative interviewing assumes that "the perspective of others is meaningful, knowable, and able to be made explicit" (Patton, 2002, p.341). Semi-structured interviews are a widely used tool in qualitative research, and highly acceptable to both researchers and participants (Hansen, 2006). Semi-structured

interviews follow a general outline of topics that a researcher wants to gather information on, but the interviewer is not expected to ask the same questions in the same way in every interview, and is free to ask additional questions (Hansen, 2006). In this study, an interview guide was used as a basis for the topics queried, but it allowed for probing and exploring areas as deemed appropriate by the researcher conducting the interview (Patton, 2002).

3.2.2 Interview guide development

The interview guide was developed by the study team based on the overall goals of the research project (Appendix 1). The purpose of an interview guide is to list the questions and probes to be generally followed during an interview, ensure a general consistency of topics covered in interviews, and help to compensate for variation in interviewer skills (Patton, 2002). The interview guide focussed on neutral, open-ended questions, with each covering a singular topic (Patton, 2002). The interview guide was pilot tested and revised for clarity prior to use in this study, with continued revisions throughout data collection and analysis stages. The pilot test was a mock interview with a member of the targeted study population, who also provided feedback on question clarity after the interview. Interview guides are meant to be dynamic, and the topics or questions raised in earlier interviews can shape the line of questioning in later interviews (Hansen, 2006). The two researchers involved in data collection debriefed after each interview, which allowed for identification of areas where the interview guide could be modified. For example, after discussion between the two researchers involved in data collection, an opening question asking the participant to describe the characteristics of their practice setting (e.g., multidisciplinary team, patient population seen, etc.) was added to the interview guide.

3.2.3 Recruitment and sampling

A purposive sampling technique of maximum variability was employed to recruit health care providers from a variety of disciplines, practicing in various urban and rural locations in Alberta and British Columbia. Maximum variability sampling aims to describe the themes that cross a great deal of participant variation (Hansen, 2006). In this study, participants were recruited to represent the range of experiences that occur for different health disciplines in different locations in each of the provinces.

Potential participants were identified through collaborating members of the "5As of Healthy Pregnancy Weight Gain" working group of the Canadian Obesity Network. Health care providers were invited to participate through email or they contacted the study team directly, expressing interest in participating. When these contacts were exhausted, an advertisement was distributed by email to medical clinics relevant to the requirements for variability in the sample. Recruitment occurred simultaneously with data collection and analysis, and was concluded once saturation of data and maximum variability was reached.

3.2.4 Data collection

Semi-structured interviews were conducted over the telephone. An experienced qualitative researcher worked alongside the writer of this thesis to conduct the interviews. The writer of this thesis observed several interviews conducted by the experienced researcher prior to conducting the interviews independently, with the experienced researcher observing and providing feedback after each interview. Interviews ranged from approximately 25 minutes to 1 hour in length. Interviews were audio-recorded and transcribed verbatim by an external transcription service. Transcripts were reviewed and verified against the audio recording by the writer of this thesis.

Data were analyzed concurrently with data collection. Additional questions for the next interview were noted, based on the prior interviews.

3.2.5 Data analysis

Qualitative content analysis was utilized to describe and inductively interpret the data (Elo & Kyngas, 2008; Hsieh & Shannon, 2005). Qualitative content analysis is a process that is a "reduction and sense making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (Patton, 2002, p.453). Hsieh and Shannon (2005) describe this process as "conventional content analysis". Elo & Kyngas (2008) note that there are no strict guidelines for content analysis; however, the process can be described as phases of preparing, organizing and reporting.

The preparation phase includes immersion in the data, to get a sense of the whole. This was done by reading through a transcript from start to finish prior to note taking and analysis. This process was repeated for each subsequent transcript.

The next phase is the analysis of the data. The analysis in this study focussed on the manifest content of the interview transcripts rather than the latent content, which is an analysis of the "silence, sighs, laughter, posture, etc." (Elo & Kyngas, 2008, p.109). The transcripts were analyzed using an inductive process, where categories are derived from the data by grouping "open codes", and the analysis moves from specific observations to general statements. "Open coding" can refer to a process where key words or phrases are highlighted in the data (Hsieh & Shannon, 2005). Transcripts were reviewed and open coded by the writer of this thesis to cover all of the content in the data. Notes were taken during the open coding process to describe each code. Codes were collected, revised and categorized as patterns and key concepts emerged (Hsieh & Shannon, 2005). For example, the initial codes included terms such as "having time", or "sensitive topic". These codes were entered into a table using Microsoft Word (Version 15.0.4815) alongside representative quotes in order to compare and contrast the data from each participant. Categories and sub-categories were grouped, a process called abstraction (Elo & Kyngas, 2008). For example, a higher level category was "system level influences". Results were discussed with two members of the study team, including the experienced qualitative researcher who conducted or observed the interviews, and findings were agreed upon as a group. This is a method of analyst triangulation, which provides multiple perspectives in the collection and interpretation of the data, and helps reduce the risk of bias that can occur with a single researcher (Patton, 2002).

Sampling adequacy was confirmed by saturation of the data, and is defined as replication in responses that occurred in categories as new participants were included in the analysis (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

3.2.6 Verification strategies

Several verification strategies were employed to increase rigour. Analysis of data simultaneously with data collection contributes to rigour. Investigator responsiveness is essential

to the validity of results, and the investigator must be creative and flexible with lines of questioning, and re-evaluating the categorization scheme of the analysis as data collection continues (Morse et al., 2002). Analysis of the data informs future participant recruitment in a purposive sample in order to reach saturation (Morse et al., 2002).

Two study team members conducted the interviews, one conducted the content analysis, and the results were discussed and revised together with the whole study team. An external researcher conducted an independent analysis of 9 of the 23 transcripts, and results were congruent with the study findings.

3.3 Quantitative methods

3.3.1 Online survey

Online survey research is appropriate when targeting populations with internet access, wide geographic dispersion, and when a large sample size is desired (Sue & Ritter, 2007). Although online surveys generally do not allow for a probability sample, which enables statistical inferences about the general population, they are suitable for research that uses a multimethod approach (Sue & Ritter, 2007). Online surveys are efficient, cost-effective, and also have the advantage of direct data entry, which reduces transcription error (Sue & Ritter, 2007). Limitations of this method are discussed further in Chapter 6.

3.3.2 Instrument development

The survey instrument was developed by the 5As of Healthy Pregnancy Weight Gain working group from the Canadian Obesity Network (Table 3.1). This working group had previously adapted the 5As of Obesity Management tool from the Canadian Obesity Network into a tool that was aimed at health care providers with the expressed purpose of promoting healthy pregnancy weight gain.

Content validity is the instrument's ability to assess all fundamental aspects of the topic, and is assessed by content experts in the area (Burns et al., 2008). To assess content validity, the questionnaire for this study was designed by a team of researchers, with content expertise in important areas related to maternal health in pregnancy. The specific expertise of each team

member is outlined in Table 3.1. The expert team provided revisions until consensus was reached.

The survey was pilot tested for face validity with a small convenience sample of members of the target audience, and further revisions made. Pilot testing reduces the likelihood of survey participants misinterpreting questions, and assesses the dynamics of the instrument such as flow and administrative ease (Burns et al., 2008).

To assess reliability of the questionnaire, a test-retest reliability assessment was conducted. This type of assessment measures whether the same questions posed to the same individuals will yield consistent results (Burns et al., 2008). A small convenience sample of members of the target audience (n=12) agreed to complete the survey questionnaire, and complete it again in two weeks' time. The survey invitation was sent by email at both time points, with a reminder email if participants had not completed the survey within one week of the invitation. Ten participants completed the survey at the first time point, and six completed the questionnaire at both time points. Likert-type responses were assigned a numeric value (1=lowest to 5=highest), and Pearson's correlation was calculated between responses at the first and second time points. Results of this assessment are presented in Appendix 2. Approximately half of the variables (12 out of 23) were correlated at a value >0.7, a generally accepted criteria for "good" reliability (Litwin, 1995). Since responses to 6 out of the 23 questions had a relatively low correlation (<0.5), the stability of responses over time should be considered with caution.

3.3.3 Recruitment and sampling

Health care providers across Canada were recruited by contacting professional associations, regulatory bodies, and networks and asking them to distribute the survey link to their networks. Organizations who participated in survey distribution are listed in Appendix 3. Disciplines targeted were family physicians, obstetricians, midwives, nurses, nurse practitioners, and dietitians. These disciplines were targeted as they are typical providers of primary care to pregnant women. Methods for survey distribution were chosen by the organization; these included direct email to members, a short message in a newsletter, posting on their website, and/or social media such as Facebook or Twitter.

The final sample size for this survey was a result of convenience sampling. The survey closed after approximately 6 months of distribution (December 2014 - May 2015).

3.3.4 Data collection

The survey instrument was entered into Research Electronic Data Capture (REDCap) software hosted at the University of Alberta. REDCap is a secure, web-based application designed to support data capture for research studies (Harris et al., 2009). Participants accessed the survey by following the link provided to them and completed the survey on-line.

3.3.5 Data analysis

Survey data were transferred into SPSS Statistics v.23 (International Business Machines Corp, Armonk, NY). Data were cleaned to remove: respondents who indicated that they did not see pregnant women in their practice; respondents who did not specify their health care discipline; and respondents who did not complete any questions beyond health care provider characteristics. Data were also cleaned to re-classify respondents who chose their discipline to be "Other", but indicated a discipline in the free text that was available from the response choices.

Responses to survey questions were summarized for the following selected health care provider disciplines: general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care. These disciplines were chosen as they represent the typical primary health care providers for women in Canada (Public Health Agency of Canada, 2009). Chi-square analyses were used to assess homogeneity of proportions where appropriate.

A principal components analysis with Varimax rotation was used reduce the GWG counselling practice items from the survey into a smaller number of new composite variables (Litwin, 2003). The aim of principal components analysis is to reduce a larger number of variables into a smaller number of "components" that explain the largest amount of the variance (Dunteman, 1989). It is particularly useful for the development of regression models, as it reduces multicollinearity by creating a new set of uncorrelated variables (Dunteman, 1989). For this thesis, ordinal scale responses to survey questions were treated as continuous data by assigning each response a

numeric value (1=lowest, 5=highest; Table 3.2). Data from 498 valid cases were used. Assumptions for this analysis were met via the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.805), and Bartlett's test of sphericity ($p<0.001$). Three components were extracted, explaining 70.5% of the variance (Table 3.3).

A survey scale (referring to the series of survey questions that examine a single construct) can be scored in various manners, including calculation of a mean score from the raw data (Litwin, 2003). New composite scores were calculated by taking the mean score of the survey items that had their primary factor loadings on each component identified in the principal components analysis. To ensure that the composite score was comprised of survey items that had appropriate internal consistency, Cronbach's alpha was calculated. Internal consistency is present when the survey items measure the same underlying construct, and is generally considered "acceptable" when Cronbach's alpha is greater than 0.7 (Altman, 1991). All scales had Cronbach's alpha values >0.8 (Table 3.3). Component 1 is referred to as "Providing weight gain advice and discussing risks", and was calculated as a mean score from the questions "I provide women with a weight gain target based on their pre-pregnancy BMI", "I discuss the recommended rate of weight gain based on their weight gain target", "I discuss the impact of inappropriate weight gain on the mother during pregnancy", and "I discuss the impact of inappropriate weight gain on the baby". Component 2 is referred to as "Discussing physical activity and food requirements", and was calculated as a mean score from the questions "I discuss appropriate physical activity with pregnant women", "I discuss appropriate extra food requirements with pregnant women", and "I can easily give examples of appropriate changes that women could make to meet extra food requirements".

Although "I weigh women at every visit ", "I relay weight gain information to women every time I weigh them", and "I discuss the importance of taking prenatal vitamins" loaded onto one component, to best answer the research questions for this thesis, these variables are considered separately as "Weighing women at every visit" and "Relaying weight gain information to women every time they are weighed".

Potential predictors of health care provider practices were entered into three principal components analyses in the same manner as the GWG counselling practices (Tables 3.4, 3.5, and 3.6). For analyses where only one component was extracted, no rotation was used. Items were averaged into a composite score based on their primary factor loadings, and were named "Knowledge of weight gain, physical activity and nutrition guidelines", "Appropriate knowledge and information resources to support guideline-concordant weight gain", and "Priority level of discussing, assessing and assisting women with appropriate weight gain". Cronbach's alpha was calculated, and indicated good internal consistency of the new composite scores (Tables 3.4, 3.5, and 3.6). One-way analysis of variance (ANOVA) with Bonferroni post-hoc analyses were conducted to assess differences in mean response scores by health care provider discipline. Cohen's d was calculated to determine the effect size of the significant post-hoc tests, and Cohen's general criteria of 0.2 for a small effect, 0.5 for a medium effect, and 0.8 for a large effect was applied (Cohen, 1988).

Bivariate relationships between practices and potential predictors of practices were explored using Pearson's correlation for continuous variables. Variables that were significantly correlated to health care provider practices were included the multiple linear regression models. One-way ANOVA and t-tests were used to explore health care provider professional practice characteristics that could be controlled for in the multiple linear regression model.

Multiple linear regression was used to determine the relative influence of knowledge, resources, and level of priority placed on GWG on practice scores while controlling for health care provider characteristics. Variables were added to regression models in blocks, with health care provider characteristics first, followed by predictors of GWG counselling practices that were assessed in the survey. Standardized residuals were plotted against predicted values to assess homoscedasticity, and plotted as a histogram to assess for normality. Variance inflation factors (VIF) and tolerance were used to assess multicollinearity, with a criteria of VIF less than 10, and tolerance greater than 0.1. One regression model was developed for each practice component of interest for the research questions.

Statistical significance was set at an alpha level of 0.05.

3.4 Integration of qualitative and quantitative data

Zhang and Creswell (2013) outline three methods of "mixing" data in mixed methods health services research: integration, connection, and embedding. Connection and embedding are procedures used in sequential and/or dominant mixed methods designs, while integration approaches are appropriate in a concurrent study design, such as this thesis.

This study was designed to capture information specific to the research questions using each method; as such, the first step in integration was to take the qualitative and quantitative results for each of the research questions and compare them side by side. This is comparing for confirmation, to determine if findings from each method confirm one another (Fetters et al., 2013). In a well-designed mixed methods study, qualitative categories can be related to quantitative variables, such that a statistical output can be related to the qualitative context (Castro et al., 2010). For example, the percentage of survey respondents who reported measuring weight at each prenatal visit was related to the qualitative sub-category of weight measurement, which described how this was a routine practice for health care providers to undertake.

Data were also used for expansion, which uses the strength of each data type to better explain the phenomenon (Fetters et al., 2013). For example, the quantitative composite score for "Priority level of discussing, assessing, and assisting women with appropriate GWG" was assessed for its influence on GWG counselling practices, while the qualitative data linked other individual and system level factors to the priority level that health care providers described that were not captured in the quantitative data. This demonstrates the strength of a mixed methods research design in addressing complex research questions.

The findings as a whole were used to develop a model of factors that influence GWG counselling practices. This is termed a "joint display" of the qualitative and quantitative findings (Fetters et al., 2013). The full, integrated model is used to generate "deep structure" conclusions, harnessing the explanatory power of both methods utilized in the design.

3.5 Summary

This study utilized mixed methods to address the complexity of the research objectives. Data from qualitative, semi-structured interviews and a quantitative online survey were collected concurrently, analyzed separately, and integrated by comparing and expanding upon the findings of each method of data collection. This study design enabled a more complete answer to the questions of interest than either method alone.

Tables

Table 3.1. Content experts involved in survey instrument development.

Name	Affiliation	Area of expertise
Rhonda Bell	University of Alberta	Nutrition
Hara Nikolopoulos	University of Alberta	Nutrition
Michael Vallis	Dalhousie University	Behaviour change; health psychology
Helena Piccinini-Vallis	Dalhousie University	Family medicine
Sarah McDonald	McMaster University	Obstetrics
Adam King	Perinatal Services BC	Health promotion
Kristi Adamo	University of Ottawa	Exercise physiology
Tara Bond	Canadian Obesity Network	Knowledge translation
Zach Ferraro	University of Ottawa	Exercise physiology

Table 3.2 Values assigned to ordinal scale survey questions

Response	Value
< 10% of pregnant patients/clients	1
10-30% of pregnant patients/clients	2
30-60% of pregnant patients/clients	3
60-90% of pregnant patients/clients	4
>90% of pregnant patients/clients	5
Strongly disagree	1
Disagree	2
Neither disagree nor agree	3
Agree	4
Strongly agree	5

Table 3.3 Principal components analysis for gestational weight gain counselling practices survey items

Original survey items	Rotated component matrix			Communalities	Cronbach's alpha
	1	2	3		
I provide women with a weight gain target based on their pre-pregnancy BMI	0.750	0.155	0.152	0.609	0.859
I discuss the recommended rate of weight gain based on their weight gain target	0.781	0.198	0.124	0.665	
I discuss the impact of inappropriate weight gain on the mother during pregnancy	0.846	0.27	0.116	0.801	
I discuss the impact of inappropriate weight gain on the baby	0.819	0.275	0.122	0.761	
I discuss appropriate physical activity with pregnant women	0.259	0.757	0.235	0.696	0.846
I discuss appropriate extra food requirements with pregnant women	0.332	0.823	0.134	0.805	
I can easily give examples of appropriate changes that women could make to meet extra food requirements	0.253	0.845	-0.017	0.779	
I weigh women at every visit	0.180	-0.181	0.842	0.774	N/A
I relay weight gain information to women every time I weigh them	0.245	0.225	0.698	0.598	

I discuss the importance of taking prenatal vitamins	-0.02	0.376	0.646	0.560
Eigenvalues	4.484	1.370	1.194	
% of total variance	44.836	13.703	11.943	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.805			
Bartlett's test of sphericity	<0.001			

Table 3.4 Principal components analysis for "Knowledge of weight gain, physical activity and nutrition guidelines"

Original survey items	Component matrix	Communalities	Cronbach's alpha
I am confident I could accurately summarize at least 80% of the content of the following guidelines to my colleagues within the next week:			
Health Canada's 2010 guidelines for pregnancy weight gain	0.836	0.699	
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	0.806	0.650	0.812
Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy	0.734	0.539	
Health Canada's nutrition guidelines for health professionals	0.823	0.677	
Extraction sums of squared loadings	2.565		
% of total variance	64.137		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.788		
Bartlett's test of sphericity	<0.001		

Table 3.5 Principal components analysis for "Appropriate knowledge and information resources to support guideline-concordant weight gain"

	Rotated component matrix		**Communalities**	**Cronbach's alpha**
	1	**2**		
I have appropriate knowledge to recommend guideline concordant:				
Pregnancy weight gain	0.759	-0.413	0.747	
Physical activity	0.801	-0.364	0.774	
Healthy eating during pregnancy	0.792	-0.257	0.694	0.889
I have appropriate information resources to support recommending guideline concordant:				
Pregnancy weight gain	0.814	0.184	0.697	
Physical activity	0.805	0.124	0.664	
Healthy eating during pregnancy	0.818	0.260	0.736	
I have appropriate programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	-0.049	0.881	0.779	N/A
Eigenvalues	4.039	1.051		
% of total variance	57.7	15.018		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.792			
Bartlett's test of sphericity	<0.001			

Table 3.6 Principal components analysis for "Priority level of discussing, assessing and assisting women with appropriate weight gain"

Original survey items	Component matrix	Communalities	Cronbach's alpha
Given all of the issues of concern during a typical prenatal visit, I consider:			
Discussing appropriate gestational weight gain with women a high priority	0.865	0.801	
Assessing gestational weight gain a high priority	0.834	0.685	
Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators, providing resources, referrals to appropriate providers, etc.) a high priority	0.830	0.688	0.812
Extraction sums of squared loadings	2.185		
% of total variance	72.824		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.688		
Bartlett's test of sphericity	<0.001		

Chapter 4: Quantitative Results

4.1 Characteristics of survey respondents

A total of 508 responses from general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care (primary care RNs) were included in this analysis. Responses from other health care provider disciplines outside the scope of this thesis and not included in the analyses are included in Appendix 4. Health care providers from across Canada responded to this survey (Table 4.1). Responses were received from all provinces and territories, with the exception of Prince Edward Island and Nunavut. The majority of respondents were from Alberta (30%) or Ontario (33%). The majority of respondents indicated they worked in urban locations (58%). Respondents were asked to describe the structure of their practice setting, and were able to choose all of the descriptors that applied to them. The majority of respondents reported that they worked in a group setting (65%), and 27% indicated that they worked in an interdisciplinary practice setting. General practitioners and midwives frequently reported working in groups as compared to obstetricians, primary care RNs, and nurse practitioners (χ^2=141.23, p<0.001). Primary care RNs and nurse practitioners more frequently reported working in interdisciplinary settings as compared to general practitioners, obstetricians, and midwives (χ^2=141.23, p<0.001). Obstetricians more frequently reported working in an urban location compared to all of the other disciplines (χ^2=83.70, p<0.001).

When asked what proportion of their patients were pregnant women, there was variation in the responses (Table 4.1). Twenty-nine percent of respondents reported that nearly all (>90%) of their patients/clients were pregnant women, and 20% indicated that very few (<10%) were pregnant women. Almost all midwives (94%) indicated that nearly all of their patients/clients are pregnant women, and 55% of obstetricians reported 30-60% of their clients were pregnant women. Midwives had a significantly greater proportion of patients who were pregnant women compared to all other disciplines (p<0.001 for all post-hoc comparisons). General practitioners and nurse practitioners had the smallest proportion of patients who were pregnant women (p≤0.01 for all post-hoc comparisons).

Respondents reported a wide range of timing of their first visit with pregnant women (Table 4.1). Overall, 65% of respondents saw women for the first time in the first trimester. Midwives and general practitioners saw patients earlier in pregnancy than obstetricians and primary care RNs ($p<0.05$ for all post-hoc comparisons), and did not differ from each other. Specifically, 98% of midwives, 70% of general practitioners and 68% of nurse practitioners all reported meeting with women in their first trimester of pregnancy. A small number of general practitioners (14%) were most likely to see women before they become pregnant, although this was more than the other disciplines. The response "Don't know/too variable to say" was filtered from the data for these comparisons (n=41).

4.2 Gestational weight gain counselling practices

4.2.1 Responses to survey questions regarding specific gestational weight gain counselling practices

Survey respondents were asked with what proportion of their pregnant patients they undertake specific GWG counselling practices with, ranging from less than 10% of their pregnant patients, to greater than 90% (Table 4.2). Providing pregnant women with a weight gain target and rate of weight gain based on pre-pregnancy BMI were activities that a small proportion of respondents (21% and 16% respectively) routinely undertook (i.e., with >90% of their pregnant patients). There were a range of responses regarding discussing the impact of inappropriate weight gain on mother and baby, with approximately equal proportions in each of the five categories of responses. Twenty percent of respondents reported routinely discussing the impact of inappropriate weight gain on mother with nearly all of their pregnant patients, and 19% routinely discussed the impact of inappropriate weight gain on baby.

Over three-quarters of respondents (76%) reported weighing nearly all of their pregnant patients at every visit. Ninety-two percent of general practitioners, 88% of obstetricians, and 84% of nurse practitioners indicated that they routinely weigh women at every visit, while only 35% of midwives reported routinely weighing women. Half of the survey respondents (50%) indicated that they relay weight gain information to nearly all of their pregnant patients every time they are weighed.

Forty-six percent of respondents indicated that they discuss appropriate physical activity with more than 90% of their pregnant patients. Fewer (28%) would routinely discuss appropriate extra food requirements. Similarly, 32% of respondents indicated that they can easily suggest appropriate dietary changes with nearly all of their pregnant patients. Midwives (64%) and nurse practitioners (53%) frequently reported routinely discussing physical activity as compared to the other disciplines. The majority of respondents indicated that they discuss prenatal vitamins with nearly all of their pregnant patients/clients (67%). Nurse practitioners (90%) and general practitioners (79%) reported routinely discussing prenatal vitamins most frequently as compared to other disciplines.

Considering the other health care provider disciplines who participated in the survey but were not included in this analysis, it is of note that registered nurses in public/community health and acute care settings reported different practices to the health care provider disciplines included in this thesis (Appendix 4). Registered nurses in these two areas less frequently weighed women at each visit, as 74% of registered nurses in public/community health indicated that they rarely do this, and 50% of registered nurses in acute care said the same. These two groups also reported rarely relaying weight gain information to women (70% and 58% respectively).

4.2.2 Comparison of the frequency of undertaking gestational weight gain counselling practices by health care provider discipline

A comparison of the scores for "Providing weight gain advice and discussing risks", "Discussing physical activity and food requirements", "Weighing women at every visit", and "Relaying weight gain information to women every time they are weighed" uncovered similarities in GWG counselling practices between health care provider disciplines, as well as differences (Table 4.3). Health care providers disciplines responded similarly regarding "Providing weight gain advice and discussing the risks" [$F(4,492)=2.17$, $p=0.072$]. However, health care provider disciplines responded differently regarding "Discussing physical activity and food requirements" [$F(4,492)=11.04$, $p<0.001$]. In post-hoc analyses, the mean score for midwives for "Discussing physical activity and food requirements" was significantly higher than general practitioners ($p<0.001$, Cohen's $d=0.63$), obstetricians ($p<0.001$, Cohen's $d=1.20$), and primary care RNs ($p<0.001$, Cohen's $d=1.56$). Health care provider disciplines also responded differently

regarding weighing women at every visit [$F(4,499)=36.19$, $p<0.001$] and relaying weight gain information to women every time they are weighed [$F(4,496)=4.19$, $p=0.002$]. Midwives reported measuring weight at every visit less frequently than all other disciplines ($p\leq0.001$ for each post-hoc test; Cohen's $d=1.29$ for general practitioners, 1.12 for obstetricians, 0.43 for primary care registered nurses, and 0.93 for nurse practitioners). Midwives also had lower scores for "Relaying weight gain information to women every time they are weighed" as compared to general practitioners ($p=0.007$; Cohen's $d=0.46$) and nurse practitioners ($p=0.012$; Cohen's $d=0.66$) in post-hoc analyses.

4.3 Knowledge and access to resources related to gestational weight gain

4.3.1 Responses to survey questions regarding health care providers' self-assessed knowledge and access to appropriate resources

The majority of respondents agreed or strongly agreed that they had appropriate knowledge for recommending guideline-concordant pregnancy weight gain (57% agreed and 21% strongly agreed), physical activity (57% agreed and 14% strongly agreed), and healthy eating during pregnancy (59% agreed and 14% strongly agreed), as presented in Table 4.4. A far larger proportion agreed as compared to strongly agreed with the statements. When it came to asking about the availability of appropriate information resources, the majority indicated that they had access to healthy eating resources (48% agreed and 9% strongly agreed). Many also indicated that they had access to appropriate information resources for recommending guideline concordant GWG (36% agreed and 12% strongly agreed), and physical activity (36% agreed and 11% strongly agree). Many respondents had appropriate programs for referral to promote healthy nutrition during pregnancy (36% agreed and 13% strongly agreed); however, a large proportion did not (21% disagreed and 13% strongly disagreed).

Respondents were asked to indicate how confident they were in their knowledge of important clinical practice guidelines for pregnancy that are related to GWG (Table 4.4). Fifty-three percent agreed (44%) or strongly agreed (9%) that they were confident in their knowledge of Health Canada's GWG guidelines. Half of respondents agreed (41%) or strongly agreed (9%) that they were confident in their knowledge of the Joint SOGC and Canadian Society for Exercise Physiology guidelines for exercise in pregnancy. In contrast, fewer respondents agreed

(21%) or strongly agreed (7%) that they were confident in their knowledge of the Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy. The PARMed-X for Pregnancy was the only guideline where the majority of respondents disagreed or strongly disagreed (33% and 23%) that they were confident in the extent of their knowledge in the particular guideline. While 40% were confident in their knowledge of Health Canada's prenatal nutrition guidelines (32% agreed and 8% strongly agreed), approximately the same proportion disagreed (25%) and strongly disagreed (14%).

4.3.2 Comparison of scores for health care providers' self-assessed knowledge and access to appropriate resources by health care provider discipline

A comparison of scores for "Knowledge of weight gain, physical activity and nutrition guidelines", "Appropriate knowledge and information resources to support guideline-concordant weight gain, physical activity and nutrition", and "Programs for referral to promote healthy nutrition during pregnancy" revealed differences between health care provider disciplines (Table 4.5). There were significant differences between health care provider disciplines in their knowledge of weight gain, physical activity, and nutrition guidelines [$F(4,478)=2.43$, $p=0.047$]. Post-hoc comparisons indicated that midwives were more confident in their guideline knowledge than general practitioners; however, this was the only significant post-hoc comparison, and the effect size of the difference between scores was small to medium ($p=0.029$ in post-hoc analysis, Cohen's $d=0.40$). There were significant differences in the appropriateness of knowledge and resources perceived by health care provider disciplines [$F(4,421)=3.05$, $p=0.017$]. Midwives were more likely than primary care RNs to consider their knowledge and information resources to support guideline-concordant weight gain appropriate ($p=0.027$ in post-hoc analysis, Cohen's $d=0.49$). Again, this was the only significant post-hoc comparison, with a medium effect size. There were differences in the availability of appropriate programs for referral to promote healthy nutrition during pregnancy [$F(4, 434)=5.51$, $p<0.001$]. Obstetricians less frequently reported having appropriate programs for referral to promote healthy nutrition during pregnancy than did general practitioners ($p=0.031$ in post-hoc analysis, Cohen's $d=0.35$), primary care RNs ($p=0.003$ in post-hoc analysis, Cohen's $d=0.57$) and nurse practitioners ($p=0.003$ in post-hoc analysis, Cohen's $d=0.78$).

4.4 Priority level of discussing, assessing and assisting women with gestational weight gain in the context of a typical prenatal appointment

4.4.1 Responses to survey questions about the priority level that health care providers give to discussing, assessing, and assisting with gestational weight gain in the context of a typical prenatal visit

The majority of respondents agreed or strongly agreed that discussing appropriate GWG with women was a high priority (50% and 20%), assessing GWG was a high priority (51% and 30%), and assisting women with achieving appropriate GWG was a high priority (54% and 24%), as presented in Table 4.6. Fewer midwives strongly agreed (7%) that assessing GWG was a high priority as compared to general practitioners (45%), obstetricians (25%), nurse practitioners (49%), and primary care RNs (24%).

Health care providers were asked what would increase the likelihood of discussing, assessing, and assisting women with GWG (Table 4.7). Having resources to prompt the discussion was important for majority of health care providers, including the majority of general practitioners (59%), nurse practitioners (53%), and primary care RNs (55%). The antenatal record was also an important prompt, with the majority of general practitioners (55%) and nurse practitioners (55%) indicating that including an area to calculate cumulative GWG on this form would increase the likelihood of discussion. Knowledge of the consequences of inappropriate GWG was important for the majority for nurse practitioners (50%) and primary care RNs (52%). Thirty-six percent of general practitioners and 48% of obstetricians said the fee schedule was not appropriate for the workload of a prenatal visit.

4.4.2 Comparison of the scores for questions related to the priority level of gestational weight gain between health care provider disciplines

As presented in Table 4.8, there were differences between health care provider disciplines in the priority level they placed on discussing, assessing and assisting women with appropriate weight gain [$F(4,458)=8.33$), $p<0.001$]. Midwives gave a lower priority to discussing, assessing, and assisting women with appropriate GWG as indicated by the post-hoc analyses, which demonstrated that midwives had a lower mean score than general practitioners ($p<0.001$; Cohen's $d=0.66$) and nurse practitioners ($p<0.001$; Cohen's $d=0.85$). Obstetricians had a lower

mean score than general practitioners (p=0.038 in post-hoc analysis; Cohen's d=0.37) and nurse practitioners (p=0.034; Cohen's d=0.58); however, the absolute difference in mean scores between obstetricians, general practitioners, and nurse practitioners was small, and had small to medium effect sizes.

4.5 Health care providers' perceptions of their role, and other health care providers' roles in gestational weight gain counselling

4.5.1 Responses to survey questions about health care provider perceptions regarding their own suitability to discuss, assess, assist and follow up with gestational weight gain

Over three quarters of respondents (77%) reported that they were the most suitable person in their practice setting to discuss GWG with women (Table 4.9). The majority also said they were the most suitable person to assess (59%), assist (54%) and follow up with GWG (53%). As these questions allowed for multiple responses ("select all that apply"), approximately half of respondents also chose general practitioners as the most appropriate provider for all of these tasks (54%, 49%, 65%, and 53% respectively; Table 4.10). Sixty-eight percent saw dietitians as the most suitable providers to assist with GWG, and 54% saw dietitians as the most suitable to follow up with GWG.

While the majority of general practitioners reported that they were the most suitable provider to discuss (80%), assess (73%), and follow up with women about their GWG (66%), only 46% of them chose "Myself" as the most appropriate provider to assist with GWG. Sixty-five percent of general practitioners chose "Dietitian" as the most appropriate provider to do this (Table 4.10). Obstetricians followed a very similar pattern, with many (83%) reporting that discussing GWG was within their role, while fewer (43%) saw themselves as the most suitable provider to assist women with GWG.

There were significant differences between health care provider disciplines' perceptions of their own role in GWG counselling (χ^2=23.51, p<0.001; Table 4.9). Midwives chose "Myself" as the most suitable provider for discussing, assessing, assisting and following up with GWG (92%, 84%, 70% and 71%) more frequently than did those in other disciplines, although approximately half of midwives who responded (53%) also chose "Dietitian" as the most appropriate provider

to assist with GWG. Primary care RNs less frequently saw themselves as the most suitable provider to assess GWG (43%) as compared to the other disciplines. Obstetricians and general practitioners less frequently saw assisting women with GWG as part of their role (43% and 46%) as compared to the other disciplines. Primary care RNs and obstetricians less frequently saw following up with GWG as part of their role (43% and 49%) as compared to other disciplines.

4.6 Influences on gestational weight gain counselling practices

4.6.1 Relationships between professional characteristics, predictors of gestational weight gain counselling practices and reported gestational weight gain counselling practices

Certain professional characteristics were correlated with gestational counselling practices (Table 4.11). The stage of pregnancy at the first visit with the health care provider (e.g. the trimester of pregnancy) was inversely associated with all three GWG counselling practices that were examined: "Providing weight gain advice and discussing risks", "Discussing physical activity and food requirements", and "Relaying weight gain information to women every time they are weighed". While the proportion of respondents' patients who were pregnant women had no significant correlation with "Providing weight gain advice and discussing risks" and a small positive correlation with "Discussing physical activity and food requirements", it was negatively correlated with "Relaying weight gain information to women every time they are weighed". When comparing the responses of health care providers who reported being part of an interdisciplinary practice setting to those who were not, there were no significant differences in "Providing weight gain advice and discussing risks" [$T(495)=-0.752$, $p=0.453$], "Discussing physical activity and food requirements" [$T(495)=-0.023$, $p=0.981$], or "Relaying weight gain information to women every time they are weighed" [$T(499)=0.559$, $p=0.576$]. When comparing health care providers who reported working in urban, rural, or urban/rural locations, there was a significant difference between these three groups for "Relaying weight gain information to women every time they are weighed" [$F(2,497)=13.075$, $p<0.001$], but not for "Providing weight gain advice and discussing risks" [$F(2,493)=-2.025$, $p=0.133$], nor "Discussing physical activity and food requirements" $F(2,493)=-2.659$, $p=0.126$].

A correlation matrix showed significant relationships between predictors of GWG counselling practices and health care providers' reported practices (Table 4.11). The priority level that health

care providers place on discussing, assessing and assisting women with appropriate GWG had significant positive correlations with each outcome, as did knowledge of weight gain, physical activity and nutrition guidelines. Appropriate knowledge and information resources was significantly correlated with "Providing weight gain advice and discussing risks" and "Discussing physical activity and food requirements". Having access to programs for referral to promote healthy nutrition during pregnancy was not correlated with the outcomes described. When comparing health care providers who reported "Myself" as the most appropriate provider to discuss GWG to those who did not choose this response, there was a significant difference in "Providing weight gain advice and discussing risks" [$T(495)=3.107$, $p=0.002$], and "Discussing physical activity and food requirements" [$T(495)=-4.551$, $p<0.001$], but not "Relaying weight gain information to women every time they are weighed" [$T(499)=1.293$, $p=0.197$].

Based on the these relationships, programs for referral to promote healthy nutrition during pregnancy and being part of an interdisciplinary practice setting were not included in multiple linear regression models, while the proportion of patients/client who are pregnant women and the stage of pregnancy at first prenatal visit were controlled for in the models.

4.6.2 Predictors of "Providing weight gain advice and discussing the risks"

Linear regression resulted in a model explaining 39.2% of the variance in the outcome, "Providing weight gain advice and discussing risks" [$F(12, 358)=19.203$, $p<0.001$], outlined in Table 4.12. The predictors in the model were not correlated, as demonstrated by the variance inflation factor and tolerance (Table 4.12). Controlling for other predictors, having a larger proportion of all patients who are pregnant women was associated with an increased likelihood of providing weight gain advice and discussing risks ($\beta=0.147$, $p=0.004$). Seeing women for the first time at a later stage of pregnancy was associated with a decreased likelihood of this practice ($\beta=-0.211$, $p=0.02$).

The priority level that health care providers placed on discussing, assessing, and assisting women with appropriate weight gain had the largest influence on how frequently they provided weight gain advice and discussed risks ($\beta=0.71$, $p<0.001$). Having knowledge of GWG, physical activity, and nutrition guidelines had a smaller but positive influence on the frequency of

providing advice and discussing risks (β=0.26, p<0.001). Having appropriate knowledge and information resources and identifying oneself as the most suitable provider to discuss GWG did not significantly influence how often health care providers provided GWG advice and discussed risks (β=0.098, p=0.227; and β=0.172, p=0.197 respectively).

4.6.3 Predictors of "Discussing physical activity and food requirements"

Linear regression resulted in a model explaining 43.4% of the variance for the outcome, "Discussing physical activity and food requirements" [F(12, 357)=22.837, p<0.001], presented in Table 4.13. The predictors in the model were not correlated, as demonstrated by the variance inflation factor and tolerance (Table 4.13). When controlling for other predictors, midwives discussed physical activity and food requirements more often than general practitioners (β=0.518, p=0.004), while the other disciplines did not differ significantly in discussing physical activity and food requirements. Being located in a rural setting was associated with increased likelihood of discussing physical activity and food requirements with pregnant women as compared to being located in an urban setting (β=0.24, p=0.043). In this model, having a larger proportion of all patients who were pregnant did not influence discussing physical activity and food requirements (p=0.126). Seeing patients for the first time at later stage of pregnancy decreased the likelihood of undertaking this practice (β=-0.351, p<0.001).

The priority level that health care providers placed on discussing, assessing, and assisting women with appropriate weight gain (β=0.341), having appropriate knowledge and information resources (β=0.311), and having knowledge of weight gain, physical activity and nutrition guidelines (β=0.277) were all significantly associated with an increased likelihood of discussing physical activity and food requirements (p<0.001 for all). Considering oneself the most appropriate provider to discuss GWG was not significantly associated with discussing physical activity and food requirements (β=0.18, p=0.133).

4.6.4 Predictors of "Relaying weight gain information to women every time they are weighed"

Table 4.14 presents a linear regression model explaining 16.9% of the variance in the outcome, "Relaying weight gain information to women every time they are weighed" [F(12, 362)=6.136, p<0.001]. There was a small improvement between the full model and the model that contained only health care provider professional characteristics (Table 4.14). This indicates that the

predictors included in the full model did not explain much more variation in "Relaying weight gain information to women every time they are weighed" compared to professional characteristics alone. When controlling for other predictors, health care providers did not differ in relaying weight gain information every time women are weighed. Being located in a rural setting was associated with an increased likelihood of relaying weight gain information every time women are weighed compared to being located in an urban setting (β=0.482, p=0.011). Seeing patients for the first time at later stage of pregnancy was inversely associated with relaying weight gain information to women every time they are weighed (β=-0.344, p=0.008).

The priority level that health care providers place on discussing, assessing, and assisting women with appropriate GWG was the only significant predictor of relaying weight gain information to women every time they are weighed, other than professional characteristics (β=0.48, p<0.001).

Of note, there were concerns with the statistical assumptions in this particular model. The plot of observed versus predicted values uncovered that the relationship was not linear, the residuals were not distributed normally, and there was significant heteroscedasticity. This is likely due to the fact that this outcome, "Relaying weight gain information to women every time they are weighed", is not a composite score created from several survey questions; rather, it represents a single survey question, and was considered because it is highly relevant to the research questions. Results from this analysis should be interpreted with caution.

Tables

Table 4.1 Characteristics of survey respondents

	GP		OB		MW		NP		RN		Total	Sig.
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)	
Province												
B.C.	22	(14)	9	(7)	24	(25)	0	(0)	0	(0)	55 (11)	N/A
Alberta	57	(37)	34	(25)	8	(8)	17	(45)	33	(44)	149 (30)	
Sask.	16	(10)	5	(4)	0	(0)	2	(5)	1	(1)	24 (5)	
Manitoba	3	(2)	4	(3)	4	(4)	3	(8)	18	(24)	32 (6)	
Ontario	32	(21)	67	(48)	53	(56)	7	(18)	9	(12)	168 (33)	
Quebec	10	(6)	5	(4)	2	(2)	0	(0)	0	(0)	17 (3)	
Nfld. And Labrador	1	(1)	3	(2)	0	(0)	0	(0)	3	(4)	7 (1)	
N.B.	5	(3)	3	(2)	0	(0)	8	(21)	9	(12)	25 (5)	
Nova Scotia	2	(1)	8	(6)	2	(2)	1	(3)	2	(3)	15 (3)	
Yukon	3	(2)	1	(1)	0	(0)	0	(0)	0	(0)	4 (1)	
N.W.T.	5	(3)	0	(0)	2	(2)	0	(0)	0	(0)	7 (1)	
Missing											5 (1)	
Location of practice												
Urban	76	(48)	111	(80)	56	(58)	21	(55)	32	(43)	296 (58)	<0.001 *
Rural	62	(39)	11	(8)	9	(9)	14	(37)	29	(39)	125 (25)	
Urban and rural	21	(13)	17	(12)	32	(33)	3	(8)	13	(18)	86 (17)	
Missing											1 (0)	
Practice setting (all that apply)												
Solo	14	(9)	36	(26)	7	(7)	2	(5)	5	(7)	64 (13)	<0.001 *
Group	128	(81)	76	(55)	86	(89)	12	(32)	30	(40)	332 (65)	<0.001 *

Interdisc-iplinary	39	(25)	11	(8)	10	(10)	28	(74)	50	(67)	138 (27)	<0.001 *
Academic	19	(12)	52	(37)	1	(1)	0	(0)	6	(8)	78 (15)	<0.001 *
Proportion of total patients/clients who are pregnant women												
<10%	60	(38)	3	(2)	0	(0)	15	(40)	25	(33)	103 (20)	<0.001ǂ
10-30%	56	(35)	12	(9)	1	(1)	11	(29)	14	(19)	94 (19)	
30-60%	22	(14)	77	(55)	1	(1)	9	(24)	10	(13)	119 (23)	
60-90%	11	(7)	28	(20)	4	(4)	0	(0)	3	(4)	46 (9)	
>90%	10	(6)	19	(14)	91	(94)	3	(8)	23	(31)	146 (29)	
Stage of pregnancy at first prenatal visit												
Before pregnancy	22	(14)	4	(3)	0	(0)	0	(0)	4	(5)	30 (6)	<0.001ǂ
First trimester	112	(70)	61	(44)	95	(98)	25	(68)	35	(47)	328 (65)	
Second trimester	11	(7)	50	(36)	0	(0)	5	(14)	8	(11)	74 (15)	
Third trimester	2	(1)	12	(9)	1	(1)	1	(3)	18	(24)	34 (7)	
Don't know/too variable to say	12	(8)	12	(9)	1	(1)	6	(16)	10	(13)	41 (8)	
Missing											1 (0)	

** Chi-square ǂ One-way ANOVA*

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN=Primary Care Registered Nurse

B.C.=British Columbia, Sask.=Saskatchewan, Nfld.=Newfoundland, N.B.=New Brunswick, N.W.T.=Northwest Territories

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.2 Summary of responses to survey questions regarding the proportion of pregnant patients with whom health care providers undertake specific gestational weight gain counselling practices

	GP		OB		MW		NP		RN		Total
% of pregnant patients	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)
I provide women with a weight gain target based on their pre-pregnancy BMI											
< 10%	41	(26)	34	(25)	23	(24)	18	(47)	42	(58)	158 (31)
10-30%	16	(10)	23	(17)	19	(20)	4	(11)	6	(8)	68 (14)
30-60%	29	(18)	28	(20)	15	(16)	3	(8)	6	(8)	81 (16)
60-90%	46	(29)	19	(14)	16	(17)	5	(13)	3	(4)	89 (18)
>90%	27	(17)	35	(25)	23	(24)	8	(21)	15	(21)	108 (21)
Missing											4 (1)
I discuss the recommended rate of weight gain based on their weight gain target											
< 10%	52	(33)	43	(31)	34	(35)	14	(37)	37	(51)	180 (36)
10-30%	24	(15)	27	(20)	18	(19)	5	(13)	6	(8)	80 (16)
30-60%	30	(19)	22	(16)	16	(17)	6	(16)	10	(14)	84 (17)
60-90%	30	(19)	26	(19)	14	(14)	2	(5)	4	(6)	76 (15)
>90%	22	(14)	19	(14)	15	(16)	11	(29)	15	(21)	82 (16)
Missing											6 (1)
I discuss the impact of inappropriate weight gain on the mother during pregnancy											
< 10%	15	(10)	8	(6)	13	(13)	8	(21)	18	(25)	62 (12)
10-30%	35	(22)	36	(26)	23	(24)	7	(18)	17	(24)	118 (23)
30-60%	47	(30)	34	(25)	19	(20)	7	(18)	11	(15)	118 (23)

60-90%	39	(25)	28	(20)	21	(22)	3	(8)	15	(21)	106 (21)
>90%	22	(14)	33	(24)	21	(22)	13	(34)	11	(15)	100 (20)
Missing											4 (1)

I discuss the impact of inappropriate weight gain on the baby

< 10%	20	(13)	14	(10)	13	(13)	8	(21)	16	(22)	71 (14)
10-30%	34	(22)	36	(26)	28	(29)	7	(18)	17	(24)	122 (24)
30-60%	47	(30)	31	(23)	17	(18)	7	(18)	15	(21)	117 (23)
60-90%	35	(22)	26	(19)	18	(19)	1	(3)	14	(19)	94 (19)
>90%	21	(13)	30	(22)	21	(22)	15	(40)	10	(14)	97 (19)
Missing											7 (1)

I weigh women at every visit

< 10%	2	(1)	3	(2)	20	(21)	3	(8)	12	(17)	40 (8)
10-30%	0	(0)	4	(3)	11	(11)	0	(0)	3	(4)	18 (4)
30-60%	2	(1)	1	(1)	14	(14)	0	(0)	3	(4)	20 (4)
60-90%	8	(5)	9	(7)	18	(19)	3	(8)	7	(10)	45 (9)
>90%	146	(92)	122	(88)	34	(35)	32	(84)	47	(65)	381 (76)
Missing											4 (1)

I relay weight gain information to women every time I weigh them

< 10%	12	(8)	16	(12)	22	(23)	3	(8)	17	(24)	70 (14)
10-30%	13	(8)	19	(14)	11	(12)	1	(3)	3	(4)	47 (9)
30-60%	17	(11)	19	(14)	10	(10)	3	(8)	2	(3)	51 (10)
60-90%	33	(21)	22	(16)	15	(16)	6	(16)	9	(13)	85 (17)

>90%	82	(52)	62	(45)	38	(40)	25	(66)	41	(57)	248 (50)
Missing											7 (1)
I discuss appropriate physical activity with pregnant women											
< 10%	2	(1)	3	(2)	0	(0)	3	(8)	11	(15)	19 (4)
10-30%	8	(5)	15	(11)	3	(3)	1	(3)	9	(13)	36 (7)
30-60%	20	(13)	27	(20)	4	(4)	5	(13)	11	(15)	67 (13)
60-90%	53	(34)	40	(29)	28	(29)	9	(24)	19	(26)	149 (30)
>90%	75	(48)	53	(38)	61	(64)	20	(53)	22	(31)	231 (46)
Missing											7 (1)
I discuss appropriate extra food requirements with pregnant women											
< 10%	16	(10)	21	(15)	3	(3)	3	(8)	16	(23)	59 (12)
10-30%	25	(16)	22	(16)	9	(9)	6	(16)	11	(16)	73 (15)
30-60%	33	(21)	38	(27)	21	(22)	6	(16)	6	(9)	104 (21)
60-90%	42	(27)	32	(23)	26	(27)	9	(24)	17	(24)	126 (25)
>90%	41	(26)	26	(19)	37	(39)	14	(37)	21	(30)	139 (28)
Missing											7 (1)
I can easily give examples of appropriate changes that women could make to meet extra food requirements											
< 10%	22	(14)	24	(17)	2	(2)	5	(14)	18	(25)	71 (14)
10-30%	23	(15)	28	(20)	4	(4)	4	(11)	6	(9)	65 (13)
30-60%	36	(23)	26	(19)	8	(8)	4	(11)	9	(13)	83 (17)
60-90%	36	(23)	30	(22)	34	(35)	7	(19)	15	(21)	122 (24)

>90%	40	(26)	30	(22)	48	(50)	17	(46)	23	(32)	158 (32)
Missing											9 (2)
I discuss the importance of taking prenatal vitamins											
< 10%	0	(0)	2	(1)	5	(5)	1	(3)	9	(13)	17 (3)
10-30%	4	(3)	7	(5)	6	(6)	0	(0)	2	(3)	19 (4)
30-60%	4	(3)	18	(13)	12	(13)	1	(3)	7	(10)	42 (8)
60-90%	25	(16)	27	(19)	24	(25)	2	(5)	10	(14)	88 (18)
>90%	124	(79)	85	(61)	49	(51)	34	(90)	44	(61)	336 (67)
Missing											6 (1)

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN= Primary Care Registered Nurse

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.3 Comparison of scores for the frequency of undertaking gestational weight gain counselling practices by health care provider discipline

	Mean	Std. Dev.	F	Sig.
Providing weight gain advice and discussing risks				
All respondents	2.91	1.20		
General Practitioner	2.95	1.08		
Obstetrician	3.03	1.18		
Midwife	2.95	1.15	2.17	0.072
Primary care RN	2.54	1.32		
Nurse Practitioner	2.91	1.46		
Discussing physical activity and food requirements				
All respondents	3.65	1.13		
General Practitioner	3.65	1.05		
Obstetrician	3.37	1.11		
Midwife	4.23	0.77	11.04	<0.001
Primary care RN	3.31	1.44		
Nurse Practitioner	3.81	1.12		
Weighing women at every visit				
All respondents	4.41	1.22		
General Practitioner	4.87	0.54		
Obstetrician	4.75	0.80		
Midwife	3.36	1.56	36.19	<0.001
Primary care RN	4.03	1.55		
Nurse Practitioner	4.61	1.10		
Relaying weight gain information to women every time they are weighed				
All respondents	3.79	1.48		
General Practitioner	4.02	1.29		
Obstetrician	3.69	1.45	4.19	0.002
Midwife	3.38	1.63		
Primary care RN	3.75	1.69		

Nurse Practitioner	4.29	1.23

Compared by one-way ANOVA

RN=Registered Nurse

Table 4.4 Summary of responses to survey questions regarding health care providers' self-assessed knowledge and access to appropriate resources

	GP		OB		MW		NP		RN		Total
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)
I have appropriate knowledge to recommend guideline concordant pregnancy weight gain											
Strongly disagree	0	(0)	1	(1)	0	(0)	1	(3)	6	(11)	8 (2)
Disagree	20	(14)	7	(6)	2	(2)	5	(15)	6	(11)	40 (9)
Neither disagree nor agree	15	(10)	15	(12)	7	(9)	5	(15)	7	(13)	49 (11)
Agree	78	(54)	73	(58)	54	(66)	21	(62)	27	(50)	253 (57)
Strongly agree	32	(22)	31	(24)	19	(23)	2	(6)	8	(15)	92 (21)
Missing											66 (13)
I have appropriate knowledge to recommend guideline concordant physical activity											
Strongly disagree	0	(0)	2	(2)	0	(0)	1	(3)	6	(11)	9 (2)
Disagree	19	(13)	7	(6)	3	(4)	4	(12)	11	(21)	44 (10)
Neither disagree nor agree	26	(18)	22	(17)	14	(17)	9	(27)	7	(13)	78 (18)
Agree	81	(57)	76	(60)	46	(56)	18	(53)	27	(51)	248 (57)
Strongly agree	17	(12)	20	(16)	19	(23)	2	(6)	2	(4)	60 (14)
Missing											69 (14)
I have appropriate knowledge to recommend guideline concordant healthy eating during pregnancy											

Strongly disagree	1	(1)	2	(2)	1	(1)	1	(3)	2	(4)	7 (2)
Disagree	18	(12)	13	(11)	4	(5)	4	(12)	10	(19)	49 (10)
Neither disagree nor agree	27	(19)	22	(18)	5	(6)	5	(15)	3	(6)	62 (14)
Agree	83	(57)	69	(56)	53	(66)	21	(62)	33	(61)	259 (59)
Strongly agree	16	(11)	18	(15)	17	(21)	3	(9)	6	(11)	60 (14)
Missing											71 (14)
I have appropriate information resources to support recommending guideline concordant pregnancy weight gain											
Strongly disagree	1	(1)	1	(1)	3	(4)	0	(0)	5	(9)	10 (2)
Disagree	42	(29)	29	(23)	14	(17)	11	(32)	11	(20)	107 (24)
Neither disagree nor agree	30	(21)	21	(17)	16	(20)	6	(18)	5	(9)	78 (18)
Agree	54	(37)	57	(45)	37	(45)	16	(47)	29	(54)	193 (36)
Strongly agree	18	(12)	19	(15)	12	(15)	1	(3)	4	(7)	54 (12)
Missing											66 (13)
I have appropriate information resources to support recommending guideline concordant physical activity											
Strongly disagree	2	(6)	5	(9)	2	(6)	5	(9)	2	(6)	19 (4)
Disagree	7	(21)	15	(28)	7	(21)	15	(28)	7	(21)	113 (26)
Neither disagree nor agree	8	(24)	7	(13)	8	(24)	7	(13)	8	(24)	99 (23)

Agree	14	(42)	24	(44)	14	(42)	24	(44)	14	(42)	160 (36)
Strongly agree	2	(6)	3	(6)	2	(6)	3	(6)	2	(6)	49 (11)
Missing											68 (13)
I have appropriate information resources to support recommending guideline concordant healthy eating during pregnancy											
Strongly disagree	2	(1)	4	(3)	2	(3)	1	(3)	2	(4)	11 (3)
Disagree	32	(22)	32	(26)	13	(16)	6	(18)	8	(15)	91 (21)
Neither disagree nor agree	38	(27)	25	(20)	10	(13)	8	(24)	5	(9)	86 (20)
Agree	61	(43)	56	(45)	42	(53)	17	(50)	33	(62)	209 (48)
Strongly agree	10	(7)	8	(6)	13	(16)	2	(6)	5	(9)	38 (9)
Missing											73 (14)
I have appropriate programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)											
Strongly disagree	13	(9)	27	(21)	9	(11)	1	(3)	5	(9)	55 (13)
Disagree	29	(20)	33	(26)	21	(26)	2	(6)	7	(13)	92 (21)
Neither disagree nor agree	33	(23)	20	(16)	9	(11)	7	(21)	7	(13)	76 (17)
Agree	50	(35)	33	(26)	31	(38)	20	(61)	23	(43)	157 (36)
Strongly agree	20	(14)	14	(11)	11	(14)	3	(9)	11	(21)	59 (13)
Missing											69 (14)

I am confident I could accurately summarize at least 80% of the content of the following guidelines to my colleagues within the next week:

Health Canada's 2010 guidelines for pregnancy weight gain

Strongly disagree	19	(12)	12	(9)	7	(8)	5	(14)	8	(12)	51 (10)
Disagree	44	(28)	32	(24)	13	(14)	4	(11)	6	(9)	99 (20)
Neither disagree nor agree	28	(18)	20	(15)	13	(14)	6	(16)	14	(21)	81 (17)
Agree	59	(37)	58	(43)	50	(54)	18	(49)	29	(43)	214 (44)
Strongly agree	8	(5)	13	(10)	10	(11)	4	(11)	11	(16)	46 (9)
Missing											17 (3)

Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy

Strongly disagree	18	(12)	8	(6)	7	(8)	5	(14)	10	(15)	48 (10)
Disagree	33	(21)	22	(16)	16	(17)	11	(31)	16	(24)	98 (20)
Neither disagree nor agree	29	(19)	30	(22)	16	(17)	4	(11)	18	(27)	97 (20)
Agree	65	(41)	60	(44)	42	(45)	13	(37)	19	(28)	199 (41)
Strongly agree	12	(8)	16	(12)	12	(13)	2	(6)	4	(6)	46 (9)
Missing											20 (4)

Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy

Strongly disagree	37	(24)	29	(22)	22	(24)	8	(22)	14	(21)	110 (23)
Disagree	53	(34)	52	(39)	24	(26)	15	(42)	19	(28)	163 (33)

Neither disagree nor agree	27	(17)	23	(17)	9	(10)	3	(8)	19	(28)	81 (17)
Agree	29	(19)	22	(16)	29	(31)	9	(25)	12	(18)	101 (21)
Strongly agree	11	(7)	9	(7)	9	(10)	1	(3)	3	(5)	33 (7)
Missing											20 (4)
Health Canada's 2010 guidelines for pregnancy weight gain											
Strongly disagree	24	(15)	17	(13)	9	(10)	6	(17)	11	(16)	67 (14)
Disagree	43	(27)	49	(37)	13	(14)	9	(25)	9	(13)	123 (25)
Neither disagree nor agree	34	(22)	28	(21)	21	(23)	6	(17)	14	(21)	103 (21)
Agree	48	(31)	31	(23)	38	(41)	12	(33)	25	(37)	154 (32)
Strongly agree	8	(5)	9	(7)	11	(12)	3	(8)	8	(12)	39 (8)
Missing											22 (4)

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN= Primary Care Registered Nurse

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.5 Comparison of scores for health care providers' self-reported knowledge and access to resources and programs to support guideline-concordant weight gain

	Mean	Std. Dev.	F	Sig.
Knowledge of weight gain, physical activity and nutrition guidelines				
All respondents	2.97	0.95		
General Practitioner	2.85	0.98	2.43	0.047
Obstetrician	2.96	0.91		
Midwife	3.22	0.88		
Primary care RN	3.00	1.01		
Nurse Practitioner	2.85	1.02		
Appropriate knowledge and information resources to support guideline-concordant weight gain				
All respondents	3.56	0.78		
General Practitioner	3.50	0.75	3.05	0.017
Obstetrician	3.61	0.75		
Midwife	3.77	0.70		
Primary care RN	3.36	0.94		
Nurse Practitioner	3.42	0.80		
Programs for referral to promote healthy nutrition during pregnancy				
All respondents	3.17	1.26		
General Practitioner	3.24	1.19	5.51	<0.001
Obstetrician	2.80	1.34		
Midwife	3.17	1.27		
Primary care RN	3.53	1.23		
Nurse Practitioner	3.67	0.85		

Compared by one-way ANOVA

RN=Registered Nurse

Table 4.6 Summary of responses to survey questions about the what would increase their likelihood of discussing, assessing, and assisting with gestational weight gain

	GP		OB		MW		NP		RN		Total
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)
Given all of the issues of concern during a typical prenatal visit, I consider:											
Discussing appropriate gestational weight gain with women a high priority											
Strongly disagree	2	(1)	3	(2)	3	(3)	1	(3)	2	(3)	11 (2)
Disagree	9	(6)	9	(7)	16	(18)	2	(6)	6	(10)	42 (9)
Neither disagree nor agree	20	(13)	33	(25)	17	(19)	7	(20)	9	(15)	86 (18)
Agree	94	(61)	61	(46)	36	(40)	12	(34)	34	(57)	237 (50)
Strongly agree	29	(19)	26	(20)	19	(21)	13	(37)	9	(15)	96 (20)
Missing											36 (7)
Assessing gestational weight gain a high priority											
Strongly disagree	0	(0)	3	(2)	7	(8)	0	(0)	2	(3)	12 (3)
Disagree	2	(1)	9	(7)	18	(20)	0	(0)	3	(5)	32 (7)
Neither disagree nor agree	7	(5)	19	(14)	12	(13)	3	(9)	5	(9)	46 (10)
Agree	75	(49)	69	(52)	47	(52)	15	(43)	35	(59)	241 (51)
Strongly agree	69	(45)	33	(25)	6	(7)	17	(49)	14	(24)	139 (30)
Missing											38 (8)
Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators, providing resources, referrals to appropriate providers, etc.) a high priority											

Strongly disagree	2	(1)	4	(3)	0	(0)	0	(0)	4	(7)	10 (2)
Disagree	5	(3)	7	(5)	4	(5)	0	(0)	2	(3)	18 (4)
Neither disagree nor agree	22	(14)	23	(17)	17	(19)	4	(11)	9	(15)	75 (16)
Agree	90	(59)	70	(53)	47	(53)	14	(40)	32	(54)	253 (54)
Strongly agree	34	(22)	28	(21)	21	(24)	17	(49)	12	(20)	198 (24)
Missing											40 (8)

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN= Primary Care Registered Nurse

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.7 Summary of responses to survey questions about the priority level they give to discussing, assessing, and assisting with gestational weight gain in the context of a typical prenatal visit

	GP		OB		MW		NP		RN		Total
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)
Are there any changes you would suggest to increase the likelihood of discussing, assessing, assisting women with gestational weight gain? *(Select all that apply)*											
Including gestational weight gain on the prenatal form											
	65	(41)	45	(32)	23	(24)	25	(66)	34	(45)	192 (38)
Including calculate cumulative gestational weight gain on the antenatal record											
	87	(55)	58	(42)	31	(32)	21	(55)	30	(40)	227 (45)
Increase your knowledge of consequences of inappropriate gestational weight gain											
	61	(38)	30	(22)	36	(37)	19	(50)	39	(52)	185 (36)
Having resources that will prompt/remind me to discuss, assess or assist women											
	94	(59)	68	(49)	42	(43)	20	(53)	41	(55)	265 (52)
Change in fee schedule											
	36	(23)	14	(10)	2	(2)	1	(3)	0	(0)	53 (10)
Is the fee schedule appropriate for the workload in prenatal visits?											
Yes	78	(51)	56	(42)	19	(21)	7	(12)	1	(3)	161 (34)
No	55	(36)	63	(48)	12	(13)	1	(2)	2	(6)	133 (28)
Not applicable	21	(14)	13	(10)	59	(66)	52	(87)	32	(91)	177 (38)

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN= Primary Care Registered Nurse

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.8 Comparison of scores for the priority level that health care providers' place on discussing, assessing, and assisting women with gestational weight gain

	Mean	Std. Dev.	F	Sig.
Priority level of discussing, assessing, and assisting women with gestational weight gain				
All respondents	3.89	0.78		
General Practitioner	4.09	0.61	8.33	<0.001
Obstetrician	3.82	0.82		
Midwife	3.59	0.86		
Primary care RN	3.80	0.87		
Nurse Practitioner	4.25	0.65		

Compared by one-way ANOVA

RN=Registered Nurse

Table 4.9 Summary and comparison of responses to survey questions about health care provider perceptions regarding their own suitability to discuss, assess, assist and follow up with gestational weight gain

	GP		OB		MW		NP		RN		Total n (%)	χ^2 (df=4) Sig.
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)		
In my practice setting, I am the most suitable person to _____ gestational weight gain:												
Discuss	121	(80)	109	(83)	80	(92)	29	(85)	35	(60)	374 (81)	23.51 <0.001
Assess	110	(73)	74	(56)	73	(84)	25	(43)	27	(79)	309 (67)	38.01 <0.001
Assist with	70	(46)	57	(43)	61	(70)	37	(64)	22	(65)	247 (54)	22.58 <0.001
Follow up with	99	(66)	65	(49)	62	(71)	25	(43)	27	(79)	278 (60)	25.18 <0.001
Missing											46 (9)	

GP=General practitioner, OB=Obstetrician, MW=Midwife, NP=Nurse practitioner, RN= Primary Care Registered Nurse

Percentage of responses are presented as valid percentage, except for missing cases.

Table 4.10 Summary of responses to survey questions about health care provider perceptions regarding their other health care providers' suitability to discuss, assess, assist and follow up with gestational weight gain

	GP		OB		MW		NP		RN		Total
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n (%)
In your practice setting, who do you think is the most suitable person to discuss gestational weight gain with women?											
Myself	121	(80)	109	(83)	80	(92)	29	(85)	35	(60)	374 (81)
General practitioner/family physician	70	(46)	65	(49)	20	(23)	18	(53)	41	(71)	214 (46)
Obstetrician/gynecologist	41	(27)	70	(53)	17	(20)	15	(44)	30	(52)	173 (37)
Dietitian	46	(31)	50	(38)	25	(29)	23	(68)	29	(50)	173 (37)
Nurse	58	(38)	43	(33)	11	(13)	19	(56)	33	(57)	164 (36)
Nurse practitioner	46	(31)	38	(29)	17	(20)	24	(71)	33	(57)	158 (34)
Midwife	48	(32)	55	(42)	43	(49)	19	(56)	28	(48)	193 (42)
Behavioural health consultant	17	(11)	17	(13)	12	(14)	7	(21)	12	(21)	65 (14)
Physical activity specialist	18	(12)	21	(16)	14	(16)	6	(18)	18	(31)	77 (17)
Other	3	(2)	2	(2)	2	(2)	0	(0)	0	(0)	7 (2)
In your practice setting, who do you think is the most suitable person to assess gestational weight gain with women?											
Myself	110	(73)	74	(56)	73	(84)	27	(79)	25	(43)	309 (67)

General practitioner/family physician	59	(39)	43	(33)	12	(14)	19	(56)	42	(72)	175 (38)
Obstetrician/gynecologist	32	(21)	50	(38)	14	(16)	16	(47)	29	(50)	141 (31)
Dietitian	50	(33)	58	(44)	30	(35)	18	(53)	26	(45)	182 (39)
Nurse	50	(33)	47	(36)	10	(12)	17	(50)	33	(57)	157 (34)
Nurse practitioner	46	(31)	43	(33)	16	(18)	23	(68)	30	(52)	158 (34)
Midwife	41	(27)	48	(36)	39	(45)	16	(47)	26	(45)	170 (37)
Behavioural health consultant	19	(13)	19	(14)	12	(14)	9	(27)	9	(16)	68 (15)
Physical activity specialist	26	(17)	24	(18)	15	(17)	8	(24)	16	(28)	89 (19)
Other	3	(2)	0	(0)	2	(2)	0	(0)	0	(0)	5 (1)
In your practice setting, who do you think is the most suitable person to assist women with gestational weight gain?											
Myself	70	(46)	57	(43)	61	(70)	22	(65)	37	(64)	247 (54)
General practitioner/family physician	39	(26)	32	(24)	19	(22)	11	(32)	28	(48)	129 (28)
Obstetrician/gynecologist	32	(21)	29	(22)	15	(17)	9	(27)	20	(35)	105 (23)
Dietitian	98	(65)	81	(61)	46	(53)	26	(77)	36	(62)	287 (62)
Nurse	66	(44)	45	(34)	12	(14)	19	(56)	39	(67)	181 (39)
Nurse practitioner	46	(31)	39	(30)	17	(20)	20	(59)	28	(48)	150 (33)

Midwife	38	(25)	38	(29)	34	(39)	16	(47)	24	(41)	150 (33)
Behavioural health consultant	50	(33)	46	(35)	26	(30)	13	(38)	14	(24)	149 (32)
Physical activity specialist	54	(36)	56	(42)	31	(36)	13	(38)	16	(28)	170 (37)
Other	2	(1)	0	(0)	3	(3)	0	(0)	0	(0)	5 (1)
In your practice setting, who do you think is the most suitable person to follow-up with gestational weight gain with women?											
Myself	99	(66)	65	(49)	62	(71)	27	(79)	25	(43)	278 (6)
General practitioner/family physician	56	(37)	50	(38)	23	(26)	18	(53)	34	(59)	181 (39)
Obstetrician/gynecologist	27	(18)	41	(31)	12	(14)	15	(44)	29	(50)	124 (27)
Dietitian	68	(45)	57	(43)	35	(40)	19	(56)	30	(52)	209 (45)
Nurse	57	(38)	38	(29)	7	(8)	15	(44)	33	(57)	150 (33)
Nurse practitioner	40	(27)	36	(27)	18	(21)	24	(71)	30	(52)	148 (32)
Midwife	36	(24)	37	(28)	33	(38)	15	(44)	25	(43)	146 (32)
Behavioural health consultant	29	(19)	20	(15)	16	(18)	10	(29)	14	(24)	89 (19)
Physical activity specialist	33	(22)	22	(17)	21	(24)	9	(27)	17	(29)	102 (22)
Other	2	(1)	0	(0)	4	(5)	0	(0)	1	(2)	7 (2)

Table 4.11 Correlations between health care provider professional characteristics, predictors of gestational weight gain counselling practices, and reported gestational weight gain counselling practices

	1	2	3	4	5	6
Providing weight gain advice and discussing risks	0.06	-0.163**	0.420**	0.350**	0.113*	0.540**
Discussing physical activity and food requirements	0.108*	-0.322**	0.480**	0.441**	0.123*	0.351**
Relaying weight gain information to women every time they are weighed	-0.246**	-0.212**	0.136**	0.041	0.01	0.316**

1. Proportion of all patients who are pregnant women
2. Stage during pregnancy at first visit
3. Knowledge of weight gain, physical activity and nutrition guidelines
4. Appropriate knowledge and information resources to support guideline-concordant weight gain
5. Programs for referral to promote healthy nutrition during pregnancy
6. Priority level of discussing, assessing and assisting women with appropriate weight gain

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.12 Predictors of "Providing weight gain advice and discussing risks"

Variable	Model 1			Model 2				
	Unstd β	S.E. of β	Std Beta	Unstd β	S.E. of β	Std Beta	Tol.	VIF
(Constant)	3.11**	0.25		-1.14**	0.38			
General practitioner *(reference)*								
Obstetrician	-0.42	0.24	-0.14	0.242	0.145	0.093	0.54	1.84
Midwife	-0.16	0.21	-0.04	-0.076	0.199	-0.026	0.36	2.79
Primary care RN	0.13	0.25	0.03	-0.029	0.177	-0.008	0.77	1.30
Nurse Practitioner	0.29	0.16	0.11	-0.057	0.206	-0.012	0.87	1.15
Urban *(reference)*			-0.06					
Rural	0.289	0.162	0.105	0.203	0.132	0.074	0.73	1.36
Urban and rural	-0.18	0.17	-0.19	-0.26	0.137	-0.084	0.87	1.15
Proportion of all patients who are pregnant	0.202**	0.062	0.259	0.147**	0.051	0.188	0.40	2.49
Stage of pregnancy at first visit	-0.36**	0.11	-0.194	-0.211*	0.09	-0.115	0.71	1.42
Knowledge of weight gain, physical activity and nutrition guidelines				0.26**	0.069	0.202	0.59	1.70
Appropriate knowledge and information resources to support guideline-concordant weight gain				0.098	0.081	0.065	0.60	1.68

Priority level of discussing, assessing and assisting women with appropriate weight gain		0.71**	0.071	0.459	0.80	1.25
Role (I am the most appropriate provider to discuss gestational weight gain)		0.172	0.133	0.056	0.92	1.09
R^2	0.06	0.392				
F for change in R^2		48.8**				

*p<0.05 **p<0.01

Unstd=Unstandardized

S.E.=Standard Error

Std=Standardized

Tol.=Tolerance

VIF=Variance Inflation Factor

Table 4.13 Predictors of "Discussing physical activity and food requirements"

Variable	Model 1			Model 2				
	Unstd β	S.E. of β	Std Beta	Unstd β	S.E. of β	Std Beta	Tol.	VIF
(Constant)	4.134	0.222		0.688	0.345			
General practitioner *(reference)*								
Obstetrician	-0.005	0.157	-0.002	0.022	0.13	0.009	0.55	1.83
Midwife	0.359	0.214	0.133	0.518**	0.179	0.192	0.36	2.79
Primary care RN	-0.097	0.189	-0.028	0	0.16	0	0.77	1.30
Nurse Practitioner	0.385	0.227	0.087	0.342	0.189	0.077	0.87	1.14
Urban *(reference)*								
Rural	0.314*	0.142	0.123	0.24*	0.118	0.094	0.74	1.36
Urban and rural	-0.161	0.149	-0.056	-0.212	0.123	-0.074	0.87	1.15
Proportion of all patients who are pregnant	0.145**	0.055	0.199	0.07	0.046	0.096	0.40	2.49
Stage of pregnancy at first visit	-0.46**	0.097	-0.269	-0.351**	0.081	-0.205	0.70	1.42
Knowledge of weight gain, physical activity and nutrition guidelines				0.277**	0.063	0.229	0.58	1.71
Appropriate knowledge and information resources to support guideline-concordant weight gain				0.311**	0.073	0.22	0.60	1.68

Priority level of discussing, assessing and assisting women with appropriate weight gain		0.341**	0.064	0.236	0.80	1.25
Role (I am the most appropriate provider to discuss gestational weight gain)		0.18	0.12	0.063	0.92	1.09
R^2	0.159	0.434				
F for change in R^2		43.39**				

*p<0.05 **p<0.01

Unstd=Unstandardized

S.E.=Standard Error

Std=Standardized

Tol.=Tolerance

VIF=Variance Inflation Factor

Table 4.14 Predictors of relaying weight gain information to women every time they are weighed

Variable	Model 1			Model 2				
	Unstd β	S.E. of β	Std Beta	Unstd β	S.E. of β	Std Beta	Tol.	VIF
(Constant)	4.855	0.303		2.708	0.548			
General practitioner *(reference)*								
Obstetrician	0.125	0.213	0.039	0.211	0.207	0.066	0.55	1.83
Midwife	-0.245	0.292	-0.068	-0.009	0.287	-0.003	0.36	2.79
Primary care RN	0.237	0.257	0.051	0.291	0.254	0.063	0.76	1.31
Nurse Practitioner	0.398	0.306	0.069	0.282	0.297	0.049	0.87	1.15
Urban *(reference)*								
Rural	0.51	0.193	0.151	0.482*	0.189	0.143	0.74	1.36
Urban and rural	-0.028	0.203	-0.007	-0.07	0.197	-0.018	0.87	1.15
Proportion of all patients who are pregnant	-0.072	0.074	-0.074	-0.082	0.073	-0.085	0.40	2.48
Stage of pregnancy at first visit	-0.413	0.133	-0.182	-0.344	0.129	-0.152	0.71	1.42
Knowledge of weight gain, physical activity and nutrition guidelines				0.123	0.099	0.077	0.59	1.69
Appropriate knowledge and information resources to support guideline-concordant weight gain				-0.058	0.115	-0.031	0.60	1.67

Priority level of discussing, assessing and assisting women with appropriate weight gain		0.48	0.102	0.251	0.80	1.25
Role (I am the most appropriate provider to discuss gestational weight gain)		-0.075	0.191	-0.02	0.92	1.09
R^2	0.102	0.169				
F for change in R^2		7.351**				

*p<0.05 **p<0.01

Unstd=Unstandardized

S.E.=Standard Error

Std=Standardized

Tol.=Tolerance

VIF=Variance Inflation Factor

Chapter 5: Qualitative Results

Three major categories emerged from the qualitative analysis of the health care provider interviews. These are: GWG counselling practices of health care providers, individual level influences on GWG counselling practices, and system level influences on GWG counselling practices. Concepts relating to each of these categories are presented below, along with the characteristics of interview participants.

5.1 Characteristics of interview participants

Characteristics of participants who were interviewed for the qualitative portion of this study are presented in Table 5.1. Participants were general practitioners, obstetricians, midwives, nurse practitioners and registered nurses, and included those from urban and rural locations in Alberta and British Columbia.

Table 5.1 Characteristics of interview participants

	n	%
Health care provider discipline		
General Practitioner	7	30%
Obstetrician	5	22%
Midwife	5	22%
Nurse Practitioner	2	9%
Registered Nurse	4	17%
Province		
British Columbia	9	39%
Alberta	14	61%

5.2 Gestational weight gain counselling practices

5.2.1 Frequency and content of gestational weight gain discussions

Health care providers reported considerable variability in the frequency with which they discussed weight gain with women. Health care providers were asked when (e.g., at what stage of pregnancy) they typically initiated a discussion about GWG. Many health care providers reported that they address GWG with every woman at the first or second prenatal visit. However, some would only address GWG at the first visit if the woman was underweight or overweight/obese, or would spend more time on the topic in these cases. Nurses often reported providing general information to women about GWG, nutrition, and physical activity. Some health care providers reviewed dietary misconceptions, such as "not eating for two", or provided general healthy eating advice. For a few, nutrition education was provided to women later in pregnancy, around 20-24 weeks in conjunction with discussions about gestational diabetes screening.

Although some health care providers described providing women with an individualized GWG gain target based on her pre-pregnancy BMI, others gave generalized advice that was not based on IOM/Health Canada guidelines or did not provide a specific weight gain target at all.

Interviewees felt that the first prenatal visit may be perceived to be overwhelming for women, as there is a large volume of information that must be provided. Many health care providers offered additional information about weight gain and related topics by providing a package of print resources which women could review at home after the visit. Alberta participants frequently mentioned the resources Healthy Eating and Active Living for Pregnancy (Alberta Health) and Healthy Parents, Healthy Children (Alberta Health Services), but other resources mentioned included Baby's Best Chance (Healthy Families BC), Healthy Weight Gain During Pregnancy (Health Canada), Canada's Food Guide (Health Canada), Eating Well for Both of You (Alberta Milk), Food Safety for Pregnant Women (Health Canada), and handouts created by the health care providers themselves.

The extent to which weight gain was discussed at subsequent visits varied among participants. Often, weight was only addressed again at subsequent visits in detail if it was problematic in the

view of the health care provider, such as inadequate or excessive GWG, pre-pregnancy overweight or obesity, previous large baby, or gestational diabetes. Women's weight was also addressed again if the woman brought forward concerns or questions. Some health care providers noted that they provided feedback on the patient's GWG at every visit, relaying to women if their weight gain is over or under a target and discussing it further if needed. A few health care providers reported that they would not discuss weight after an initial conversation if the woman had indicated she did not want to discuss it. Below are two quotes from health care providers that demonstrate the variation in practices, ranging from discussing weight at every prenatal appointment, to only discussing weight if there was a concern.

> *"We look at the weight every visit and we talk about it both ways. If it's appropriate weight gain and they've been doing very well, we're their cheerleader, and if they've gained more than the expected amount then we'll address it then and we come at it in an approach where we're not going to let it sneak by."*
>
> - **Nurse, Alberta**

> *"Weight is something I would bring up with everyone at the first visit and only -- well, I always check the weight every single other visit. But if there's no problem, I wouldn't bring it up. I might make a comment like, 'Oh, your weight looks good.'"*
>
> - **General Practitioner, Alberta**

Health care providers noted that follow up appointments were a time to assist women with concerns, such as GWG. Health care providers reported that the high frequency of prenatal visits allowed for regular follow up to address issues or concerns.

5.2.2 Gestational weight gain assessment practices

The assessment process described by health care providers for GWG varied across practice settings. General practitioners and obstetricians typically worked in clinical settings alongside nurses and/or medical office assistants, and each had a role in the assessment process. A few

midwives worked in settings such as a home office, or provided care in the client's home. In one case, a health care provider worked with a larger multidisciplinary team and included a dietitian in the assessment process.

General practitioners, obstetricians, nurse practitioners and registered nurses reported that weight and height were typically assessed at the first prenatal visit, and these would be used to calculate the woman's pre-pregnancy BMI. Weight and height were generally measured by a nurse or medical office assistant, depending on the practice setting. Nurses often reported completing the medical history with the woman.

Health care providers, with the exception of midwives, reported that weight is measured at every visit. This was generally done by a medical office assistant or nurse, but in some cases was done by the woman herself and then reported to the health care provider. The amount of weight gained since the last visit was relayed back to the woman by some health care providers, while others would leave this up to the medical office assistant or not discuss it.

For midwives, GWG was assessed using slightly different practices than other health care providers. Midwives generally reported that the emphasis in midwifery practice was on women's overall wellness and not on GWG specifically. For example, one midwife commented that she doesn't "push weight" in her practice, and that monthly weigh-ins were optional under her care. In one midwifery practice, patients charted their own weights and BMI as a means to engage patients in tracking the appropriateness of their weight trajectory. Midwives noted that women may be uncomfortable with having their weight taken at every visit, and repeated weight measurements may bring on additional stress for the woman. However, it should also be noted that one midwife reported practices very similar to the other disciplines, routinely measuring weight and relaying this information to women at each visit. This demonstrates the variation in practices within the midwifery discipline. The quote below summarizes one midwife's approach to weight measurement, and the overall focus on women's wellness rather than weight.

"We do let them [women] know that it is a voluntary weigh system and we're happy to take that information. But, if they choose not to weigh in on a

regular basis, we will just ask for a weight closer to delivery. And we ask for weight if we see, clinically, things that make us decide that we want to follow their weight more closely."

"We are aware of their weight gain. But more important to us than their weight gain is their nutrition and how they're feeling about it and, you know, providing encouragement, support and education so that we can be empowered to make healthy choices."

- **Midwife, Alberta**

5.2.3 Exploring barriers and drivers: physical activity, nutrition, and other drivers of gestational weight gain

While some health care providers noted that they assessed the barriers and drivers that impact weight gain, others reported that they did not reach this level of detail with women. For those who did discuss barriers and drivers, the assessment commonly included questions regarding diet and physical activity, and some would ask questions regarding food insecurity, stress, or employment conditions. Midwives in particular reported assessing drivers and barriers to appropriate GWG thoroughly. Some health care providers reported assessing readiness to change by evaluating body language or following the client's lead in terms of questions or their perceived interest in discussing weight gain.

"The big piece now for weight, whether it's for pregnancy or for children, it's looking at their readiness - whether they're ready to make a change and if they are concerned."

- **Nurse, Alberta**

Other factors that the interviewees thought may impact on women's ability to successfully manage healthy GWG included women's knowledge, education, working status and socioeconomic status. Previous experiences with weight management or eating disorders were also suggested to possibly heighten a patient's awareness of weight gain in pregnancy, and this was typically in a negative manner.

For some health care providers who were part of a multidisciplinary team, the exploration of drivers and barriers to GWG was a discussion that was perceived to be within the role of allied health care provider disciplines. As such, the health care provider may refer the woman to other allied health care members of the multidisciplinary team in order to explore drivers and barriers to GWG in more depth. Health care providers' perception of their own role and other health care providers' roles in GWG counselling is reported in more depth in a subsequent section (5.3.4).

5.2.4 Assisting women with gestational weight gain

Health care providers described the importance of goal setting for assisting women to achieve appropriate weight gain. However, as with exploring barriers and drivers to weight gain, not all of the health care providers reported that they directly facilitated goal setting with their patients.

Most health care providers would refer to a dietitian when a woman required more time and expertise to address her weight concerns. For example, some of the health care providers indicated that women who required more substantial support such as a meal plan, or who had specialized dietary concerns such as food allergies, would be referred to a dietitian. Other disciplines that health care providers referred to included psychology or social work, depending on the concerns of the client.

> *"So I find the most successful story of patients achieving their [weight] goals and continuing postpartum, were women who I initially brought up the topic [with], referred to our dietitian and psychologist and they [women] continued to follow up with me and with them. So they had that longer term follow-up and this goal setting and checking in with someone."*
>
> - **Obstetrician, Alberta**

Community support programs, such as prenatal classes or the Canada Prenatal Nutrition Program, were also supportive programs to which health care providers referred women. The Canada Prenatal Nutrition Program provides social and nutritional support (e.g., meals, prenatal

vitamins) to women facing social risks to a healthy pregnancy, such as poverty or isolation, and is offered in many communities across Canada.

5.3 Individual level influences on gestational weight gain counselling practices

5.3.1 Perception of sensitivity of discussing weight

Many health care providers noted they were quite comfortable discussing weight gain and that their level of comfort increased over time with years of experience and/or the routine of discussing the subject with every pregnant woman.

> *"I'm very comfortable, I have to do it every day. I wasn't as comfortable in the beginning, but now because I have to. And you know, I don't apologize anymore. I used to apologize or kind of tiptoe around it, but now - and so far it's well received."*
>
> - **Nurse, Alberta**

For others, there was some discomfort with initiating the conversation or discussing it too often. Negative experiences described by health care providers included women's discomfort in discussing weight when her partner is present, women's reluctance to discuss weight at all, and women's perceptions that health care providers are "hard" on women about weight gain. For one health care provider working with socially at risk women, the conversation was sensitive due to the woman's lack of economic access to healthy food to promote healthy weight gain. Participants noted that they were more comfortable discussing weight gain when the woman brought up the subject herself, or in situations where the health care provider had built rapport with the woman before initiating the discussion. Several health care providers reported feeling comfortable with the discussion because they used a non-judgemental manner, but they acknowledged that this took some skill on the part of the practitioner. One health care provider described a strategy of mentioning weight gain, and then asking women if they are interested in talking about it.

For a few participants, their own weight status affected their comfort level with discussing GWG, both normal weight and overweight. One participant described how she perceived that

women may not respond as well to her advice about nutrition and weight because she was overweight herself, while a normal weight practitioner found it difficult to provide advice to overweight women as she had never experienced trouble with weight management herself.

Health care providers described how some women felt offended or that they were being called "fat" when health care providers tried to describe the risks associated with obesity in pregnancy. In the quote below, a nurse describes the perceived sensitivity of discussing weight with women, in particular for obese women.

> *"It's hard to talk to people. Like a lot of people are okay, they understand, but some people get very offended when you're talking and you're telling them that they're obese."*
>
> - **Nurse, Alberta**

Patients with a history of eating disorders or weight management concerns were sometimes described to be less willing to discuss the topic of weight. The frequency of health care providers encountering patients with these medical histories was not described.

> *"Any discussion around weight can be a very charged issue and, depending on the woman and her BMI, and her history, she may have had a history of an eating disorder or whatever. You don't always know what issues she's had in the past and they can be very significant, so there could be a lot of anxiety on the patient's side around weight gain and so that will always cover a conversation, especially if you don't know her very well."*
>
> - **General Practitioner, British Columbia**

Health care providers were also concerned that a discussion about weight in pregnancy may affect a woman's body image if not approached in an appropriate manner, and some did not feel that they had the skills to do this. Both being non-judgemental and building rapport with women were important facilitators, as health care providers felt that this helped support ongoing conversations with women. The corollary was also true in that a few health care providers felt

that women may avoid the topic of weight in pregnancy if a good rapport had not been established previously or if women felt judged during the conversation.

5.3.2 Knowledge of gestational weight gain, physical activity and nutrition

Nutrition knowledge was an area that some health care providers said they would like to develop. Some felt they could not provide women with specific food recommendations to help them achieve healthy weight gain. General practitioners and obstetricians noted that nutrition is not covered in medical school or residency. One general practitioner reported that after medical school, she assumed she would have access to a dietitian once she was in practice. However, she soon realized that these services can be difficult to access, and she could not refer her patients to a dietitian as easily or as frequently as she would like. The quote below highlights one obstetrician's lack of nutrition training in medical school, and how this affects her practice.

> *"I do find that nutrition is not covered at all in my medical school and through residency. I don't remember any teaching sessions at all on weight gain in pregnancy, obesity in pregnancy or that. We have one teaching session every two years for an hour on it."*
>
> *"I find it's a topic that more patients are asking about and that I really don't have a good answer other than multivitamins and folic acid. People are asking about fish oil, they're asking about Vitamin D, they're asking about lots of other things that we don't have any teaching on."*
>
> - **Obstetrician, Alberta**

Health care providers also noted it is difficult to find credible sources of information to improve their nutrition knowledge. Beyond general information on important nutrients for pregnancy, health care providers were interested in specialized nutrition information, such as caloric requirements, Aboriginal dietary practices, and vegetarian/vegan diets.

Health care providers were interested in learning more about obesity in pregnancy. Notably, health care providers often discussed obesity in pregnancy in response to questions regarding healthy GWG. This may be because of the increase in the number of obese pregnant women,

and several participants reported noticing a rise in the number of obese pregnant women they saw in their practice in recent years. It may also indicate a need for further education for the importance of healthy GWG for all women, rather than just overweight and obese women. Areas that health care providers noted they needed more information about included the safety of weight loss in pregnancy, the importance of weight management in the perinatal period, and training on the use of the Physical Activity Readiness Medical Examination for Pregnancy tool from SOGC and the Canadian Society for Exercise Physiology.

Interestingly, some general practitioners and a nurse practitioner had contradicting views about their need for additional nutrition knowledge. For those with easy access to a dietitian on site, there was a general view that discussing weight and healthy eating could be left to the dietitian. Some general practitioners felt they had adequate knowledge of nutrition due to years in practice or personal interest, but lacked time to assess women's diets and set goals with them. Another general practitioner described how it was difficult to be an expert in every area, and that a basic level of knowledge coupled with access to a dietitian was more desirable than having additional knowledge in nutrition.

> *"Certainly, I mean, my knowledge would be lacking in those areas [weight and nutrition] if I were writing an exam. But that's why I have people working with me. So as a family doctor, I don't expect myself to know everything about everything. So my job is kind of just have a nose for trouble, knowing when things aren't quite right. And then, those ones, referring to the proper people."*

> *"I don't have time to learn everything about everything. So in that sense, I'm not interested in learning more. I'm very interested in making sure that I have the right people around me to help me, though."*

> **- General Practitioner, Alberta**

Another area for knowledge development was goal setting and behaviour change. Health care providers found it difficult to engage women to help them move past ambivalence to change. One health care provider reported that she would ask women if they were concerned about

weight, and if they were not, she would go no further with the discussion. Another described how women would request information and resources but struggle with actually making a behaviour change. Generally, health care providers reported making recommendations without much success in promoting behaviour change.

> *"But I think that overall, like, for how many times I've had that conversation it just sort of seems to go the same way. Like I feel like I'm telling them that they're overweight and that they shouldn't gain too much weight and it just doesn't seem to culminate in any real change for the patient that I can see. I feel that it's just sort of like I'm pointing out the problem and you're aware of it and it just doesn't seem like there's any capacity for change."*
>
> **- Obstetrician, British Columbia**

5.3.3 Knowledge and use of gestational weight gain guidelines

Notably, while many health care providers would calculate pre-pregnancy BMI, and some would provide women with a weight gain target based on this BMI, they typically did not identify that IOM/Health Canada GWG guidelines were used to provide this target. Some health care providers demonstrated a lack of knowledge of these guidelines, or how to use them correctly. For example, some health care providers described re-calculating women's BMI throughout their pregnancy as a means to assess appropriateness of GWG. Others demonstrated a general knowledge of the guidelines by indicating that they provide women with a weight gain target that is loosely based on pre-pregnancy BMI, or on an approximate "rule of thumb". One general practitioner emphasized that he could not remember all the guidelines for the breadth of conditions he sees in a family practice. It was more important for him to have an easy to recall recommendation that can be shared with women; detailed guidance is provided via resources that he made available to women, or through referral to a dietitian.

Clinical practice guidelines for the care of obese pregnant women were an area of concern for health care providers, as they reported there are increasing numbers of obese pregnant women in their clinics that they were having difficulty managing. Health care providers reported that their

clinics or regions were developing or have developed clinical guidance in this area; for example, a rural area had developed a pathway for referring high risk obese women to a larger urban centre for delivery.

5.3.4 Health care provider's perception of their own role, and other health care providers' roles, in gestational weight gain counselling

Most health care providers indicated that discussing GWG with pregnant women was within their role; however, some noted that other health care providers were needed to work with women who had health concerns beyond their own expertise. Interestingly, general practitioners who worked in a team saw the role of nurses and/or nurse practitioners in their clinics as assessment-focussed, while the general practitioner's role would be to discuss GWG with the patient. At the same time, general practitioners reported a desire for an expanded role of the nurse in discussing GWG, although they perceived that nurses would require increased knowledge in the area of weight gain and nutrition in order to do this. On the other hand, nurses saw patient education to be an important part of their role, and this included providing women with education or information on healthy weight gain, nutrition and exercise. Midwives reported similar views of their role.

For some health care providers who worked in a team setting, GWG discussions were seen to be a team responsibility, and they felt that multiple health care providers should communicate the same message. Some general practitioners, obstetricians, and a nurse practitioner reported that goal setting in particular was within the role of allied health professionals (e.g., social workers, dietitians, psychologists) if the complexity of the woman's needs was beyond their own capacity in the amount of time they had available to set goals with the woman, or the amount of knowledge they had in the specific area, such as nutrition or mental health.

The importance of general practitioners' and obstetricians' engagement in promoting appropriate GWG was noted by allied health care providers. One registered nurse suggested that the general practitioner or obstetrician should take the lead in GWG discussions, as physicians are ultimately responsible for helping their patient to have a healthy pregnancy. A general practitioner

described how his patients value his expertise more than the allied health care providers on the team, and look to him for endorsement of the allied health care providers' recommendations.

> *"The doctor [general practitioner] often kind of has the last word. So I find that I just simply reassure and endorse what the nurse practitioner and the dietitian say. The dietitian, I think, has better knowledge and more expertise but for some reason people often don't consider that as the final word. So I simply endorse what they say."*
>
> - **General Practitioner, Alberta**

One registered nurse reported a hierarchical system in the clinic, where the obstetricians would have the final say. This made it difficult to incorporate new guidelines and resources until they received approval from the obstetricians. Obstetricians remarked that they may begin their care for pregnant women later in pregnancy, and there is an important role for the woman's primary health care provider (e.g. general practitioner) to discuss GWG earlier in pregnancy.

5.3.5 Priority level given to gestational weight gain by health care providers

In some cases, health care providers gave GWG a lower priority in the context of a typical prenatal appointment. For general practitioners and obstetricians, this was typically due to time constraints (outlined in a subsequent section), which meant that other topics received higher priority. For some health care providers, the lower priority placed on GWG was related to their knowledge of the risks of inappropriate GWG, as weight was not seen to have an immediate impact on infant outcomes; rather, it was a long-term issue for the mother. Others noted that if GWG was not high priority for women, it was not a high priority for the health care provider.

> *"I don't think every pregnant woman needs to have an explicit detailed discussion about it, I think, with their GP. I think when it's appropriate to introduce the topic and explore it, if the patient is interested, but if you can see her history and from her attitude and the way she looks that she is likely to proceed on an appropriate weight gain trajectory, then I would move on possibly to focus on other more important things."*

> *"I guess my issue with the question is the discussion. I think you should bring it up with every pregnant woman because every pregnant woman wants to know something, but I don't think an in-depth discussion about it is appropriate with every pregnant woman. In the context of limited time and resources with a woman, you may choose to have your detailed discussions around other issues."*
>
> - **General Practitioner, British Columbia**

For midwives, GWG was given lower priority as compared to discussing physical activity and nutrition. This was related to the midwives' focus on overall wellbeing of the women and provision of support, as outlined earlier.

5.4 System level influences on gestational weight gain counselling practices

5.4.1 The impact of the length of a typical appointment on gestational weight gain counselling practices

A barrier to discussing GWG noted by general practitioners and obstetricians was the lack of time they have in a typical prenatal appointment. General practitioners and obstetricians reported they have a very limited length of time for appointments, usually 15 to 20 minutes. While brief GWG discussions may occur, there was a lack of time to explore the topic in depth, and an additional appointment may be required in order to do so. In the context of the short appointment time, general practitioners and obstetricians may prioritize other topics to discuss. In contrast, nurses and midwives reported that they had greater flexibility with the length of time for appointments, and felt this was an important component of their care. In particular, midwives noted that their initial appointment is up to one hour in length. These nurses and midwives described how having time to discuss women's concerns was essential to supporting women to have a healthy pregnancy.

> *"I think that is a little bit different where midwifery care is – we do believe that it's absolutely essential to be able to offer that time with women when they're pregnant in order to be able to do all this."*

> *"If they want to support healthy women in pregnancy, as far as I'm concerned, all the things we've been talking about relate back to amount of time. I don't think we're doing a great job in the area of just simply spending time with a pregnant woman."*
>
> - **Midwife, Alberta**

5.4.2 The impact of compensation on gestational weight gain counselling practices

Prenatal appointments differed in length of time available depending on health care provider discipline, and this was reported to be related to compensation. As discussed earlier, general practitioners and obstetricians reported they have a very limited length of time for appointments, typically 10 to 20 minutes, and noted that they were compensated by billing by fee code. General practitioners and obstetricians commented that aspects of the health care system, including time available in an appointment and compensation structure, limit the extent of the care that they can provide to patients, and that this impacts their discussions with women about GWG.

> ***"****I guess the biggest structural problem is the short prenatal visit and the amount of information that has to be gathered and disseminated in that visit, which is typically anything from 10 to 15 minutes long. It is challenging and the primary thing driving the short prenatal visit is financial compensation, so, yes, I guess if I made prenatal visits longer and I could double the length of time without halving my fee, essentially, then, yes, I would probably have more impact in this respect."*
>
> **- General Practitioner, British Columbia**

Some suggested including a billing code to compensate physicians for counselling on GWG, as it was noted that this topic was very complex and likely required an extended amount of time to explore the issues and make a plan. A general practitioner commented that British Columbia has introduced a billing code for preventative health counselling, but there were limits on the number of times per year that physicians are able to use this code, and the limit was too low compared to the frequency of patients who would require GWG counselling. However, this health care

provider commented that the billing code for preventative health counselling was an important step in the right direction, and noted that this made her feel rewarded for her work.

> *"So if there was a specific fee, like a billing code for initiation and formulation of plan relating to a high risk issue, because it could be generalized to other issues that I guess would be--, this issue of [weight gain in] pregnancy, and it's huge. I think it has a lot of components that makes you spend a lot of time with patients. I can't think of many other common conditions that require as much time. But if there would be just an added code for something very descriptive that makes you have to sit down and make a plan with the patient, because that part I think is what takes longest. The discussion part is a little bit faster but it's the sitting down and coming up with an actual plan for this patient to go home and have something to do and not just send her home with information and then she feels overwhelmed and doesn't know where to start."*
>
> - **Obstetrician, Alberta**

One health care provider suggested changes to the billing structure to allow for a longer initial visit to adequately address weight gain in the early stages of pregnancy, as well as extended follow up visits for women who were having concerns. They also suggested that referral to a dietitian could occur if women continued to have struggles.

> *"I'd say half an hour in their early pregnancy, the first few visits, then maybe another half an hour over the next few months, maybe two more 15-minute sessions for follow-up and then the rest of it, a long-term follow-up, unless the person's really struggling. In that case, they'd probably be referred [to a dietitian], but from what I could do, it's a lot about – The big step is in the beginning, and then, the tweaks can occur pretty much in a regular visit."*
>
> **- General Practitioner, British Columbia**

Conversely, health care providers who had more time in an appointment, and the flexibility to discuss any issue of concern with the woman in an appointment without the constraints of

billing, highlighted the advantages of this for promoting healthy weight gain. Nurses and nurse practitioners were not constrained by billing, which allowed them to have greater flexibility with the length of time for an appointment. One nurse reported that she was available for additional appointments with women outside of their regular physician appointments if they required additional support.

A key advantage of midwifery practice, as reported by midwives, was the extended length of time available to devote to a prenatal visit as compared to general practitioner or obstetrician care. Midwives noted that their first prenatal appointment was typically 45 minutes to an hour in length. One midwife noted that having the time to discuss concerns with women was essential in order to gather enough information to provide specific suggestions or set goals with women. The quote below highlights the advantages of the compensation methods for midwives, as viewed by a midwife.

> *"And that's a different model, right, for us because we're not billing per fee code. So when I see a woman, I can talk to her or counsel her or do anything in that visit, it doesn't – so, it's different than the physicians, I guess, because they're constrained by billing for what they're talking to the people about, right?"*
>
> **- Midwife, British Columbia**

5.4.3 Timing of prenatal visit

Alberta midwives noted that funding support for midwifery services was inadequate in relation to the number of women wanting midwifery care. An unintended benefit of this was that midwives tended to see women very early in pregnancy, as high demand meant women would seek out their services immediately after learning they were pregnant. This meant more opportunity for discussions with women.

Some health care providers noted that their first visit with a woman may be in the later stages of her pregnancy. This was due to system processes such as women's care being transferred from a

rural community to a larger centre, or referrals from a general practitioner to an obstetrician midway through pregnancy. One health care provider noted that women who were transferred into her care in the late stages of pregnancy missed the opportunity for education and discussion regarding nutrition and weight.

5.4.4 Resources and programs for referral

Health care providers indicated a need for new or improved resources to support healthy GWG and nutrition. Print resources were favoured by many health care providers. Gaps in current print resources included weight-specific resources for pregnancy, such as a resource outlining the risks of obesity in pregnancy, and the risks of inappropriate weight gain. One health care provider noted that this type of resource would aid in the sensitive discussion of obesity, so that the conversation would be framed around health and be less offensive for the woman. Worksheets or a "passport" where women could track their own goals were also suggested. Web resources were favoured by some, including online videos for pregnant women to access for information. An opportunity was also identified for the development of a Smartphone application (App), as health care providers noted that most women have Smartphones. There was also an acknowledgement of the need for resources for diverse groups, with some recommending culturally appropriate or translated resources.

Several health care providers saw a gap in prenatal physical activity resources, and noted the need for credible resources and programming. Health care providers reported that current prenatal physical activity programming is typically offered privately, and can be costly for women. Opportunities mentioned by the health care providers included a provider with expertise in exercise available for referral, a prenatal exercise class with reduced or no cost, or print resources.

Although print resources, web resources, and programs for referral were all identified as beneficial, there was an emphasis from some health care providers on the importance of health care providers themselves as resources. Patient-provider relationships were seen to be key in sharing information with women, as the approach must be tailored to each individual woman. One health care provider reported that her clinic's most effective way to share nutrition

information was not a handout, but meeting with the dietitian. A midwife commented that the lack of the right type or amount of resources is not the problem; the most important way for women to achieve healthy weight gain during pregnancy is through relationships and time with care providers.

> *"There's not a singular handout, or a particular thing. But rather, you know, the relationship and communication that, I think, is most key."*
>
> - **Midwife, Alberta**

5.4.5 Access to dietitian services

Although most health care providers reported having dietitian services available, there were barriers for women to access this service. For example, one health care provider reported that only women with a diabetes diagnosis were able to see a dietitian, while several others reported a long wait time in order to get an appointment with a dietitian. One described how the limited availability of the dietitian led to a several month wait time after referral, and the window of opportunity to change nutrition habits in early pregnancy may be lost. Some health care providers referred to a dietitian located at the nearest hospital, adding an extra step to accessing services. Another in a rural area only had access to a private practice dietitian. Even when women were referred and successfully saw a dietitian, one general practitioner noted that follow up was not available. Opportunities were identified for a structured program for pregnant women that included dietitian services throughout the antenatal period, or expanded telehealth/videoconference dietitian services. Generally, these health care providers felt there was a lack of funding for dietitian services, and reported a need for expansion of services.

> **"***Yes. I mean, for us - for BC they've cut some of the funding for the nutritionists, and what they've put more of the money into is, like, a dial-a-nutritionist phone. "*
>
> **"***And so there's been that direct person-to-person time for nutritionists [that has been cut]."*
>
> **- Nurse Practitioner, British Columbia**

Some health care providers had dietitian services on site, and reported the benefits of ease of referral. One health care provider reported that the dietitian would see every client in the clinic, and this made it easy to leave all nutrition and weight counselling to her. Having a dietitian on site also was important for professional team building. One general practitioner noted that he was more comfortable referring women to a dietitian on site because he knew her, rather than referring to an unknown dietitian at the hospital.

> *"It was certainly much more difficult before I had the dietitian, because at that point I'd be alone in the office. And then I'd have to refer to the dietitian at the hospital - to a dietitian who doesn't know me from a hole in the ground, and I don't know them either. So it's difficult for me to refer a patient to somebody I don't even know. If a patient finds out that I don't even know who this person is, and this person's giving them advice, and they say "Doctor, is this person giving me the right advice?" And I'd say well - you know, it's a lot easier to say yeah, she's [the dietitian] great. She's been working for me now for five years. She knows what she's doing. It's much more reassuring for me to say that, then when I had to refer to a dietitian at the hospital somewhere else. And then in those days, it was harder to get patients in as well. But now it's - she comes in here every two weeks. You know, it's usually - I'll put you in next Monday she's here. If they agree, I'll say you'll see her on Monday. It's very quick for me to get somebody in."*
>
> **General Practitioner, Alberta**

Other general practitioners preferred to provide basic nutrition counselling themselves rather than refer to an off-site dietitian where they were unsure of her skills. A nurse practitioner noted that she was able to ask the dietitian questions and easily receive answers to pass on to patients. While onsite services reduced some barriers to accessing the dietitian, some health care providers reported that women still had difficulty adding an additional appointment due to work schedules, or had a general reluctance to see a dietitian.

5.4.6 Multidisciplinary teams

While some multidisciplinary teams were reported to consist of a nurse and a general practitioner or obstetrician, some health care providers worked with expanded multidisciplinary teams that included allied health providers, sometimes located within the same clinic. Notably, this was much more common in Alberta than British Columbia. Several of the health care providers in Alberta were part of a Primary Care Network (PCN), which provides multidisciplinary services in conjunction with general practitioners' medical care. Location of the whole team at the same clinic was of particular benefit due to the ease of referral to the appropriate provider on the team and the reduced barrier of accessing a separate appointment, on top of the benefits noted in the previous section. As one health care provider noted, women are able to get an appointment with another provider on the same day, which is of particular benefit for women who are juggling multiple appointments for ultrasounds, blood work, and other prenatal items. Furthermore, it was noted that having these services on site demonstrates that these expanded services are part of routine care. For health care providers in this situation, the general model for supporting patient issues or concerns involved ongoing follow up with a nurse or physician in parallel with visits to a dietitian or other allied health professionals. Another benefit of multidisciplinary teams was the continuity of care that could be provided by a nurse when the physicians or obstetricians provide shared care. Shared care refers to several physicians or obstetricians who share the same clients, which results in women seeing a rotation of different physicians. Continuity of care led to rapport-building; as noted earlier, this was seen to be important for promoting healthy GWG.

> *"I mean if the government would continue to build on the success of PCNs and allowing some of those programs to expand I think that is only been shown to do good things. And patients are starting to understand like what the PCN is and how to access them through the clinic. That being said, they're different throughout the province, each PCN is tailor-made to suit the needs of a region. So, I think that would be one way to kind of work with already something that's working."*
>
> - **General Practitioner, Alberta**

Health care providers acknowledged that there are, however, challenges to working within multidisciplinary teams. A lack of team consensus among practitioners was described as a

challenge by some health care providers regarding each individual's approach to discussing or assessing weight gain. A particular challenge for nurses was when the general practitioner or obstetrician would inform women that their weight gain was appropriate when the nurse had identified it as an issue of concern. This was even a concern when the general practitioner or obstetrician did not mention weight gain at all, as nurses noted that women perceived this to mean that weight gain is appropriate. As well, it was remarked that some practitioners may be using outdated guidelines for various aspects of care, and may not be receptive to learning about new research. This was seen to be challenging for women who received different messages at the same clinic about weight gain, and also for colleagues who could not obtain buy-in from patients. There also was a reported lack of communication about team members' practices. For example, general practitioners described a lack of knowledge of what the nurses on their team do in regards to weight gain. While nurses described discussing, assessing and counselling women about weight gain, general practitioners were unsure if the nurses addressed this topic beyond weight measurement. One nurse reported women's frustrations with hearing different advice from each health care provider on the multidisciplinary team, describing how women say,

> *"'Everybody says something different, She said I was fine, he called me fat, you know get your stuff together, like what do you guys [health care providers] want me [woman] to do?'"*
>
> - **Nurse, Alberta**

British Columbia health care providers emphasized the need for multidisciplinary services to support appropriate GWG, in particular for women who begin pregnancy obese.

> **"***I would love an affiliated health professional in my office… I think a nurse would be fine. I think a dietitian would be great to address the eating issues, but I think it's not always around eating, a lot of it is lifestyle and exercise and other things, so it needs to be more comprehensive than just dietary advice, and I think a nurse would be appropriate for giving that advice. I think that would be lovely, to have someone I could send my patients to. And I also think it would be better within my practice. I would rather do it myself than probably send someone to a specialized clinic to talk about it. I don't*

want this to be a burden on my patient, but if she could just see me for part of the visit and then move on to the next room and see a nurse for the counselling around that, that would be great. But I wouldn't send her off-site, I would just do it myself, I think, or I guess maybe it wouldn't get done."

- General Practitioner, British Columbia

"So, the patients that we see that have excessive weight gain or are obese, usually, you know, they require actually a multidisciplinary approach. And that's what's lacking right now. So if we did have the capability to have a multidisciplinary clinic for the obese patient - like I'm talking BMI over 30, or you could even make the argument for BMI over 40 – you know, involving medicine, or endocrinology, OB [obstetrics], anaesthesia, nursing, dietitian. I think that would be – that's what's missing right now, in my region."

- Obstetrician, British Columbia

5.4.7 Group appointments

Group care, such as the "Centering Pregnancy" program, is an approach to prenatal appointments where a group of women with similar due dates will come together to discuss health topics as a group, as well as see their health care provider in a brief one-on-one interaction within the group setting. Group care typically starts mid-pregnancy and may continue into the postpartum period. Some health care providers offered group care and reported benefits of this approach in relation to promoting healthy GWG, while others saw potential in this mode of care delivery.

Health care providers who delivered group care reported that the topics discussed in group appointments can be flexible, and the group allows for sharing and relationship building among women. Group care allowed a greater length of time for the appointment, which included more time for discussing lifestyle information such as nutrition, physical activity and weight gain. One midwife described how this approach was used by her general practitioner colleagues to increase the amount of time available to discuss lifestyle issues, and reduce physician workload by including a nurse to facilitate the group. Another reported that group appointments allowed

her clinic to hire a private practice dietitian to come speak to the group, as the cost of seeing the dietitian individually may be prohibitive for some women. The quotes below emphasize health care providers' perceived advantages of the group approach in regards to providing more face-to-face time with women, and allowing women to gain support from each other.

> *"They [the general practitioners in the area] actually started to do a Centering Pregnancy program there and hired a nurse to come in and do some of this type of work. I don't know how much time she spends on diet and exercise but I just think that there are other ways of getting around to offer more time to your patients than what happens currently. I think that's the kind of way that you need to approach pregnancy care."*
>
> - **Midwife, Alberta**

> *"Women in the group talk to each [other], we usually pair them off and say, you know, talk to one person and talk about what you're doing, and then, sometimes we talk in the group about what are tips that you have for managing your weight, or eating well, or managing your exercise, or whatever. And so, everybody gets ideas from everybody else in the group."*
>
> **- General Practitioner, British Columbia**

For some who were not currently providing group care, this approach was seen to have potential to support healthy weight gain. Health care providers saw an opportunity for groups to be led by allied health, and potentially have groups specialized towards women with identified weight concerns. In particular, an opportunity was identified to integrate group care with the public health system, utilizing public health nurses to deliver group services in conjunction with standard prenatal care. It was noted that typical prenatal classes are targeted towards labour and delivery, and early prenatal classes that cover lifestyle issues are not well attended. One health care provider thought that integrating group care with the public health system could improve attendance and may provide women with more comprehensive information that is broader than labour and delivery.

5.5 Summary of qualitative results

Health care providers reported a range of practices related to GWG. Typically, GWG is discussed within the first few appointments, but may not be discussed again in detail throughout the rest of the pregnancy. There are many barriers and facilitators to optimal GWG counselling that were reported by health care providers, and these were at the individual and system levels, including knowledge, resources, time, and appointment structure (e.g. group appointments), among other factors.

Chapter 6: Discussion and Conclusions

6.1 Addressing the research objectives: Integrating the quantitative and qualitative data

This thesis examined perceptions of and influences on health care providers' practices in relation to GWG, using a mixed methods approach. It adds much needed evidence to the body of literature on GWG counselling practices of health care providers, in particular for the Canadian context. It also contributes valuable information to the ENRICH research program, as it adds to a knowledge base that will be used to develop strategies to promote healthy weights and dietary intake for pregnant women in Alberta. This thesis aids in identifying needs, gaps and opportunities in health service delivery that could potentially be addressed to promote appropriate GWG for all women.

Overall, this thesis has captured some of the complexity of how GWG counselling is currently provided during routine prenatal care in Canada, as well as the multiple levels of influence on counselling practices, from interpersonal to policy. This chapter synthesizes the results from the project to identify areas for improvement in the GWG counselling practices of health care providers in addition to foci for further research to develop the evidence base to support best practices in GWG counselling. The results of this thesis project are discussed in relation to the six research objectives outlined in Chapter 1, and recommendations are provided for the development of interventions for health care providers.

6.1.1 Research objective 1: The practices of health care providers in relation to gestational weight gain, physical activity and nutrition

The integrated qualitative and quantitative data support the notion that there was a great variety of practices undertaken by health care providers when it comes to GWG. However, few health care providers reported that they *routinely* provided women with a weight gain target based on pre-pregnancy BMI, discussed the recommended rate of weight gain based on their weight gain target, and discussed the risks of inappropriate weight gain on mother and baby with every

pregnant patient. The qualitative data suggests that while a discussion about GWG typically occurred within the first few appointments, it usually occurred in combination with a discussion of many other important topics related to prenatal care. Olander et al (2011) conducted focus groups with health care and other types of providers (midwives, social workers, clinic managers) as well as prenatal and postnatal women in one area of the UK to explore their perceptions of GWG counselling. Similar to this thesis, the authors found that both the providers and the women perceived that there was a large amount of information sharing at the initial appointment. For the providers, that meant there was less time to discuss GWG; for the women, that meant it was more difficult to "digest" all of the information that was provided. In Whitaker et al's (2016) qualitative interviews with US health care providers (physicians, residents, and a nurse practitioner) regarding GWG counselling, some health care providers reported that a general overview of GWG information at the first prenatal visit is the only counselling on GWG that is provided. Lindqvist et al (2014) conducted focus groups with midwives in Sweden to gain insight into their physical activity counselling practices; the authors found that midwives reported increasing pressure to fit more topics into a single visit. The findings from this thesis indicate that Canadian health care providers reported similar practices to health care providers other areas of the world in regards to providing general GWG information in the early prenatal appointments. This may pose a challenge for promoting optimal GWG, as both health care providers and pregnant women may be overwhelmed by the information sharing, as indicated in the qualitative studies from other areas (Lindqvist et al., 2014; Olander et al., 2011; Whitaker et al., 2016).

The qualitative data suggested that pre-pregnancy BMI was often calculated, but not all health care providers used it to guide the provision of an individualized weight gain target. Several US studies have found a lack of use of pre-pregnancy BMI in the provision of GWG advice. A national survey of US obstetricians (n=250) found that only 42% always used pre-pregnancy BMI to modify their GWG advice (Boothe-LaRoche et al., 2014). Another larger (n=900) national survey of obstetrician members of the American College of Obstetricians and Gynecologists' found that 35.7% modified their GWG advice based on a woman's pre-pregnancy BMI "most of the time" and 28% modified their advice based on pre-pregnancy BMI "often" (Power et al., 2006). Qualitative data from this thesis suggested that discussing GWG

occurred more frequently with women who began pregnancy underweight or overweight/obese, or who brought up the topic themselves. This is similar to findings from US qualitative studies. In qualitative interviews with a variety of health care providers, Oken et al (2013) found that health care providers reported discussing weight more frequently with women who began pregnancy overweight or obese. Duthie et al (2013) interviewed both obstetricians and women in the third trimester of pregnancy, and found that women reported initiating the discussion about GWG with their health care provider, rather than their obstetrician bringing up the topic. The women in the study reported that even though their weight gain was excessive, their obstetrician reassured them that they were doing well. Obstetricians in the study noted that they tailored their counselling based on the patient's characteristics: women with a high BMI prior to pregnancy received more counselling, while women who displayed anxiety about their weight received less counselling. It appears from the results of this thesis that most health care providers discussed GWG with some women, but this does not occur with *every* pregnant woman. While the finding that GWG discussions occur with only a portion of pregnant patients is consistent with those reported by other studies, they underline the lack of adherence to the IOM recommendation that health care providers provide every woman with a weight gain target based on her pre-pregnancy BMI; Health Canada's guidance for health professionals recommends the same alongside letting women know why GWG is important (Health Canada, 2010; Institute of Medicine and National Research Council, 2013; Lutsiv et al., 2012; Power et al., 2006).

Most health care providers in this study noted that they discuss physical activity and nutrition with pregnant women. This is consistent with Ferraro et al's (2013) survey of 174 Canadian prenatal care providers on the mailing list for the SOGC, as well as Lutsiv et al's (2012) survey of 42 health care providers in Hamilton, Ontario, both of which found that the majority of health care providers reported counselling on physical activity and nutrition. However, the information provided to women that was described by the health care providers in this thesis was general, and often included the provision of information via print resources. While the provision of information is an important component of behaviour change, knowledge alone may not be sufficient for behaviour change; rather, additional support with goal setting and empowerment for women is needed (Barker et al., 2011). As well, the general nutrition information provided to women that was found in this thesis was more often about the importance of prenatal vitamins

than about caloric requirements, which would have an impact on appropriate GWG. This is very similar to the findings from McDonald et al's (2012) survey of Hamilton women, where 98% of women reported that their health care provider discussed prenatal vitamins, as compared to 18% who reported that additional caloric requirements were discussed. Although there are no Canadian qualitative studies to compare these findings to, a qualitative study from the US of both obstetricians' and women's perceptions of GWG counselling interactions found that obstetricians reported discussing physical activity and nutrition, but women reported a lack of depth in the information (Duthie et al., 2013). Once again, this is in contrast to the IOM's recommendations that suggest health care providers offer tailored physical activity and nutrition counselling to women (Institute of Medicine and National Research Council, 2013).

The weight assessment practices of Canadian prenatal health care providers have not been well studied, and this thesis reports novel findings in this area. The majority of general practitioners, obstetricians, nurse practitioners and registered nurses in primary care reported routinely weighing pregnant women at every prenatal visit, which is in line with Lutsiv et al's (2012) smaller survey (n=42) of health care providers in Ontario that reported that 83% of health care providers measured weight at the first visit, and approximately two-thirds did this at subsequent visits (Lutsiv et al., 2012). While it seems clear that measuring weight at each prenatal visit is a common practice, few health care providers in this thesis reported routinely relaying this information to women. The qualitative data suggested this may be because weight is not discussed at subsequent visits unless it becomes a concern for the health care provider or the woman. Although this has not been previously explored in the Canadian literature, international qualitative studies have also found this "reactive" approach, where GWG is only discussed when it becomes concerning, such as excessive weight gain (Chang et al., 2013; Duthie et al., 2013). This is of concern for the promotion of appropriate GWG, as weight loss in pregnancy is not recommended; as such, it is important to address GWG early, in order to prevent excess weight gain before it occurs (Health Canada, 2010). Health Canada and the IOM both recommend tracking weight throughout pregnancy as a means to identify inappropriate weight trajectories early, and provide weight gain charts as a means for health care providers to do so (Health Canada, 2010; Institute of Medicine and National Research Council, 2013). From the qualitative data in this thesis, monitoring the weight gain trajectory of women using weight gain graphs was

not identified as a typical weight assessment practice. This may make it more difficult to identify inappropriate weight gain patterns. The weight assessment practices outlined in this thesis are also in contrast to the IOM's recommendations, which state that health care providers should discuss the progression of women's GWG with them, so they are aware of their progress towards their GWG target (Institute of Medicine and National Research Council, 2013). On another note, the qualitative data also indicated that other health care providers are sometimes involved in the weight measurement process, such as a nurse or medical office assistant, or that women measured their own weight and reported it back to the health care provider. As a result, the health care provider may not be directly relaying that information to women after they are weighed. The delineation of roles of various health care providers in the weight assessment process has not been previously studied, but may be important information for the development of GWG counselling interventions in the primary care setting.

Figure 6.1 shows a typical model of GWG assessment and counselling practices reported by health care providers, with the exception of midwives, while acknowledging the large variation in practices. Midwives differed from the other health care provider disciplines in their assessment and counselling practices, and this is discussed further in the next section.

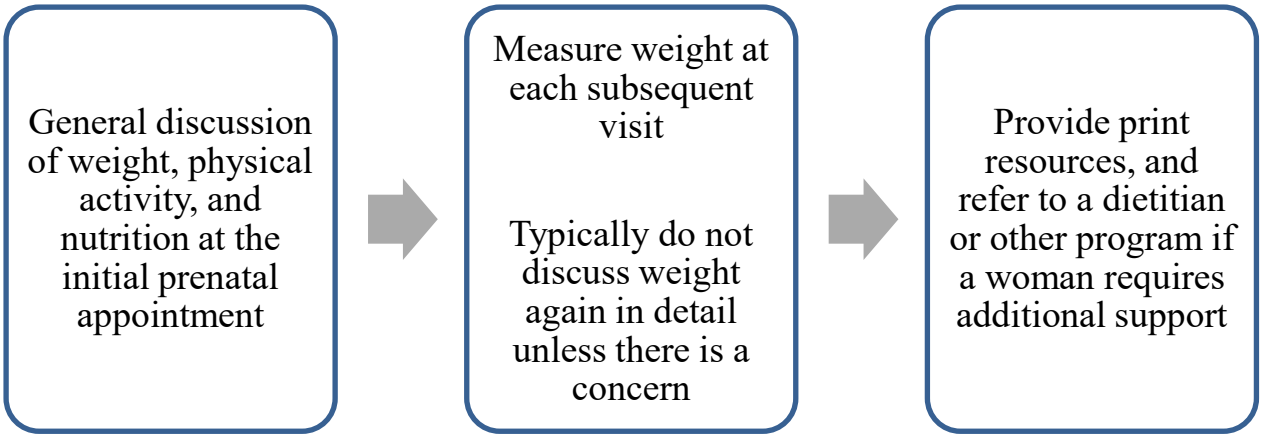

Figure 6.1. Model of typical gestational weight gain assessment and counselling practices.

Differences in gestational weight gain counselling practices by health care provider discipline

One of the objectives of this thesis project was to compare the GWG counselling practices of general practitioners, obstetricians, midwives, nurse practitioners and registered nurses in

primary care. A key and novel finding of this study was the differences in the practices of midwives as compared to the other health care provider disciplines. Midwives reported discussing physical activity and nutrition more frequently and more in depth than other disciplines of health care providers, and reported measuring weight less frequently than other disciplines. The only Canadian study reporting the weight measurement practices of prenatal health care providers did not compare responses by health care provider discipline (Lutsiv et al., 2012). Studies of GWG counselling conducted in Ontario have reported that patients of midwives are more likely to recall having discussed physical activity with their health care provider as compared to patients of general practitioners and obstetricians, and midwives themselves report providing physical activity counselling to women more frequently than other disciplines (Ferraro et al., 2013; Lutsiv et al., 2012; McDonald et al., 2012). Furthermore, in a retrospective chart review of 300 women who had recently given birth, patients under exclusive midwifery care had physical activity checked off on their charts as a discussion topic more frequently than patients under general practitioner or obstetrician care, which suggests that midwives more frequently discuss this topic (McDonald et al., 2014). The difference between midwives' practices and other health care provider disciplines in regard to nutrition counselling are not as well documented in the Canadian literature. In McDonald et al's (2012) comparison of the perceptions of Ontario women of the GWG counselling they received, there were no significant differences between patients of midwives recall of discussing appropriate extra caloric requirements with their health care provider as compared to patients of general practitioners, obstetricians, or a combined group of patients of nurse practitioners and registered nurses. Ferraro et al's (2013) survey of health care providers found that midwives more frequently reported counselling on nutrition as compared to obstetricians and registered nurses, but did not differ from general practitioners (96.9% of midwives reporting counselling compared to 96.6% of general practitioners). While these studies provide important information, they did not capture the frequency of undertaking these activities with pregnant women. This thesis project gathered more detail as to the proportion of pregnant patients that health care providers provided counselling on physical activity and appropriate extra food requirements. While general practitioners, obstetricians, nurse practitioners and registered nurses reported providing physical activity and nutrition counselling to pregnant women in other studies, they may not do this with *all* of their pregnant patients. Furthermore, the qualitative data from this thesis

indicated that midwives undertook physical activity and nutrition counselling in more depth than other disciplines, which is also not captured in the other Canadian studies. The reasons behind the differences in the practices of midwives as compared to other disciplines is related to the priority level they placed on GWG, as well as the midwifery approach to prenatal care; this is discussed further in section 6.1.6.

The weight assessment practices of midwives differed from the recommended practices from IOM; however, further research is needed to determine if this of concern. As there is little evidence in the literature to suggest what the most effective counselling practices for health care providers are to promote optimal GWG, it remains to be determined whether the combination of less frequent weight assessment and more frequent and detailed physical activity and nutrition discussions are more beneficial than more frequent weighing. Regular weight monitoring by health care providers during pregnancy is not recommended in the UK or Australia due to the lack of evidence of clinical benefit, and potential for psychological harm (Australian Government Department of Health, 2013; National Institute of Health and Clinical Excellence, 2010). A study by Brownfoot et al (2016) randomized women (n=614) in Melbourne, Australia to weight measurement at each antenatal visit or routine care, and calculated the mean difference in weight gain per week between the intervention and control groups. The authors found no significant differences between groups. However, this study would have benefited from a process evaluation component, as there was a variety of frequencies of weight measurement in both the intervention and control group; for example, 12% of women in the intervention group were weighed only twice over the course of pregnancy, which was the same as 96% of the control group. The authors also used weight at the baseline visit (median=18 weeks gestation) to calculate pre-pregnancy BMI and determine the appropriate rate and total weight gain according to IOM guidelines, which is likely to overestimate pre-pregnancy BMI, and therefore incorrectly lower the weight gain targets for women. While more remains to be explored regarding regular weight measurement in pregnancy, physical activity and dietary counselling interventions have been shown to reduce excessive GWG (Muktabhant et al., 2015). This suggests that the midwifery approach may hold promise in reducing excess GWG. However, while weight monitoring on its own may not be effective, weight monitoring combined with feedback from a health care provider may have more potential. Some randomized clinical trials of various sizes

(ranging from n=100 to n=401) have used this approach as one component of a lifestyle intervention, and have found significant reductions in GWG; however, they cannot be directly compared as they included a variety of different approaches to behaviour change incorporated in their study designs (Asbee et al., 2009; Huang, Yeh, & Tsai, 2011; Phelan et al., 2014). Although there is heterogeneity in the study designs, a common feature is the feedback for women on the appropriateness of their weight gain as compared to the IOM guidelines by a health care provider. While this is not enough to conclude that feedback is an essential component of an intervention to promote appropriate GWG, it shows that it has been incorporated in successful interventions. In this thesis, routine measurement of weight was much more common than routinely relaying the information back to women. Further research into the most effective approach to assessing GWG in the context of promoting weight gain within the guidelines is warranted.

6.1.2 Research objective 2: Adequacy of knowledge in gestational weight gain, physical activity and nutrition, and related practice guidelines

Overall, most general practitioners, obstetricians, midwives, nurse practitioners and registered nurses in primary care reported that they had appropriate general knowledge to recommend guideline-concordant GWG (78%), physical activity (56%), and healthy eating (71%). However, fewer reported that they had detailed knowledge in GWG guidelines (53%), physical activity guidelines (50%), and nutrition guidelines (40%). In particular, only 28% of health care providers reported that they had detailed knowledge about the Physical Activity Readiness Medical Examination for Pregnancy. This is similar to another smaller survey of members of SOGC (n=195), which identified that 57.5% of respondents were unaware of this tool (Schmidt et al., 2016). In the same survey, 55.5% of respondents reported using the Joint SOGC and Canadian Society for Exercise Physiology guidelines for exercise in pregnancy, which is slightly higher than the 40% in this thesis project who were confident in the extent of their knowledge in these guidelines. It is possible that Schmidt et al's (2016) sample had a particular interest in exercise and therefore were better informed of the guidelines, as exercise was the focus of that survey; as well, the survey had a modest response rate at 15.2%.

Beyond knowledge of practice guidelines related to GWG, this thesis project identified need for detailed knowledge to enable health care providers to provide specific examples so that women could meet extra food requirements, and other topics such as maternal obesity and caloric requirements. This is the first Canadian study to show that health care providers feel they have adequate general knowledge, but many lack detailed knowledge in order to support GWG counselling. Ferraro et al's (2013) survey of Canadian health care providers also found that the majority reported that they had adequate knowledge in GWG (97%), physical activity (82%), and nutrition (86%), and in addition, they provided GWG advice to obese pregnant women that was at or below the IOM/Health Canada guidelines. However, Ferraro et al's survey did not examine detailed knowledge in physical activity and nutrition guidelines for pregnancy, nor did it present detailed results for knowledge in GWG guidelines for other pre-pregnancy BMI categories. Therefore, this thesis adds valuable information in the area of the importance of health care providers having detailed knowledge to support this area of practice.

6.1.3 Research objective 3: Access to information resources and programs for referral related to gestational weight gain

Health care providers' access to appropriate information resources to support recommending guideline-concordant GWG, physical activity, and nutrition was closely related to adequacy of knowledge in these areas according to the survey data. The qualitative findings suggest more of a need for information resources. However, it should be noted that survey respondents chose "agree" over "strongly agree" much more frequently; 36-57% agreed to these three questions, while 9-14% strongly agreed. This may indicate that there was not total satisfaction with the current availability of information resources. The areas which could benefit from further resources as identified in the qualitative data included GWG-specific information resources, especially for maternal obesity, as well as worksheets, web-based resources, and Smartphone applications (Apps). There is little in the Canadian literature to examine the needs of health care providers in regards to patient resources to support appropriate GWG. Lutsiv et al's (2012) survey of 42 health care providers in Ontario found that over three-quarters of health care providers sought a tool, in the form of a handout or a website that would calculate a woman's weekly rate of weight gain as well as her total weight gain. Other international studies have found that health care providers reported a lack of access to written or online patient resources in

relation to GWG, maternal obesity, nutrition, and physical activity (Lucas, Charlton, & Yeatman, 2014; Macleod et al., 2013; van der Pligt et al., 2011). In this thesis, there was also a noted lack of awareness of current resources that are available, which may partially explain the relationship with appropriate knowledge and resources.

Generally, there was less agreement that there were appropriate programs for referral available to promote optimal nutrition in pregnancy as compared to appropriate information resources. Obstetricians reported having access to appropriate programs for referral to promote healthy nutrition during pregnancy less frequently than did general practitioners, registered nurses in primary care and nurse practitioners. Several obstetricians in the qualitative interviews noted a lack of access to a dietitian, while the ones who did have access to a dietitian worked at the same tertiary care centre with an innovative model focussed on interdisciplinary practice. Obstetricians may lack access to a dietitian or other allied health care providers as compared to general practitioners, as there are a number of provinces that have moved towards interdisciplinary team-based primary care centered around general practitioners, such as Primary Care Networks in Alberta, or Family Health Teams in Ontario (Alberta Health, 2016; Ontario Ministry of Health and Long-term Care, 2016). For those with access to dietitian services, there were still barriers to appropriate care. A generally cited barrier to accessing dietitian services was the long wait times, which has been found in several qualitative studies from Australia and New Zealand (Fieldwick et al., 2014; Schmied et al., 2011; van der Pligt et al., 2011).

6.1.4 Research objective 4: Perceptions of gestational weight gain as a priority in a typical prenatal visit

While many health care providers responding to the survey reported that GWG was a high priority in a typical prenatal visit, it is important to note that more “agreed” than “strongly agreed”. This was reflected in the qualitative interviews, as health care providers reported that GWG was important, but may receive a lower priority than other topics. The lower priority given to GWG was due to individual and system level barriers; in particular, the amount of time available in a typical appointment, which in turn was related to financial compensation for health care providers. General practitioners and obstetricians were typically compensated by a fee-for-service model, where the amount of compensation that the health care provider receives is based

on a fee schedule. This model of care compensates a physician for each "unit" of care provided, e.g. writing a prescription or a conducting a physical exam (McDowell, 2015). The fee schedule is set by the provincial government, and outlines how much the physician will be compensated for each "unit" provided to patients. Although not the majority, there was a substantial proportion of general practitioners (36%) and obstetricians (48%) who said the fee schedule was not appropriate for the workload of a prenatal visit. Comparatively, 95% of family medicine residents in an Ontario survey said the remuneration for obstetric care was inadequate; however, the majority of those surveyed were not planning to practice maternity care, which may explain the discrepancy between that number and the one found in this thesis (Godwin, Hodgetts, Seguin, & MacDonald, 2002).

In the survey data, midwives had significantly lower scores for the priority level placed on discussing, assessing, and assisting women with GWG as compared to general practitioners and nurse practitioners (a composite score of 3.59 on a scale of 1=lowest to 5=highest, as compared to 4.09 and 4.25, respectively). In particular, midwives placed a lower priority on assessing women's weight regularly. This is congruent with midwives' reported practices, as they less frequently reported routinely assessing the GWG of their patients as compared to other health care disciplines. From the qualitative data, the lower priority level placed on GWG appeared to be related to the midwifery approach. Kennedy (2000) compares the midwifery model to usual medical care, and describes midwifery as being focussed on the "normalcy" of birth. While the medical model of care is based on screening, diagnosis, and treatment of complications, midwifery supports a low medical intervention approach, focussing on time, encouragement and support for women and their families (Kennedy, 2000). The significance of the reduced priority level placed on GWG is that it influences GWG counselling practices, which is discussed in section 6.1.6.

6.1.5 Research objective 5: Perceptions of health care providers' roles in gestational weight gain counselling

The integrated data indicated that health care providers considered GWG counselling as part of their role; in particular, discussing and assessing GWG. However, health care providers also reported that other health care disciplines could or already do play a role. In particular, dietitians

were frequently cited in both the qualitative and quantitative data as having an important role in assisting women to achieve guideline-concordant weight gain, as they had more time and expertise in nutrition than other health care providers, and could aid women in setting lifestyle goals. Several lifestyle intervention studies aiming to limit excessive GWG have compared individual counselling by a dietitian with the provision of a healthy eating and/or physical activity print resource (Di Carlo et al., 2014; Hui et al., 2012). Hui et al (2011) recruited 190 healthy pregnant women in Winnipeg, and randomized them to either the intervention group which included two individual visits with a dietitian and an exercise program (a weekly group exercise session plus additional recommended exercise), or the control group who received usual care plus a package of physical activity and nutrition handouts from Health Canada. The proportion of women in the intervention group who gained weight in excess of the IOM/Health Canada guidelines was significantly lower than the control group (35% vs 55%, $p=0.008$). Di Carlo et al (2014) conducted a similar intervention, with women randomized to the intervention group with monthly visits with the dietitian, and the control group who received a nutrition handout. There was no exercise component to this study. Although the authors did not compare the total weight gain of participants to the IOM guidelines, they found lower GWG in the intervention group (an average weight gain of 8.2 kg in the intervention group vs 13.4 kg in the control group, $p<0.001$). Although Di Carlo's study, which was conducted in Italy, did not use the IOM guidelines to frame whether weight gain was appropriate or not, the study shows the effectiveness of individualized counselling by a dietitian in managing GWG. It appears that enhanced access to dietitian services for pregnant women is both desired by health care providers, and potentially effective in reducing excessive GWG among some women.

Despite the acknowledgement of the importance of multiple health care providers on a team, a key finding from the qualitative data was the lack of knowledge of the role that each health care provider plays on a multidisciplinary team, and the need for consistency with messaging from all members of the team. While interview participants viewed multidisciplinary teams as a facilitator to promoting appropriate GWG, role delineation was an area for improvement. This has also been found in a qualitative study conducted in Alberta in a non-pregnant weight management setting (Asselin, Osunlana, Ogunleye, Sharma, & Campbell-Scherer, 2016). In Asselin et al's study, health care providers in Primary Care Networks noted a lack of face-to-face

discussion and collaboration between team members, and lack of knowledge of the roles of other members of the health care team. Another common concern was inconsistent messaging between team members, which the health care providers perceived to cause reduced interest or confidence on the part of the patient. The authors suggested that interdisciplinary collaboration has great potential to address the complex nature of weight management, but it is not as simple as placing different disciplines of health care providers within the same clinic; communication, collaboration and role delineation is needed.

6.1.6 Research objective 6: Influences on gestational weight gain counselling practices

Priority level of gestational weight gain

Quantitative regression identified that the priority level placed on GWG had the greatest influence on the frequency of undertaking gestational counselling practices while controlling for professional characteristics and other potential covariates. However, the qualitative data indicated that the priority level that health care providers place on GWG is related to other factors, including time and compensation, resources, knowledge, and the midwifery versus medical model of care.

The system level barriers of time and compensation, were large influences on practice cited by all health care provider disciplines. Surprisingly, while interview participants saw a change in the fee schedule as a potential way to increase the amount of time available to provide GWG counselling, only 23% of general practitioners and 10% of obstetricians indicated this would increase the likelihood of discussing, assessing and assisting women with GWG. This is in contrast to the qualitative data, which indicated that health care providers that were compensated in this manner perceived that a change in the fee schedule would increase counselling. In Lutsiv et al's (2012) survey of 42 health care providers in Ontario, 46% said they would be better able to provide GWG counselling if they had more time. Studies from other countries have also found the lack of time to be a barrier; in particular, the first prenatal appointment contains a large amount of information to be shared, which was also identified in this thesis project (Macleod et al., 2013; Olander et al., 2011). Despite the mention of time as barrier to GWG counselling in the literature, compensation has not been well explored as an influence on the time available in a typical appointment. It appears from the integrated data in this thesis that a change in the fee

schedule would help some health care providers increase the amount of time available for GWG counselling, but this is not the most important barrier to counselling for most health care providers. This thesis contributes valuable information on the influence of compensation methods on the time available in an appointment as a barrier to providing GWG counselling.

The qualitative findings also suggested a link between some health care providers' knowledge and their priority level for GWG counselling, such that a lack of knowledge of the risks of inappropriate weight gain resulted in a lower priority placed on the topic. Interestingly, in a secondary analysis of the open-ended questions included in the survey, 24% of the 90 open-ended responses indicated that more knowledge, and more evidence of the effectiveness of GWG counselling would increase the priority level placed on GWG. Furthermore, 20% indicated that the priority level would only increase if the patient had a concerning medical status, also indicating a lack of knowledge of the risks of inappropriate GWG. Comparatively, in Lutsiv et al's (2012) survey, the vast majority of health care providers understood that there are risks of inappropriate weight gain to mother and baby; however, this survey did not ask health care providers what they perceived the risks to be, thus their response may not be indicative of detailed knowledge of the topic.

General and detailed knowledge

Knowledge had both a direct influence on GWG counselling practices as identified in quantitative regression, as well as an indirect relationship through an association with the priority level health care providers place on GWG as identified in the qualitative data. Interestingly, although health care providers perceived their general knowledge in GWG, physical activity, and nutrition as appropriate, the majority of registered nurses in primary care and nurse practitioners reported that an increase in their knowledge of consequences of inappropriate gestational weight was a means to increase the likelihood of them providing GWG counselling. This is comparable to Lutsiv et al's (2012) survey of health care providers in Ontario, which found that 49% of respondents felt they would be better able to counsel patients on GWG if they had more knowledge. In contrast, an increase in knowledge was less frequently cited as a means to increase GWG counselling by other disciplines in this thesis (~25% of general practitioners and obstetricians). Notably, general practitioners in the qualitative interviews did not desire

increased knowledge; rather, they preferred to access their multidisciplinary team when women's concerns were beyond their expertise. General practitioners who provide care across the life-course may benefit more from supports, rather than an increase in detailed knowledge in an area that they may not practice in often. Quantitative results also showed that knowledge, in particular detailed knowledge of GWG, physical activity, and nutrition guidelines, had a significant influence on the practices of providing weight gain advice and discussing risks of inappropriate weight gain, and in discussing physical activity and nutrition. Perceived appropriate general knowledge only significantly predicted discussing physical activity and nutrition. This may be because detailed knowledge of practice guidelines is required to provide individualized GWG targets to women, while discussions of physical activity and nutrition have been reported to be based more on general knowledge gathered from health care providers' personal experience, rather than credible sources (Haruna et al., 2010; Heslehurst et al., 2013; Stotland et al., 2010).

Although the majority of survey respondents reported that they felt they had appropriate information resources to support GWG counselling, the most frequently cited way to increase the likelihood of counselling was having resources to prompt GWG discussions. Although it is not a true "information resource", many general practitioners and obstetricians recommended changes to the antenatal record to prompt the discussion. In the qualitative interviews, lack of information resources specific to GWG were identified as a gap in current support for offering GWG counselling. Although it was acknowledged that there was a lack of awareness of currently available resources, suggesting that a lack of awareness of available resources may be the true gap.

Midwifery versus bmedical approach

Interestingly, even after controlling for professional characteristics (such as being located in an urban or rural setting, or the proportion of patients who are pregnant women) and multiple other covariates such as perceived knowledge and the priority level placed on GWG, being a midwife remained a significant predictor of discussing physical activity and nutrition. Specifically, although midwives reported a lower priority for GWG and this was a significant predictor of practice, there was still a positive association between being a midwife and more frequently

discussing physical activity and nutrition after controlling for priority level they placed on GWG. There is clearly an influence of the midwifery approach on the frequency of discussing physical activity and nutrition.

Sensitivity of discussing weight

Some participants in the qualitative interviews described the sensitivity of discussing weight as a barrier to GWG counselling. However, for some this was a facilitator to physical activity and nutrition counselling, as these topics were addressed instead of directly discussing weight. This area was not addressed in the quantitative data, and has been minimally studied in the Canadian literature. Lutsiv et al's (2012) Ontario survey of health care providers found that one-fifth would avoid weighing women or discussing weight due to the perceived sensitivity of the topic. International qualitative studies have found that health care providers avoid weighing women too frequently, or discussing weight too often, as there is a concern that this will cause distress or embarrassment for women (Fieldwick et al., 2014; Haruna et al., 2010; Olander et al., 2011; Stotland et al., 2010; Willcox et al., 2012).

Model of influences on gestational weight gain counselling practices

Figure 6.2 shows a model demonstrating the influences on GWG counselling practices found in the integration of qualitative and quantitative data in this thesis. The counselling practices of providing weight gain advice and discussing risks, and discussing physical activity and nutrition are presented in the starred shapes at the bottom of the figure. Individual level influences are located in the inner ring. Priority level appeared to be related to several individual level factors as identified in the qualitative data, such as considering GWG counselling within one's role, knowledge, and time in a typical appointment. As considering GWG counselling within one's role was only associated with the frequency of GWG counselling in the qualitative data, it is depicted with a dashed line. Knowledge contributed directly to the frequency of providing weight gain advice and discussing risks, as well as discussing physical activity and nutrition counselling while controlling for priority level as per the regression model. Knowledge also appears to be related to the priority level of GWG for some health care providers as identified in the qualitative interviews. Detailed knowledge of practice guidelines is an important influence on the frequency of both providing weight gain advice and discussing risks, as well as discussing

physical activity and nutrition counselling. The relationship between compensation method influencing the individual level factors of time in a typical appointment and priority level is shown. Time is depicted as an individual level factor as it is an individual decision by physicians compensated by fee-for-service as to the length of their appointments, as physicians operate independently. However, quite logically, physicians will provide an appointment length that is congruent with their compensation, which is mandated at a system level; in other words, physicians are able to increase the length of their appointment and spend more time on GWG counselling if they so choose, but they would not be compensated for it. The sensitivity of discussing weight with pregnant women is noted with dashed lines, as this was not examined in the survey questions. System level influences on practices are located in the outer ring. The midwifery or biomedical approach to care is shown for its relationship with priority level as identified in the qualitative data, as well as its influence on practices as identified in the quantitative data. Print and web resources were identified in the integrated data as a support that may increase the likelihood of GWG counselling. The effect of a multidisciplinary team on health care providers' perception of their role in GWG counselling is depicted with a dashed line, as it was only identified in the qualitative data. Finally, professional characteristics such as stage of pregnancy at first visit and proportion of patients who are pregnant are shown for their influence on practices, as identified in the quantitative data.

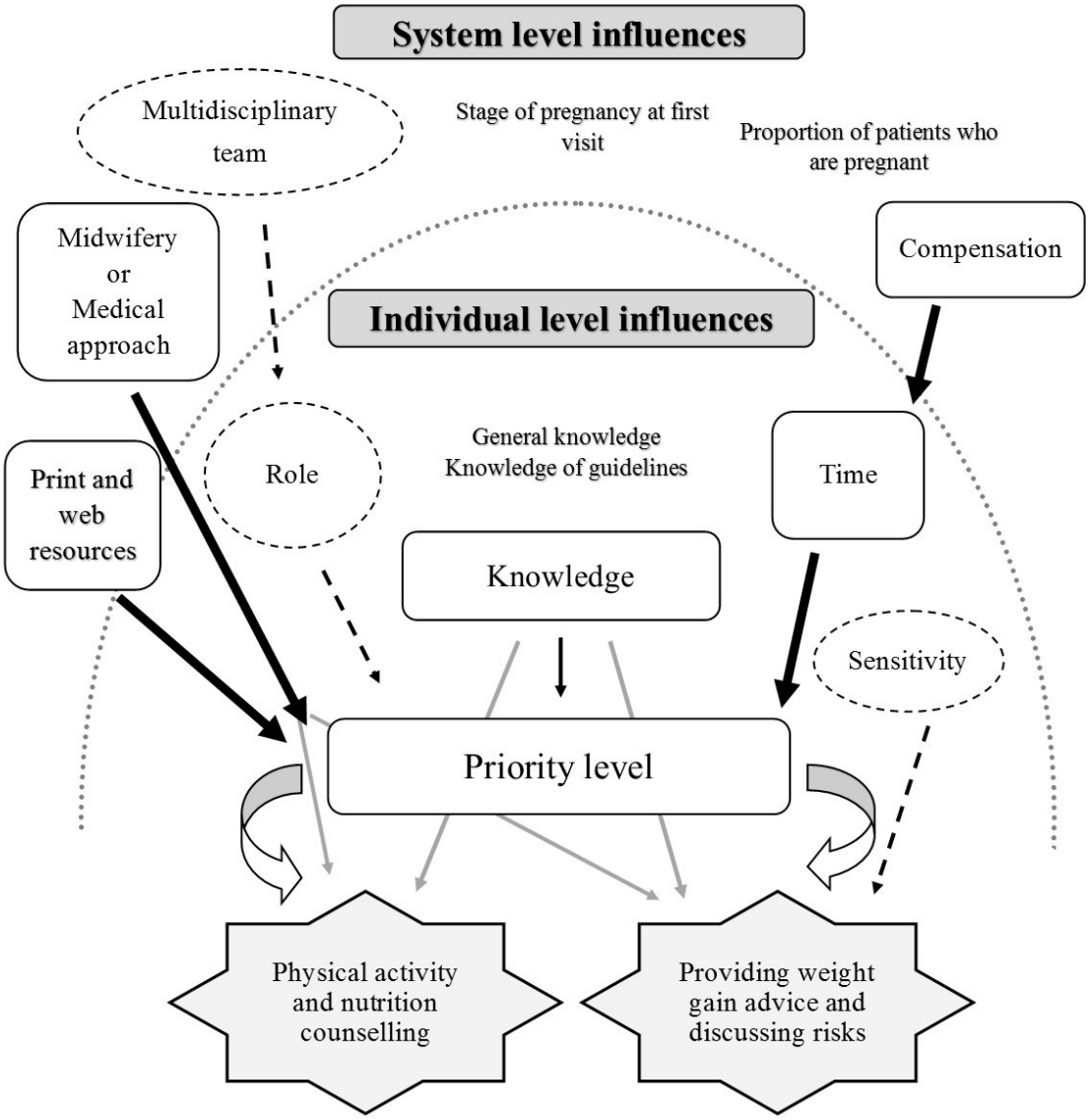

Figure 6.2. Model of influences on gestational weight gain counselling practices.

6.2 Recommendations for the development of interventions for health care providers

6.2.1 The Theoretical Domains Framework

The Theoretical Domains Framework (TDF) is an integrative framework developed from a synthesis of psychological theories as a vehicle to help apply theoretical approaches to interventions aimed at behaviour change, in particular for clinical practice change for health care

providers (Cane et al., 2012). The domains of the TDF are: knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, memory, attention and decision processes, environmental context and resources, social influences, emotion, and behavioural regulation. The TDF has been used in a variety of health care settings to implement evidence-based practices (French et al., 2012). Interventions are more likely to be successful if they are theoretically based, as they are more likely to address causal determinants of behaviour (Michie, Johnson, Francis, Hardeman, & Eccles, 2008). However, Michie et al (2008) notes that theory is more often used to understand behaviours than it is for the development of interventions. French et al (2012) recommend a four step approach for developing a theory-based intervention for clinical practice change.

The first step is to determine "who needs to do what differently". This study addressed the current practices of various health care provider disciplines, which is critical in determining what practices need to change, and which health care provider disciplines will need to make changes. However, the evidence is less strong when it comes to which exact practices are important for health care providers to adopt. A study by Cogswell et al (1999) is frequently cited to support the suggestion that health care providers' advice about GWG influences actual GWG. However, this study was conducted prior to the release of the revised 2009 IOM guidelines. This is important, as the revisions to the guidelines resulted in more women being classified as overweight or obese, which meant a lower total weight gain target that may be more difficult to achieve (Rasmussen, Catalano, & Yaktine, 2009). More recent studies have found that while the provision of weight gain advice by a health care provider has been associated with women's personal goals for their own GWG, advice from a health care provider has not been associated with achieving GWG within the guidelines (Arinze et al., 2015; Ferrari & Siega-Riz, 2013; Tovar et al., 2011). The content and depth of the counselling interaction regarding GWG is not examined in these studies; as such, it is difficult to say whether the counselling is of sufficient quality to result in appropriate GWG for women. One aspect of the quality of the interactions that has been studied is the congruency of health care provider advice with IOM guidelines, and several studies have linked guideline-incongruent advice from health care providers, as recalled by women, with inadequate or excessive GWG (Brawarsky et al., 2005; Liu et al., 2016). For

example, in Liu et al's (2016) survey of a stratified random sample of 3,402 postpartum women in Los Angeles County, women who recalled GWG advice greater than the IOM guidelines had twice the odds of gaining weight in excess of the guidelines as compared to women recalling correct advice (95% Confidence Interval 1.4–2.9). As such, it is clear that there is a need for health care providers to provide accurate advice to women, but the other aspects of the counselling interaction, such as whether or not women should be weighed, and the depth of physical activity and nutrition counselling that is provided, need to be evaluated. Further research evaluating the effectiveness of GWG counselling strategies on women's GWG needs to be conducted to form the evidence base for practice.

The next step in developing a theory-informed intervention is identifying barriers and facilitators to practice, which were assessed in this thesis. An intervention is then planned based on key modifiable barriers to practice that were identified in the previous step, and key barriers to practice can be mapped to relevant behaviour change techniques to create a comprehensive intervention (Michie et al., 2008). Lastly, the proposed intervention is then tested in a randomized clinical trial prior to implementation. In the next section, potential interventions that are relevant to the key modifiable barriers and facilitators to GWG counselling identified in this thesis are suggested.

Potential interventions based on the Theoretical Domains Framework

This thesis project was an assessment of individual and system level influences on health care providers' GWG counselling practices. If these results are mapped onto the TDF to determine the domains that may be targeted for an intervention, the key areas would be: environmental context and resources, knowledge, and social/professional role and identity. It is also important to note that an intervention's success is likely to be increased if it is multi-faceted in its approach and outcomes (Grimshaw et al., 2001).

The environmental context and resources that impacted the GWG counselling practices of health care providers included compensation and time available in a typical appointment. Group prenatal care was one method identified and practiced by some of the health care provider interview participants for overcoming this barrier. Group care, such as the "Centering

Pregnancy" program, is a model of prenatal care where a women with similar due dates meet as a group to see their health care provider, as well as discuss prenatal care topics. It should be noted that group care models, such as "Centering Pregnancy", often include women in measuring their own weight and blood pressure. In this thesis, group care enabled health care providers to partner with another health care provider or team of health care providers, which allowed for a greater length of time to be spent on lifestyle-related issues that are pertinent to weight management in pregnancy. A study by Magriples et al (2015) randomly assigned a sample of 984 young, primarily Hispanic and black women to usual or group prenatal care, and examined their weight trajectories over the course of their pregnancy and 12 months postpartum. Although half of all participants gained weight in excess of IOM guidelines with no differences between intervention and control groups, women receiving group prenatal care gained significantly less weight, and retained less weight one year postpartum (Magriples et al., 2015). These findings are particularly interesting when considering best practices for health care providers, as group care is not a focussed weight management intervention; however, nutrition and physical activity are covered as topics during the course of care, women are involved in self-monitoring and recording their weight gain, and women receive more individual time with a health care provider. Similar findings have been reported in retrospective chart review of predominantly black women receiving group care as compared to matched controls (Tanner-Smith, Steinka-Fry, & Gesell, 2014). Tanner-Smith et al (2014) found that those participating in group care had a reduced risk of excessive GWG, and this was of particular benefit for obese women. However, it is not known whether this approach to care would apply to the general population of Canadian pregnant women. Qualitative studies of group care conducted in Alberta have found perceived benefits from the perspectives of both women and physicians, but an evaluation of GWG outcomes has yet to be published (McNeil et al., 2012; McNeil et al., 2013). As health care providers in both the qualitative and quantitative arms of the study identified dietitians as an asset in assisting women with GWG concerns, a dietitian could be incorporated into the group appointment model, or access to a dietitian could be enhanced in the traditional model of care.

Another strategy within the domain of environmental context and resources is to improve or develop new resources. Health care providers in the qualitative interviews suggested that resources such as worksheets, websites, or a Smartphone application could help them to promote

optimal GWG to their patients, and those in the survey suggested that the provincial antenatal care record should be adjusted to include cumulative GWG in order to prompt GWG discussions.

Interventions in the knowledge domain, such as workshops or webinars, could be developed to address the gaps that result in a decreased priority and decreased frequency of counselling for GWG in a typical prenatal visit. Information on the risks of inappropriate GWG appears to be relevant to increase priority level. As well, there may be a knowledge gap that exists in regards to practice guidelines for GWG, physical activity, and nutrition, which also influenced practice.

Lastly, an interesting and novel finding of this study was the differences in practices of midwives, which was linked to both the model of compensation and time available in an appointment, as well as the midwifery approach to care. Further research into the weight gain of women in the care of midwives is warranted. This would need to be compared to healthy controls under biomedical care, as midwives only accept low-risk patients (Alberta Association of Midwives, 2015). Midwifery care has been shown in Alberta to reduce health care system costs, primarily through the provision of out-of-hospital delivery, while providing an increased number and length of appointments as compared to other providers (O'Brien et al., 2010). Patients of midwives may also feel more supported, as another Alberta study found that patients of midwives were less likely to call a telephone nurse hotline or visit the emergency department as compared to patients of other health care providers (Metcalfe, Grabowska, Weller, & Tough, 2013). Thus, there are some key aspects of midwifery care that appear to be supportive for appropriate GWG, and should be further explored.

6.2.3 The 5As of Healthy Pregnancy Weight Gain

The Canadian Obesity Network has developed a set of resources for obesity management in primary care called the 5As for Obesity Management, which has been shown in preliminary evaluations to increase the initiation of obesity management, as well as follow up (Rueda-Clausen et al., 2014). As many of the barriers to obesity management in primary care are similar to those for GWG counselling, a working group of the Canadian Obesity Network has adapted this tool for pregnancy. The 5As of Healthy Pregnancy Weight Gain is intended to promote

discussions of GWG using a patient-centered perspective, and encourage shared goal-setting and long-term follow up.

The 5As of Healthy Pregnancy Weight Gain may assist with several barriers and deficits in practices identified in this thesis. This resource assists with the sensitivity of the topic by recommending that health care providers begin by asking for permission to discuss weight. It also addresses the knowledge gaps of health care providers, by outlining the Health Canada guidelines, and providing a framework for assessing the root causes of inappropriate GWG. Another step in the framework is agreeing on individualized goals that fit the context of the woman, which is currently not well addressed by most health care providers. The resource comes with a checklist for health care providers to act as a prompt for the discussions.

Preliminary evaluations are underway to examine health care providers' initial impressions of the tool, their intentions to implement the tool, as well a randomized clinical trial to determine the effectiveness of the tool. These evaluations will provide important evidence to support the 5As of Healthy Pregnancy Weight Gain for implementation in practice.

6.2.4 Next steps: Contribution to ENRICH

The ENRICH research program aims to develop, implement, and evaluate strategies to promote healthy weights and healthy diets in pregnancy and postpartum. This includes strategies that apply to all pregnant women in Alberta, such as interventions to enhance GWG counselling in primary care settings. This study contributes to the knowledge base needed for the development of appropriate strategies for the ENRICH program to implement and evaluate. ENRICH will consider this study, as well as other studies such as the evaluation of the 5As of Healthy Pregnancy Weight Gain, to develop strategies to achieve its objectives.

6.3 Strengths and limitations

The use of mixed methods in this study allowed for an in-depth exploration of the research questions, and the findings from each arm of the study were verified against each other. With a total number of 508 respondents, this is the largest national survey to date to examine the GWG counselling practices of health care providers, as previous surveys have gathered less than 200

responses (Ferraro et al., 2013; Lutsiv et al., 2012). It is currently the only Canadian study to examine the influences on GWG counselling practices. It also contributes to a gap in qualitative literature on the views of Canadian prenatal health care providers in regards to their GWG counselling practices. The collection of qualitative and quantitative data concurrently is a strength, as it is considered to be optimal for integration purposes, rather than have a sequential design where one method informs the other (Castro et al., 2010).

The use of semi-structured telephone interviews allowed for the rapid collection of data from a wide range of health care providers in various locations in Alberta and British Columbia. Although less utilized in qualitative research compared to face-to-face interviews, telephone interviews have been shown to provide high quality data, and reduce the barriers of reaching participants in distant locations (Novick, 2008). The limitations of telephone interviews include the loss of visual cues and non-verbal data, and difficulties in developing rapport with the participant (Novick, 2008). However, this anonymity may allow the participant to feel comfortable sharing opinions with the researcher.

It should be noted that the backgrounds and experiences of qualitative researchers play a role in the analysis of the data, and a completely objective and value-free analysis is nearly impossible to achieve (Ellingson, 2011, p.596). While the use of two qualitative researchers in the data analysis process for this thesis reduced the risk of bias as compared to just one researcher, both of the researchers conducting the analysis had a focus on gestational weight gain and nutrition, which meant that the data was analyzed from this particular perspective. This is not necessarily a limitation; rather, an acknowledgement of the perspectives of the researchers that shaped the analysis.

A limitation of the qualitative methods of this study was the sample of only participants from Alberta and British Columbia, rather than a national sample. This was a result of a partnership with Perinatal Services BC, an agency of the Provincial Health Services Authority, who were gathering information on the same topic as this thesis in order to inform their own programming. Although the findings from the qualitative methods in this thesis may differ from other areas in Canada, they are applicable to Alberta, which is important for the contribution of this thesis to

the ENRICH research program. However, the qualitative sample differs from the quantitative sample. Furthermore, they may have different practices than the quantitative sample, as the quantitative online survey required less time commitment on the part of the respondent, and therefore the survey respondents may be less engaged in the research topic than the qualitative participants.

A strength of the quantitative survey design is the wide reach of online survey distribution, which enabled representation of health care providers across the country in diverse urban and rural settings, as well as a large sample size enabling more sophisticated statistical analysis. Additionally, the use of secure online software allowed for direct export of coded data into statistical software, thus eliminating human data entry errors.

A limitation of the survey is the self-selected convenience sample. Due to recent privacy legislation that requires consent from individuals before distributing electronic communication to them (commonly referred to as "anti-spam" legislation), distributing this survey in partnership with professional organizations allowed for a wider reach, and thus a larger sample size. A limitation of this method is the inability to calculate a response rate, as it is unclear how many of the target population were reached. Due to this, non-response bias cannot be assessed, but is likely present. Sampling bias may also be present; not all health care providers who are part of the target population had an equal chance of being included in the sample, as it was reliant upon the organizations agreeing to assist with distribution. Thus, some areas of the country or certain health care provider disciplines may be under or over represented. As this was a self-administered survey, it is also possible that this survey reached respondents who were not part of the target population. As a screening measure, the question "Do you see pregnant women in your practice?" was added as the first page of the survey, and the software would only allow respondents who answered "Yes" to complete the survey.

Another limitation of this study was that it was only available in English. Bilingual recruitment messages were utilized; however, the survey itself was only available in English. This likely led to underrepresentation from Quebec and other Francophone areas of the country.

Some of the survey questions did not meet the recommended test-retest reliability measures. For the purposes of this thesis, these questions were not removed from the analysis. Test-retest reliability assesses the stability of responses over a set time period; the greater awareness of the subject area after the first completion of the questionnaire may have led to some changes in the responses at the second time point. As well, only a small number of participants completed both time points of the reliability assessment, which reduces the strength of this assessment. The results of the assessment should be interpreted with caution.

There is controversy in the literature regarding the use of parametric statistical tests with ordinal data (e.g. Likert-type scales). However, parametric tests have been shown to be robust against violations of assumptions, and are argued to be useful in the analysis of ordinal data (Norman, 2010). The responses outlined in Table 3.2 are not equally spaced intervals, thus the interpretation of parametric test results are done with caution.

The percentage of missing responses to survey questions relating to appropriate knowledge and information resources to recommend guideline concordant GWG was higher than the other questions on the survey (13-14% as compared to <5% for the majority of other questions). This is likely due to fatigue, as these questions were positioned later in the survey, and thus likely have a lower response rate due to respondents abandoning the survey before completion. However, all survey questions were optional, so it is possible that respondents chose not to answer this series of questions, which may have exposed the results to additional bias.

6.4 Conclusion

The GWG counselling practices of health care providers in this sample were not congruent with Health Canada recommendations, and may require enhancement in order to promote appropriate GWG for all women. While health care providers discussed GWG in some capacity, this was not a routine practice offered to every pregnant patient. Health care providers typically did not provide women with individualized weight gain advice or discuss the risks of inappropriate weight gain. More discussed physical activity and nutrition, but this discussion lacked depth and individualized advice.

While most health care providers felt their general knowledge in GWG, physical activity, and nutrition was adequate, fewer reported feeling that they possessed detailed knowledge of related practice guidelines. Some health care providers desired increased knowledge in areas such as maternal obesity, detailed nutrition information, or the risks of inappropriate GWG. However, others suggested that the availability of referrals to other health care providers, or having resources to support them in these areas, was preferred. Generally, health care providers felt they had access to appropriate information resources, but areas for improvement included specific print or online resources for GWG or maternal obesity. Fewer health care providers felt they had appropriate and timely access to dietitian services.

The majority of health care providers considered GWG counselling as being within their role, but they also suggested a role for dietitians when it comes to assisting women to achieve healthy GWG. Working on multidisciplinary teams did not have a large influence on counselling practices, but were seen to be positive when it came to promoting appropriate GWG.

The priority level that health care providers place on GWG was the most significant predictor of counselling practices, and was related to other factors. The compensation method of the health care provider influenced the amount of time available in a prenatal appointment, which then was related to the priority level that GWG received. Another important influence on practices included detailed knowledge of practice guidelines for GWG, physical activity, and nutrition. Lastly, the midwifery approach was related to priority level, as midwives reported a decreased emphasis on GWG (particularly weight assessment), and increased emphasis on physical activity, nutrition, and overall wellbeing.

This assessment of current practices and the influences on practices can be used for the development of theory-informed interventions. The first step in this process is to ensure that there is a solid evidence base for recommended practices, which is currently being undertaken in the ENRICH research program. Interventions should take into account the priority level of GWG of health care providers and the factors related to this. Potential strategies include individual level interventions to increase the knowledge of health care providers, development of GWG specific resources or an increased awareness of current resources, and system level

interventions to increase group care delivery to pregnant women. Implementation and evaluation of these strategies will help promote the appropriate GWG and ultimately the health of all mothers and their babies in Alberta.

References

Adamo, K. B., Ferraro, Z. M., & Brett, K. E. (2012). Can we modify the intrauterine environment to halt the intergenerational cycle of obesity?. *International Journal of Environmental Research & Public Health [Electronic Resource], 9*(4), 1263-1307. doi:http://dx.doi.org/10.3390/ijerph9041263

Alberta Association of Midwives. (2015). What is a midwife? Retrieved from https://www.abmidwives.ca/what-is-a-midwife/

Alberta Health. (2016). Primary care networks. Retrieved from http://www.health.alberta.ca/services/primary-care-networks.html

Althuizen, E., van Poppel, M. N., Seidell, J.,C., & van Mechelen, W. (2009). Correlates of absolute and excessive weight gain during pregnancy. *Journal of Women's Health, 18*(10), 1559-1566. doi:http://dx.doi.org/10.1089/jwh.2008.1275

Altman, D. G. (1991). *Practical statistics for medical research* London ; New York : Chapman and Hall, 1991; 1st ed. Retrieved from http://login.ezproxy.library.ualberta.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cat03710a&AN=alb.822580&site=eds-live&scope=site

American Academy of Pediatrics, & American College of Obstetricians and Gynecologists. (2007). Antepartum care. *Guidelines for perinatal care* (6th ed., pp. 83). Elk Grove Village, IL: American Academy of Pediatrics.

Arinze, N. V., Karp, S. M., & Gesell, S. B. (2015). Evaluating provider advice and women's beliefs on total weight gain during pregnancy. *Journal of Immigrant and Minority Health*, 1-5. doi:10.1007/s10903-015-0162-8

Asbee, S. M., Jenkins, T. R., Butler, J. R., White, J., Elliot, M., & Rutledge, A. (2009). Preventing excessive weight gain during pregnancy through dietary and lifestyle counseling: A randomized controlled trial. *Obstetrics & Gynecology, 113*(2), 305-312. doi:10.1097/AOG.0b013e318195baef

Asselin, J., Osunlana, A. M., Ogunleye, A. A., Sharma, A. M., & Campbell-Scherer, D. (2016). Challenges in interdisciplinary weight management in primary care: Lessons learned from the 5As team study. *Clinical Obesity, 6*(2), 124-132.

Australian Government Department of Health. (2013). Clinical practice guidelines antenatal care: 7.2 weight and body mass index. Retrieved from http://www.health.gov.au/internet/publications/publishing.nsf/Content/clinical-practice-guidelines-ac-mod1~part-b~clinical-assessments+~weight-bmi

Barker, M., Baird, J., Lawrence, W., Jarman, M., Black, C., Barnard, K., . . . Cooper, C. (2011). The southampton initiative for health: A complex intervention to improve the diets and increase the physical activity levels of women from disadvantaged communities. *Journal of Health Psychology, 16*(1), 178-191.

Begum, F., Colman, I., McCargar, L. J., & Bell, R. C. (2012). Gestational weight gain and early postpartum weight retention in a prospective cohort of Alberta women. *Journal of Obstetrics & Gynaecology Canada: JOGC, 34*(7), 637-647.

Boothe-LaRoche, A., Belay, B., & Sharma, A. J. (2014). Pregnancy and postpartum related weight counseling practices of U.S. obstetrician-gynecologists: Results from the Doc Styles survey, 2010. *Journal of Womens Health Care, 3*(208) doi:http://doi.org/10.4172/2167-0420.100020

Bowling, A. (2014). *Research methods in health : Investigating health and health services* Milton Keynes : Open University Press, 2014.

Brawarsky, P., Stotland, N. E., Jackson, R. A., Fuentes-Afflick, E., Escobar, G. J., Rubashkin, N., & Haas, J. S. (2005). Pre-pregnancy and pregnancy-related factors and the risk of excessive or inadequate gestational weight gain. *International Journal of Gynaecology & Obstetrics, 91*(2), 125-131.

Brown, A., & Avery, A. (2012). Healthy weight management during pregnancy: What advice and information is being provided. *Journal of Human Nutrition & Dietetics, 25*(4), 378-387. doi:http://dx.doi.org/10.1111/j.1365-277X.2012.01231.x

Brownfoot, F. C., Davey, M., Kornman, L., & Brownfoot, F. C. (2016). Routine weighing to reduce excessive antenatal weight gain: A randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology, 123*(2), 254-261. doi:10.1111/1471-0528.13735

Burns, K., Duffett, M., Kho, M. E., Meade, M. O., Adhikari, N., Sinuff, T., & Cook, D. J. (2008). A guide for the design and conduct of self-administered surveys of clinicians. *Canadian Medical Association Journal*, 179(3), 245-252.

Canadian Association of Midwives. (2016a). Midwifery in canada - provinces/territories. Retrieved from http://www.canadianmidwives.org/province/.html

Canadian Association of Midwives. (2016b). Midwifery practice - what is a midwife? Retrieved from http://www.canadianmidwives.org/what-is-a-midwife.html

Canadian Family Practice Nurses Association. (2016). Sample role description for registered nurses in family practice. Retrieved from https://nurseone.ca/~/media/nurseone/files/en/sample_role_description_e.pdf?la=en

Canadian Institute of Health Information. (2004). Giving birth in canada: Providers of maternity and infant care. Retrieved from https://secure.cihi.ca/free_products/GBC2004_report_ENG.pdf

Canadian Nurses Association. (2016a). Becoming an RN: Education. Retrieved from https://www.cna-aiic.ca/en/becoming-an-rn/education

Canadian Nurses Association. (2016b). Nurse practitioners and clinical nurse specialists. Retrieved from https://www.cna-aiic.ca/en/professional-development/nurse-practitioners-and-clinical-specialists

Canadian Society for Exercise Physiology. (2013). PARMed-X for pregnancy: Physical activity readiness medical examination. Retrieved from http://www.csep.ca/CMFiles/publications/parq/parmed-xpreg.pdf

Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science, 7*(1), 37-53. doi:10.1186/1748-5908-7-37

Carreno, C. A., Clifton, R. G., Hauth, J. C., Myatt, L., Roberts, J. M., Spong, C. Y., . . . for the Eunice Kennedy Shriver National Institute of Child Health and Human Development MaternalFetal Medicine Units Network. (2012). Excessive early gestational weight gain and risk of gestational diabetes mellitus in nulliparous women. *Obstetrics & Gynecology, 119*(6), 1227-1233. doi:10.1097/AOG.0b013e318256cf1a

Castro, F. G., Kellison, J. G., Boyd, S. J., & Kopak, A. (2010). A methodology for conducting integrative mixed methods research and data analyses. *Journal of Mixed Methods Research, 4*(4), 342-360.

Chang, T., Llanes, M., Gold, K. J., & Fetters, M. D. (2013). Perspectives about and approaches to weight gain in pregnancy: A qualitative study of physicians and nurse midwives. *BMC Pregnancy & Childbirth, 13*, 47. doi:http://dx.doi.org/10.1186/1471-2393-13-47

Cogswell, M. E., Scanlon, K. S., Fein, S. B., & Schieve, L. A. (1999). Medically advised, mother's personal target, and actual weight gain during pregnancy. *Obstetrics & Gynecology, 94*(4), 616-622.

Cohen, T. R., Plourde, H., & Koski, K. G. (2010). Are Canadian women achieving a fit pregnancy? A pilot study. *Canadian Journal of Public Health,* 101(1), 87-91.

College of Family Physicians of Canada. (2009). Family medicine maternity care: Implications for the future. Retrieved from http://www.cfpc.ca/uploadedFiles/Directories/Committees_List/Family%20Medicine%20Maternity%20Care%20Implications%20for%20the%20Future.pdf

College of Family Physicians of Canada. (2016). Why family medicine? Retrieved from http://www.cfpc.ca/Why_Family_Medicine/

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Smith, K. C. (2011). *Best practices for mixed methods research in the health sciences.* Office of Behavioral and Social Sciences Research, National Institutes of Health. Retrieved from: https://www2.jabsom.hawaii.edu/native/docs/tsudocs/Best_Practices_for_Mixed_Methods_Research_Aug2011.pdf

Crozier, S. R., Robinson, S. M., Borland, S. E., Godfrey, K. M., Cooper, C., & Inskip, H. M. (2009). Do women change their health behaviours in pregnancy? Findings from the Southampton Women's Survey. *Paediatric and Perinatal Epidemiology,* 5, 446.

Davies, G. L., Maxwell, C., & McLeod, L. (2010). SOGC clinical practice guideline: Obesity in pregnancy. *Journal of Obstetrics and Gynaecology Canada, 32*(2), 165.

Davies, G. A. L., Wolfe, L. A., Mottola, M. F., & MacKinnon, C. (2003). Joint SOGC/CSEP clinical practice guideline: Exercise in pregnancy and the postpartum period. *Canadian Journal of Applied Physiology, 28*(3), 329-341.

de Jersey, S. J., Nicholson, J. M., Callaway, L. K., & Daniels, L. A. (2013). An observational study of nutrition and physical activity behaviours, knowledge, and advice in pregnancy. *BMC Pregnancy & Childbirth, 13*, 115. doi:http://dx.doi.org/10.1186/1471-2393-13-115

Deierlein, A. L., Siega-Riz, A. M., & Herring, A. (2008). Dietary energy density but not glycemic load is associated with gestational weight gain. *American Journal of Clinical Nutrition, 88*(3), 693-699.

Di Carlo, C., Iannotti, G., Sparice, S., Chiacchio, M. P., Greco, E., Tommaselli, G. A., & Nappi, C. (2014). The role of a personalized dietary intervention in managing gestational weight gain: A prospective, controlled study in a low-risk antenatal population. *Archives of Gynecology & Obstetrics, 289*(4), 765-770. doi:http://dx.doi.org/10.1007/s00404-013-3054-y

Dunteman, G. H. (1989). *Principal components analysis. [Electronic resource]*. Newbury Park, Calif.; London: SAGE Publications.

Duthie, E. A., Drew, E. M., & Flynn, K. E. (2013). Patient-provider communication about gestational weight gain among nulliparous women: A qualitative study of the views of obstetricians and first-time pregnant women. *BMC Pregnancy & Childbirth, 13*, 231. doi:http://dx.doi.org/10.1186/1471-2393-13-231

Dzakpasu, S., Fahey, J., Kirby, R. S., Tough, S. C., Chalmers, B., Heaman, M. I., . . . McDonald, S. D. (2015). Contribution of prepregnancy body mass index and gestational weight gain to adverse neonatal outcomes: Population attributable fractions for Canada. *BMC Pregnancy & Childbirth, 15*, 21. doi:http://dx.doi.org/10.1186/s12884-015-0452-0

Ellingson, L.L. (2011). Analysis and representation across the continuum. In Denzin N.K. & Lincoln, Y.S. (Eds.). *The SAGE handbook of qualitative research*. Thousand Oaks, California: SAGE Publications.

Elo, S., & Kyngas, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107-115. doi:http://dx.doi.org/10.1111/j.1365-2648.2007.04569.x

Fell, D. B., Joseph, K. S., Armson, B. A., & Dodds, L. (2009). The impact of pregnancy on physical activity level. *Maternal & Child Health Journal, 13*(5), 597-603. doi:http://dx.doi.org/10.1007/s10995-008-0404-7

Ferrari, R. M., & Siega-Riz, A. M. (2013). Provider advice about pregnancy weight gain and adequacy of weight gain. *Maternal & Child Health Journal, 17*(2), 256-264. doi:http://dx.doi.org/10.1007/s10995-012-0969-z

Ferraro, Z. M., Boehm, K. S., Gaudet, L. M., & Adamo, K. B. (2013). Counseling about gestational weight gain and healthy lifestyle during pregnancy: Canadian maternity care providers' self-evaluation. *International Journal of Women's Health, 5*, 629-636. doi:http://dx.doi.org/10.2147/IJWH.S49422

Ferraro, Z. M., Gaudet, L., & Adamo, K. B. (2012). The potential impact of physical activity during pregnancy on maternal and neonatal outcomes. *Obstetrical & Gynecological Survey, 67*(2), 99-110. doi:http://dx.doi.org/10.1097/OGX.0b013e318242030e

Ferraro, Z. M., Rutherford, J., Keely, E. J., Dubois, L., & Adamo, K. B. (2011). An assessment of patient information channels and knowledge of physical activity and nutrition during pregnancy. *Obstetric Medicine, 4*(2), 59-65. doi:10.1258/om.2011.110006

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs - Principles and practices. *Health Services Research, 48*(6), 2134-2156. doi:10.1111/1475-6773.12117

Fieldwick, D., Paterson, H., Stephen, M., Cameron, A., Egan, R., McFadden, S., . . . Watson, C. (2014). Management of excess weight in pregnancy in Otago, New Zealand: A qualitative study with lead maternity carers. *New Zealand Medical Journal, 127*(1392), 27-37.

Fink, A. (2003). Sound survey design and sampling. In A. Fink (Ed.), *The urvey handbook* (2nd ed., pp. 30-47). Thousand Oaks, CA: SAGE Publications. doi:http://dx.doi.org/10.4135/9781412986328

Fowler, J. K., Evers, S. E., & Campbell, M. K. (2012). Inadequate dietary intakes among pregnant women. *Canadian Journal of Dietetic Practice & Research, 73*(2), 72-77. doi:10.3148/73.2.2012.72

French, S. D., Green, S. E., O'Connor, D. A., McKenzie, J. E., Francis, J. J., Michie, S., . . . Grimshaw, J. M. (2012). Developing theory-informed behaviour change interventions to implement evidence into practice: A systematic approach using the theoretical domains framework. *Implementation Science, 7*(1), 38-45. doi:10.1186/1748-5908-7-38

Furness, P. J., McSeveny, K., Arden, M. A., Garland, C., Dearden, A. M., & Soltani, H. (2011). Maternal obesity support services: A qualitative study of the perspectives of women and midwives. *BMC Pregnancy & Childbirth, 11*, 69. doi:http://dx.doi.org/10.1186/1471-2393-11-69

Gaston, A., & Vamos, C. (2013). Leisure-time physical activity patterns and correlates among pregnant women in ontario, canada. *Maternal & Child Health Journal, 17*(3), 477-484. doi:10.1007/s10995-012-1021-z

Gilmore, L. A., Klempel-Donchenko, M., & Redman, L. M. (2015). Pregnancy as a window to future health: Excessive gestational weight gain and obesity. *Seminars in Perinatology, 39*(4), 296-303. doi:http://dx.doi.org.login.ezproxy.library.ualberta.ca/10.1053/j.semperi.2015.05.009

Godwin, M., Hodgetts, G., Seguin, R., & MacDonald, S. (2002). The ontario family medicine residents cohort study: Factors affecting residents' decisions to practise obstetrics. *Canadian Medical Association Journal,* 166(2), 179-184.

Grimshaw, J. M., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L., . . . O'Brien, M. A. (2001). Changing provider behavior: An overview of systematic reviews of interventions. *Medical Care, 39*(8,Suppl 2), 2-45.

Hansen, E. C. (2006). *Successful qualitative health research : A practical introduction*. Maidenhead, England: Open University Press.

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics, 42*(2), 377-381. doi:http://dx.doi.org/10.1016/j.jbi.2008.08.010

Haruna, M., Yeo, S., Watanabe, E., Matsuzaki, M., Ota, E., Nakayama, K., & Murashima, S. (2010). Perceptions of women and health-care providers in tokyo of appropriate weight gain during pregnancy. *Nursing & Health Sciences, 12*(1), 21-26. doi:http://dx.doi.org/10.1111/j.1442-2018.2009.00478.x

Health Canada. (2009a). Prenatal nutrition guidelines for health professionals: Background on Canada's food guide. Retrieved from http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/pubs/guide-prenatal-eng.pdf

Health Canada. (2009b). Prenatal nutrition guidelines for health professionals: Fish and omega-3 fatty acids. Retrieved from http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/pubs/omega3-eng.pdf

Health Canada. (2009c). Prenatal nutrition guidelines for health professionals: Folate. Retrieved from http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/pubs/folate-eng.pdf

Health Canada. (2009d). Prenatal nutrition guidelines for health professionals: Iron contributes to a healthy pregnancy. Retrieved from http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/pubs/iron-fer-eng.pdf

Health Canada. (2010). Prenatal nutrition guidelines for health professionals: Gestational weight gain. Retrieved from http://www.hc-sc.gc.ca/fn-an/nutrition/prenatal/ewba-mbsa-eng.php

Herring, S. J., Platek, D. N., Elliott, P., Riley, L. E., Stuebe, A. M., & Oken, E. (2010). Addressing obesity in pregnancy: What do obstetric providers recommend?. *Journal of Women's Health, 19*(1), 65-70. doi:http://dx.doi.org/10.1089/jwh.2008.1343

Herring, S. J., Nelson, D. B., Davey, A., Klotz, A. A., Dibble, L. V., Oken, E., & Foster, G. D. (2012). Determinants of excessive gestational weight gain in urban, low-income women. *Women's Health Issues: Official Publication of the Jacobs Institute of Women's Health, 22*(5), e439-e446. doi:10.1016/j.whi.2012.05.004

Heslehurst, N., Newham, J., Maniatopoulos, G., Fleetwood, C., Robalino, S., & Rankin, J. (2014). Implementation of pregnancy weight management and obesity guidelines: A meta-synthesis of healthcare professionals' barriers and facilitators using the theoretical domains framework. *Obesity Reviews, 15*(6), 462-486. doi:http://dx.doi.org/10.1111/obr.12160

Heslehurst, N., Russell, S., McCormack, S., Sedgewick, G., Bell, R., & Rankin, J. (2013). Midwives perspectives of their training and education requirements in maternal obesity: A qualitative study. *Midwifery, 29*(7), 736-744. doi:http://dx.doi.org/10.1016/j.midw.2012.07.007

Hochner, H., Friedlander, Y., Calderon-Margalit, R., Meiner, V., Sagy, Y., Avgil-Tsadok, M., . . . Manor, O. (2012). Associations of maternal prepregnancy body mass index and gestational weight gain with adult offspring cardiometabolic risk factors: The Jerusalem perinatal family follow-up study. *Circulation, 125*(11), 1381-1389.

Hrolfsdottir, L., Rytter, D., Olsen, S. F., Bech, B. H., Maslova, E., Henriksen, T. B., & Halldorsson, T. I. (2015). Gestational weight gain in normal weight women and offspring cardio-metabolic risk factors at 20 years of age. *International Journal of Obesity, 39*(4), 671-676.

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288.

Huang, T., Yeh, C., & Tsai, Y. (2011). A diet and physical activity intervention for preventing weight retention among taiwanese childbearing women: A randomised controlled trial. *Midwifery, 27*(2), 257-264 8p. doi:10.1016/j.midw.2009.06.009

Hui, A., Back, L., Ludwig, S., Gardiner, P., Sevenhuysen, G., Dean, H., . . . Shen, G. (2012). Lifestyle intervention on diet and exercise reduced excessive gestational weight gain in pregnant women under a randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology, 119*(1), 70-77. doi:10.1111/j.1471-0528.2011.03184.x

Hytten, F. E., & Chamberlain, G. (1991). *Clinical physiology in obstetrics*. Oxford: Blackwell Scientific Publications.

Institute of Medicine and National Research Council. (2009). In Rasmussen K. M., Yaktine A. L. (Eds.), *Weight gain during pregnancy: Reexamining the guidelines* The National Academies Press. Retrieved from http://www.nap.edu/openbook.php?record_id=12584

Institute of Medicine and National Research Council. (2013). *Implementing guidelines on weight gain and pregnancy* National Acadmies Press.

Jackson, R. A., Stotland, N. E., Caughey, A. B., & Gerbert, B. (2011). Improving diet and exercise in pregnancy with video doctor counseling: A randomized trial. *Patient Education and Counseling, 83*(2), 203-209. doi:http://dx.doi.org/10.1016/j.pec.2010.05.019

Kennedy, H. P. (2000). A model of exemplary midwifery practice: Results of a delphi study. *Journal of Midwifery & Women's Health, 45*(1), 4-19.

Kominiarek MA, Gay F, & Peacock N. (2015). Obesity in pregnancy: A qualitative approach to inform an intervention for patients and providers. *Maternal & Child Health Journal, 19*(8), 1698-1712. doi:http://dx.doi.org/10.1007/s10995-015-1684-3

Kowal, C., Kuk, J., & Tamim, H. (2012). Characteristics of weight gain in pregnancy among Canadian women. *Maternal & Child Health Journal, 16*(3), 668-676.

Kuhle, S., Allen, A. C., & Veugelers, P. J. (2010). Perinatal and childhood risk factors for overweight in a provincial sample of canadian grade 5 students. *International Journal of Pediatric Obesity, 5*(1), 88-96. doi:http://dx.doi.org/10.3109/17477160903060028

Leiferman, J., Gutilla, M., Paulson, J., & Pivarnik, J. (2012). Antenatal physical activity counseling among healthcare providers. *Open Journal of Obstetrics and Gynecology,* (4), 346.

Lindberg, S. M., & Anderson, C. K. (2014). Improving gestational weight gain counseling through meaningful use of an electronic medical record. *Maternal and Child Health Journal,* 18, 2188-2194. doi:10.1007/s10995-014-1467-2

Lindqvist, M., Mogren, I., Eurenius, E., Edvardsson, K., & Persson, M. (2014). "An on-going individual adjustment": A qualitative study of midwives' experiences counselling pregnant women on physical activity in Sweden. *BMC Pregnancy & Childbirth, 14*, 343. doi:http://dx.doi.org/10.1186/1471-2393-14-343

Litwin, M. S. (2003). Scaling and scoring. In M. S. Litwin (Ed.), *How to assess & interpret survey psychometrics* (2nd Edition ed., pp. 46-51). Thousand Oaks, CA: SAGE Publications, Inc. doi:http://dx.doi.org/10.4135/9781412984409

Litwin, M. S. (1995). *How to measure survey reliability and validity: The survey kit, volume 7.* Thousand Oaks, CA: SAGE Publications, Inc.

Liu, J., Whitaker, K. M., Yu, S. M., Chao, S. M., & Lu, M. C. (2016). Association of provider advice and pregnancy weight gain in a predominantly Hispanic population. *Women's Health Issues: Official Publication of the Jacobs Institute of Women's Health,* 26(3), 321-328. doi:10.1016/j.whi.2016.01.004

Lohr, K. N., & Steinwachs, D. M. (2002). Health services research: An evolving definition of the field. *Health Services Research, 37*(1), 7-9. doi:http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291475-6773/issues

Lucas, C., Charlton, K., & Yeatman, H. (2014). Nutrition advice during pregnancy: Do women receive it and can health professionals provide it? *Maternal and Child Health Journal, 18*(10), 2465-2478. doi:10.1007/s10995-014-1485-0

Lutsiv, O., Bracken, K., Pullenayegum, E., Sword, W., Taylor, V. H., & McDonald, S. D. (2012). Little congruence between health care provider and patient perceptions of counselling on gestational weight gain. *Journal of Obstetrics & Gynaecology Canada: JOGC, 34*(6), 518-524.

Macleod, M., Gregor, A., Barnett, C., Magee, E., Thompson, J., & Anderson, A. S. (2013). Provision of weight management advice for obese women during pregnancy: A survey of current practice and midwives' views on future approaches. *Maternal & Child Nutrition, 9*(4), 467-472. doi:http://dx.doi.org/10.1111/j.1740-8709.2011.00396.x

Magriples, U., Boynton, M. H., Kershaw, T. S., Lewis, J., Rising, S. S., Tobin, J. N., . . . Ickovics, J. R. (2015). The impact of group prenatal care on pregnancy and postpartum weight trajectories. *American Journal of Obstetrics & Gynecology, 213*(5), 688.e1-688.e9. doi:http://dx.doi.org/10.1016/j.ajog.2015.06.066

McDonald, S. D., Machold, C. A., Marshall, L., & Kingston, D. (2014). Documentation of guideline adherence in antenatal records across maternal weight categories: A chart review. *BMC Pregnancy & Childbirth, 14*, 205. doi:http://dx.doi.org/10.1186/1471-2393-14-205

McDonald, S. D., Pullenayegum, E., Bracken, K., Chen, A. M., McDonald, H., Malott, A., . . . Sword, W. (2012). Comparison of midwifery, family medicine, and obstetric patients' understanding of weight gain during pregnancy: A minority of women report correct counselling. *Journal of Obstetrics & Gynaecology Canada: JOGC, 34*(2), 129-135.

McDonald, S. D., Pullenayegum, E., Taylor, V. H., Lutsiv, O., Bracken, K., Good, C., . . . Sword, W. (2011). Despite 2009 guidelines, few women report being counseled correctly

about weight gain during pregnancy. *American Journal of Obstetrics & Gynecology, 205*(4), 333.e1-333.e6. doi:http://dx.doi.org/10.1016/j.ajog.2011.05.039

McDonald, S. D., Park, C. K., Pullenayegum, E., Bracken, K., Sword, W., McDonald, H., . . . Brouwers, M. (2015). Knowledge translation tool to improve pregnant women's awareness of gestational weight gain goals and risks of gaining outside recommendations: A non-randomized intervention study. *BMC Pregnancy & Childbirth, 15*(1), 1-13.

McDowell, I. (2015). Society, the individual, and medicine: Alternative methods of payment of MDs and hospitals: Impact on patterns of practice. Retrieved from http://www.med.uottawa.ca/sim/data/MD_Payment_e.htm

McMillen, I. C., MacLaughlin, S. M., Muhlhausler, B. S., Gentili, S., Duffield, J. L., & Morrison, J. L. (2008). Developmental origins of adult health and disease: The role of periconceptional and foetal nutrition. *Basic & Clinical Pharmacology & Toxicology, 102*(2), 82-89. doi:10.1111/j.1742-7843.2007.00188.x

McNeil, D. A., Vekved, M., Dolan, S. M., Siever, J., Horn, S., & Tough, S. C. (2012). Getting more than they realized they needed: A qualitative study of women's experience of group prenatal care. *BMC Pregnancy & Childbirth,12*(1), 17-26. doi:10.1186/1471-2393-12-17

McNeil, D. A., Vekved, M., Dolan, S. M., Siever, J., Horn, S., & Tough, S. C. (2013). A qualitative study of the experience of CenteringPregnancy group prenatal care for physicians. *BMC Pregnancy & Childbirth, 13*(Suppl 1), S6.

Melzer, K., & Schutz, Y. (2010). Pre-pregnancy and pregnancy predictors of obesity. *International Journal of Obesity, 34*, S44-S52. doi:10.1038/ijo.2010.239

Metcalfe, A., Grabowska, K., Weller, C., & Tough, S. C. (2013). Impact of prenatal care provider on the use of ancillary health services during pregnancy. *BMC Pregnancy & Childbirth, 13*(1), 1-11. doi:10.1186/1471-2393-13-62

Michie, S., Johnson, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derivied behavioural determinants to behaviour change techniques. *Applied Psychology, 57*, 660-680. doi:10.1111/j.1464-0597.2008.00341.x

Minakami, H., Hiramatsu, Y., Koresawa, M., Fujii, T., Hamada, H., Iitsuka, Y., . . . Japan Association of Obstetricians and Gynecologists. (2011). Guidelines for obstetrical practice in Japan: Japan society of obstetrics and gynecology (JSOG) and Japan association of obstetricians and gynecologists (JAOG) 2011 edition. *Journal of Obstetrics & Gynaecology Research, 37*(9), 1174-1197.

Moore Simas, T. A., Doyle Curiale, D. K., Hardy, J., Jackson, S., Zhang, Y., & Liao, X. (2010). Efforts needed to provide institute of medicine-recommended guidelines for gestational weight gain. *Obstetrics & Gynecology, 115*(4), 777-783. doi:http://dx.doi.org/10.1097/AOG.0b013e3181d56e12

Moore Simas, T. A., Waring, M. E., Sullivan, G. M., Liao, X., Rosal, M. C., Hardy, J. R., & Berry, R. E.,Jr. (2013). Institute of medicine 2009 gestational weight gain guideline knowledge: Survey of obstetrics/gynecology and family medicine residents of the United States. *Birth, 40*(4), 237-246. doi:http://dx.doi.org/10.1111/birt.12061

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods, 1*(2), 13-22.

Muktabhant, B., Lawrie, T. A., Lumbiganon, P., & Laopaiboon, M. (2015). Diet or exercise, or both, for preventing excessive weight gain in pregnancy. *Cochrane Database of Systematic Reviews, 6*, 007145. doi:http://dx.doi.org/10.1002/14651858.CD007145.pub3

National Institute of Health and Clinical Excellence. (2010). Weight management before, during and after pregnancy. NICE guideline (PH27). Retrieved from: https://www.nice.org.uk/guidance/ph27

Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education, 15*(5), 625-632. doi:http://dx.doi.org/10.1007/s10459-010-9222-y

Novick, G. (2008). Is there a bias against telephone interviews in qualitative research? *Research in Nursing & Health, 31*(4), 391-398. doi:10.1002/nur.20259

O'Brien, B., Harvey, S., Sommerfeldt, S., Beischel, S., Newburn-Cook, C., & Schopflocher, D. (2010). Comparison of costs and associated outcomes between women choosing newly integrated autonomous midwifery care and matched controls: A pilot study. *Journal of Obstetrics and Gynaecology Canada, 32*(7), 650.

Ojha, S., Saroha, V., Symonds, M. E., & Budge, H. (2013). Excess nutrient supply in early life and its later metabolic consequences. *Clinical & Experimental Pharmacology & Physiology, 40*(11), 817-823.

Oken, E., Switkowski, K., Price, S., Guthrie, L., Taveras, E. M., Gillman, M., . . . Dietz, P. (2013). A qualitative study of gestational weight gain counseling and tracking. *Maternal & Child Health Journal, 17*(8), 1508-1517.

Olander, E. K., Atkinson, L., Edmunds, J. K., & French, D. P. (2011). The views of pre- and post-natal women and health professionals regarding gestational weight gain: An exploratory study. *Sexual & Reproductive Healthcare : Official Journal of the Swedish Association of Midwives, 2*(1), 43-48. doi:http://dx.doi.org/10.1016/j.srhc.2010.10.004

Olson, C. M., & Strawderman, M. S. (2003). Modifiable behavioral factors in a biopsychosocial model predict inadequate and excessive gestational weight gain. *Journal of the American Dietetic Association, 103*(1), 48-54. doi:http://dx.doi.org.login.ezproxy.library.ualberta.ca/10.1053/jada.2003.50001

Ontario Ministry of Health and Long-term Care. (2016). Family health teams. Retrieved from http://www.health.gov.on.ca/en/pro/programs/fht/

Ontario Ministry of Health and Long-term Care and the Ontario Medical Association. (2005). Antenatal record. Retrieved from http://www.fammedref.org/wp-content/uploads/2011/12/Ontarioantenatalrecord2005.pdf

Park, C. K., Timm, V., Neupane, B., Beyene, J., Schmidt, L. A., & McDonald, S. D. (2015). Factors associated with women's plans to gain weight categorized as above or below the national guidelines during pregnancy. *Journal of Obstetrics & Gynaecology Canada, 37*(3), 225-235 11p.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd Edition ed.). Thousand Oaks, Calif: SAGE Publications.

Phelan, S. (2010). Pregnancy: A "teachable moment" for weight control and obesity prevention. *American Journal of Obstetrics & Gynecology, 202*(2), 135.e1-135.e8. doi:http://dx.doi.org/10.1016/j.ajog.2009.06.008

Phelan, S., Phipps, M. G., Abrams, B., Darroch, F., Grantham, K., Schaffner, A., & Wing, R. R. (2014). Does behavioral intervention in pregnancy reduce postpartum weight retention? twelve-month outcomes of the fit for delivery randomized trial. *American Journal of Clinical Nutrition, 99*(2), 302-311. doi:http://dx.doi.org/10.3945/ajcn.113.070151

Phelan, S., Phipps, M. G., Abrams, B., Darroch, F., Schaffner, A., & Wing, R. R. (2011). Practitioner advice and gestational weight gain. *Journal of Women's Health, 20*(4), 585-591. doi:http://dx.doi.org/10.1089/jwh.2010.2316

Pick, M. E., Edwards, M., Moreau, D., & Ryan, E. A. (2005). Assessment of diet quality in pregnant women using the healthy eating index. *Journal of the American Dietetic Association, 105*(2), 240-246. doi:http://dx.doi.org/10.1016/j.jada.2004.11.028

Power, M. L., Cogswell, M. E., & Schulkin, J. (2006). Obesity prevention and treatment practices of U.S. obstetrician-gynecologists. *Obstetrics & Gynecology, 108*(4), 961-968.

Public Health Agency of Canada. (2009). What mothers say: The Canadian maternity experiences survey. Retrieved from http://www.phac-aspc.gc.ca/rhs-ssg/survey-eng.php

Rasmussen, K. M., Catalano, P. M., & Yaktine, A. L. (2009). New guidelines for weight gain during pregnancy: What obstetrician/gynecologists should know. *Current Opinion in Obstetrics & Gynecology, 21*(6), 521-526. doi:http://dx.doi.org/10.1097/GCO.0b013e328332d24e

Ravelli, A. C., van der Meulen, J. H., Michels, R. P., Osmond, C., Barker, D. J., Hales, C. N., & Bleker, O. P. (1998). Glucose tolerance in adults after prenatal exposure to famine. *Lancet, 351*(9097), 173-177.

Rueda-Clausen, C., Benterud, E., Bond, T., Olszowka, R., Vallis, M. T., & Sharma, A. M. (2014). Effect of implementing the 5As of obesity management framework on provider-patient interactions in primary care. *Clinical Obesity,* (1), 39.

Sandelowski, M. (2000). Focus on research methods. whatever happened to qualitative description? *Research in Nursing & Health, 23*(4), 334-340.

Schmidt, S. M., Chari, R., & Davenport, M. H. (2016). Commentary: Exercise during pregnancy: Current recommendations by Canadian maternity health care providers. *Journal of Obstetrics and Gynaecology Canada, 38*, 177-178. doi:10.1016/j.jogc.2015.12.012

Schmied, V. A., Duff, M., Dahlen, H. G., Mills, A. E., & Kolt, G. S. (2011). 'Not waving but drowning': A study of the experiences and concerns of midwives and other health professionals caring for obese childbearing women. *Midwifery, 27*(4), 424-430. doi:http://dx.doi.org.login.ezproxy.library.ualberta.ca/10.1016/j.midw.2010.02.010

Schumann, N. L., Brinsden, H., & Lobstein, T. (2014). A review of national health policies and professional guidelines on maternal obesity and weight gain in pregnancy. *Clinical Obesity, 4*(4), 197-208. doi:http://dx.doi.org/10.1111/cob.12062

Scott, C., Andersen, C. T., Valdez, N., Mardones, F., Nohr, E. A., Poston, L., . . . Abrams, B. (2014). No global consensus: A cross-sectional survey of maternal weight policies. *BMC Pregnancy & Childbirth, 14*(1), 1-22. doi:10.1186/1471-2393-14-167

Smid, M. C., Dorman, K. F., & Boggess, K. A. (2015). Lost in translation? english- and spanish-speaking women's perceptions of gestational weight gain safety, health risks and counseling. *Journal of Perinatology : Official Journal of the California Perinatal Association, 35*(8), 585-589. Retrieved from http://dx.doi.org/10.1038/jp.2015.24

Society of Obstetricians and Gynaecologists of Canada. (2009). Policy statement no.229: The role of obstetrician-gynaecologists in canada. *Journal of Obstetrics and Gynaecology Canada, 31*(7), 666.

Stewart, Z. A., Wallace, E., & Allan, C. (2012). Weight gain in pregnancy: A survey of current practices in a teaching hospital. *Australian & New Zealand Journal of Obstetrics & Gynaecology, 52*(2), 208-210 3p. doi:10.1111/j.1479-828X.2012.01418.x

Stotland, N. E., Tsoh, J. Y., & Gerbert, B. (2012). Prenatal weight gain: Who is counseled?. *Journal of Women's Health, 21*(6), 695-701. doi:http://dx.doi.org/10.1089/jwh.2011.2922

Stotland, N. E., Gilbert, P., Bogetz, A., Harper, C. C., Abrams, B., & Gerbert, B. (2010). Preventing excessive weight gain in pregnancy: How do prenatal care providers approach counseling?. *Journal of Women's Health, 19*(4), 807-814. doi:http://dx.doi.org/10.1089/jwh.2009.1462

Stotland, N. E., Haas, J. S., Brawarsky, P., Jackson, R. A., Fuentes-Afflick, E., & Escobar, G. J. (2005). Body mass index, provider advice, and target gestational weight gain. *Obstetrics & Gynecology, 105*(3), 633-638.

Sue, V. M., & Ritter, L. A. (2007). *Conducting online surveys [Electronic resource]*. Los Angeles, Calif.; London : SAGE Publications. Retrieved from http://login.ezproxy.library.ualberta.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cat03710a&AN=alb.6913938&site=eds-live&scope=site; http://srmo.sagepub.com/view/conducting-online-surveys/SAGE.xml

Szwajcer, E. M., Hiddink, G. J., Koelen, M. A., & van Woerkum, C. M. (2005). Nutrition-related information-seeking behaviours before and throughout the course of pregnancy: Consequences for nutrition communication. *European Journal of Clinical Nutrition, 59*(Suppl 1), S57-65.

Szwajcer, E. M., Hiddink, G. J., Koelen, M. A., & van Woerkum, C. M. J. (2009). Written nutrition communication in midwifery practice: What purpose does it serve? *Midwifery, 25*, 509-517. doi:10.1016/j.midw.2007.10.005

Taffel, S. M., Keppel, K. G., & Jones, G. K. (1993). Medical advice on maternal weight gain and actual weight gain: results from the 1988 national maternal and infant health survey. *Annals of the New York Academy of Sciences, 678*, 293-305.

Taffel, S. M., & Keppel, K. G. (1986). Advice about weight gain during pregnancy and actual weight gain. *American Journal of Public Health, 76*(12), 1396-1399.

Tanner-Smith, E. E., Steinka-Fry, K. T., & Gesell, S. B. (2014). Comparative effectiveness of group and individual prenatal care on gestational weight gain. *Maternal & Child Health Journal, 18*(7), 1711-1720. doi:http://dx.doi.org/10.1007/s10995-013-1413-8

Thorsdottir, I. R. D., Torfadottir, J. E., Birgisdottir, B. E., R.D., & Geirsson, R. T. (2002). Weight gain in women of normal weight before pregnancy: Complications in pregnancy or delivery and birth outcome. *Obstetrics & Gynecology, 99*(5, Part 1), 799-806.

Tovar, A., Guthrie, L. B., Platek, D., Stuebe, A., Herring, S. J., & Oken, E. (2011). Modifiable predictors associated with having a gestational weight gain goal. *Maternal & Child Health Journal, 15*(7), 1119-1126. doi:http://dx.doi.org/10.1007/s10995-010-0659-7

United States Department of Agriculture Food and Nutrition Service. (2016). Women, infants, and children (WIC). Retrieved from http://www.fns.usda.gov/wic/women-infants-and-children-wic

van der Pligt, P., Campbell, K., Willcox, J., Opie, J., & Denney-Wilson, E. (2011). Opportunities for primary and secondary prevention of excess gestational weight gain: General

practitioners' perspectives. *BMC Family Practice, 12*, 124. doi:http://dx.doi.org/10.1186/1471-2296-12-124

Viswanathan, M., Siega-Riz, A. M., Moos, M. K., Deierlein, A., Mumford, S., Knaack, J., . . . Lohr, K. N. (2008). Outcomes of maternal weight gain. *Evidence Report/Technology Assessment,* (168), 1-223.

Wang, M. L., Arroyo, J., Druker, S., Sankey, H. Z., & Rosal, M. C. (2015). Knowledge, attitudes and provider advice by pre-pregnancy weight status: A qualitative study of pregnant latinas with excessive gestational weight gain. *Women & Health, 55*(7), 805-828. doi:http://dx.doi.org/10.1080/03630242.2015.1050542

Waring, M. E., Moore Simas, T. A., Barnes, K. C., Terk, D., Baran, I., Pagoto, S. L., & Rosal, M. C. (2014). Patient report of guideline-congruent gestational weight gain advice from prenatal care providers: Differences by prepregnancy BMI. *Birth, 41*(4), 353-359. doi:http://dx.doi.org/10.1111/birt.12131

Wennberg, A. L., Lundqvist, A., Högberg, U., Sandström, H., & Hamberg, K. (2013). Womens experiences of dietary advice and dietary changes during pregnancy. *Midwifery,* 29(9), 1027-34.

Whitaker, K. M., Wilcox, S., Liu, J., Blair, S. N., & Pate, R. R. (2016). Patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy: A qualitative study. *Women's Health Issues,* (1), 116. doi:10.1016/j.whi.2015.10.007

Willcox, J. C., Campbell, K. J., McCarthy, E. A., Lappas, M., Ball, K., Crawford, D., . . . Wilkinson, S. A. (2015). Gestational weight gain information: Seeking and sources among pregnant women. *BMC Pregnancy and Childbirth,* 15(164), 1-10.

Willcox, J. C., Campbell, K. J., van der Pligt, P., Hoban, E., Pidd, D., & Wilkinson, S. (2012). Excess gestational weight gain: An exploration of midwives' views and practice. *BMC Pregnancy & Childbirth, 12*, 102. doi:http://dx.doi.org/10.1186/1471-2393-12-102

World Health Organization. (2016). Health statistics and information systems. Metrics: Population attributable fraction (PAF). Retrieved from http://www.who.int/healthinfo/global_burden_disease/metrics_paf/en/

Wrotniak, B. H., Dentice, S., Mariano, K., Salaam, E. M., Cowley, A. E., & Mauro, E. M. (2015). Counseling about weight gain guidelines and subsequent gestational weight gain. *Journal of Women's Health, 24*(10), 819-824. doi:10.1089/jwh.2014.4984

Zhang, W., & Creswell, J. (2013). The use of "mixing" procedure of mixed methods in health services research. *Medical Care, 51*(8), e51-7. doi:http://dx.doi.org/10.1097/MLR.0b013e31824642fd

Appendices

Appendix 1. Interview guide for semi-structured interviews

1. From your experience, are women commonly concerned about weight gain and healthy eating during pregnancy?
    a. What types of questions do they ask you?
2. How important do you think it is to discuss weight gain with pregnant women?
    a. How comfortable are you with discussing weight gain with pregnant women?
    b. What difficulties have you experienced having this conversation with women?
    c. Typically, when is the first time you have this conversation, at what stage during the pregnancy?
        i. How often after that do you discuss weight gain with women?
    d. What do you feel is your role to discuss weight gain with pregnant women?
        i. Is there another provider you think may be more appropriate? Why?
    e. How, if at all, do you think the 5As of Healthy Pregnancy Weight Gain could help you?
        i. To begin the conversation?
        ii. To have the conversation more regularly, i.e., with more women?
        iii. To have the conversation more frequently, i.e., more than once with women?
3. What all is involved, or how exactly do you assess women's weight during pregnancy? And, do you do this or are there others involved, e.g. nurse, etc.?
    a. Typically, how do you or your staff relay that information back to women? When?
    b. How do you assess the drivers and barriers that may impact weight gain with women?
    c. How do you think the 5As could help your assessment process?
4. How important do you think it is to assist women by helping them set goals or create strategies that are right for them?
    a. What do you think is within your role to assist women?
        i. Providing them with resources; arranging for follow up?
    b. Who do you think is the most appropriate person to assist women to achieve appropriate gestational weight gain?
    c. Is there anybody else you would like to involve in that process?
5. What, if any, challenges have you experienced discussing weight gain with women during pregnancy?
    a. I don't discuss – what would help you discuss gestational weight gain with women?
6. What topics do you think your knowledge or skills are lacking or what areas would you like to learn more about?
    a. What about with respect to making nutrition recommendations, such as making recommendations for how to meet extra food requirements or substituting foods?
7. Is helping women achieve guideline concordant weight gain in any way limited by resources, time or health care system processes, e.g. billing requirements, available staff, etc.?

Now, shifting gears a little bit, I want to ask you about how you prefer to receive and learn about new information and resources.

8. What method works best for you (easiest, most convenient, most effective) to learn about new guidelines or receive new information?
    a. Online training you can refer to at your convenience?
    b. Attending a workshop?
    c. Having someone come to your practice/place of work and provide a brief in-service?
    d. Would having a key contact be helpful for you?
    e. What is it about this/these method(s) that you find helpful?
9. From your experience, what approaches have worked best for you to pass on information to your patients?
    a. What materials or resources would be helpful for you to have in your practice?
        i. What is it about these resources that you find helpful?
10. From your experience, what do you think has worked best for your patients with respect to assisting them to manage an issue or concern?
    a. Follow up appointment with you?
    b. Referral to another provider?
    c. Resources you can provide to them?
11. What feasible changes could be made within your clinic or the healthcare system that would help you assist pregnant women to achieve guideline concordant weight gain?

Now, I want to ask you a few questions about the 5As of HPWG.

12. What do you like about the 5As of HPWG?

13. What don't you like about the 5As of HPWG?

14. Do you intend to implement the 5As of HPWG approach in your practice?
    a. If **no**, can you tell me why you do not intend to implement the 5As?
    b. If **yes**, can you tell me how you think you will use this approach?

15. Is there anything that you need, or that would be helpful to assist you to implement the 5As of HPWG?
    a. Are there any other resources that you would like to help you support women to achieve gestational weight gain recommendations?
    b. If **yes**, please describe those for me.

Lastly,

16. Do you see women after they've given birth?
    a. If **yes**, for how long, i.e., timeframe (up to how many months) and approximately how many visits?
        i. As a general practice, do you discuss weight loss with women during the postpartum period?
            1. If **yes**, can you please describe that conversation for me?
            2. Is there anything else you do to help women return to their pre-pregnancy weight, i.e., assessment, assistance, follow up visits, etc.?
    b. If **no**, why is that?

Appendix 2. Test-rest reliability assessment of survey instrument.

	Pearson's R
Practices	
I provide women with a weight gain target based on their pre-pregnancy BMI	0.985
I discuss the recommended rate of weight gain based on their weight gain target	0.662
I discuss the impact of inappropriate weight gain on the mother during pregnancy	0.337
I discuss the impact of inappropriate weight gain on the baby	0.366
I weigh women at every visit	0.849
I relay weight gain information to women every time I weigh them	0.899
I discuss appropriate physical activity with pregnant women	0.675
I discuss appropriate extra food requirements with pregnant women	0.086
I can easily give examples of appropriate changes that women could make to meet extra food requirements	0.716
I discuss the importance of taking prenatal vitamins	0.207
Knowledge of gestational weight gain, physical activity and nutrition guidelines	
Health Canada's 2010 guidelines for pregnancy weight gain	0.956
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	0.891
Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy	0.966
Health Canada's prenatal nutrition guidelines for health professionals	0.965
Knowledge and resources in gestational weight gain, physical activity and nutrition	
I have appropriate knowledge to recommend guideline concordant weight gain	0.552
I have appropriate information resources to support recommending guideline concordant pregnancy weight gain	0.469
I have appropriate knowledge to recommend guideline concordant physical activity	0.707
I have appropriate information resources to support recommending guideline concordant physical activity	0.542
I have appropriate knowledge to recommend guideline concordant healthy eating during pregnancy	0.773
I have appropriate information resources to support recommending guideline concordant healthy eating during pregnancy	0.968
I have appropriate programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	0.476
Priority level of discussing, assessing and assisting women with gestational weight gain	
I consider discussing appropriate gestational weight gain with women a high priority	N/A*
I consider assessing gestational weight gain a high priority	

I consider assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators, providing resources, referrals to appropriate providers, etc.) a high priority	
Role	
I am the most suitable person to discuss gestational weight gain with women	N/A*
I am the most suitable person to assess gestational weight gain with women	0.632
I am the most suitable person to assist women with gestational weight gain	N/A*
I am the most suitable person to follow up with gestational weight gain	1.000

**Unable to compute due to lack of variation in responses.*

Appendix 3. Professional associations, regulatory bodies and networks assisting with the distribution of the online survey.

Email	Society of Obstetricians and Gynecologists of Canada	Wetaskiwin Primary Care Network	Ontario Family Health Teams – Dietitians of Canada Network
	Canadian Association of Perinatal and Women's Health Nurses	Wood Buffalo Primary Care Network	Groupe d'étude en médecine obstétricale du Québec
	Canadian Association of Rural and Remote Nursing	Alberta Medical Association*	Perinatal Program of Newfoundland and Labrador
	National Aboriginal Council of Midwives	College and Association of Registered Nurses of Alberta (CARNA)	Association of Registered Nurses of Newfoundland and Labrador
	BC Association of Perinatal Outreach Programs	Alberta Association of Midwives	Dietitians Association of Newfoundland and Labrador
	UBC Continuing Medical Education	Saskatchewan Ministry of Health	Nurses Association of New Brunswick
	Midwives Association of British Columbia	Saskatchewan Community and Regional Dietitians	Midwifery Regulatory Council of Nova Scotia
	Grande Prairie Primary Care Network	College of Registered Nurses of Manitoba	Nova Scotia Dietetic Association
	Camrose Primary Care Network	Association of Family Health Teams of Ontario	Yukon Hospital Corporation
			Northern Nutrition Association
Newsletter	Canadian Obesity Network*	Primary Care Networks Program Management Office	Nurse Practitioner Association of Manitoba
	North American Society of Obstetrical Medicine	Red Deer Primary Care Network	College of Dietitians of Manitoba*
	Society of Rural Physicians of Canada	Edmonton West Primary Care Network	Best Start Resource Centre, Maternal Newborn and Child Health Network
	Canadian Nurses Association	South Calgary Primary Care Network	Better Outcomes Registry and Network (BORN) Ontario
	Canadian Family Practice Nurses Association	College of Dietitians of Alberta*	Association of Ontario Health Centres
	Doctors of BC	Saskatchewan Medical Association	New Brunswick Medical Society
			Yukon Registered Nurses Association
Social media, website or other	Canadian Association of Midwives	Saskatchewan Prevents	Newfoundland and Labrador Medical Association
	Association of Registered Nurses of British Columbia	Association of Ontario Midwives	Association of Registered Nurses of Prince Edward Island

Appendix 4. Summary of all survey responses, including health care provider disciplines outside the scope of this thesis.

Appendix 4.1. Characteristics of all survey respondents (n=885)

	All respondents	
	n	%
Health care provider discipline		
General Practitioner	159	18%
Obstetrician	139	16%
Midwife	97	11%
Dietitian	76	9%
Nurse Practitioner	38	4%
Registered Nurse - Public/Community Health	147	17%
Registered Nurse - Acute/Other	105	12%
Registered Nurse - Primary Care	75	9%
Physician (other)	20	2%
Prenatal Educator	11	1%
Other	18	2%
Province		
British Columbia	76	9%
Alberta	289	33%
Saskatchewan	58	7%
Manitoba	97	11%
Ontario	223	25%
Quebec	29	3%
Newfoundland and Labrador	22	2%
New Brunswick	43	5%
Prince Edward Island	1	0%
Nova Scotia	25	3%
Yukon	4	0%
Northwest Territories	9	1%
Missing		
Location of practice		
Urban	467	53%
Rural	252	28%
Urban and rural	163	18%
Missing		
Practice setting (all that apply)		
Solo	180	20%
Group	490	55%
Interdisciplinary	377	43%
Academic	115	13%
Proportion of total patients/clients who are pregnant women		
<10%	208	24%
10-30%	187	21%

30-60%	159	18%
60-90%	84	9%
>90%	247	28%
Stage of pregnancy at first prenatal visit		
Before they become pregnant	37	4%
First trimester	405	46%
Second trimester	159	18%
Third trimester	129	15%
Don't know/too variable to say	154	17%
Missing		

Appendix 4.2. Gestational weight gain counselling practices reported by all survey respondents

	All respondents	
	n	%
I provide women with a weight gain target based on their pre-pregnancy BMI		
< 10% of pregnant patients	376	43%
10-30% of pregnant patients	98	11%
30-60% of pregnant patients	112	13%
60-90% of pregnant patients	122	14%
>90% of pregnant patients	165	19%
I discuss the recommended rate of weight gain based on their weight gain target		
< 10% of pregnant patients	358	41%
10-30% of pregnant patients	126	15%
30-60% of pregnant patients	130	15%
60-90% of pregnant patients	117	13%
>90% of pregnant patients	139	16%
I discuss the impact of inappropriate weight gain on the mother during pregnancy		
< 10% of pregnant patients	183	21%
10-30% of pregnant patients	201	23%
30-60% of pregnant patients	183	21%
60-90% of pregnant patients	151	17%
>90% of pregnant patients	156	18%
I discuss the impact of inappropriate weight gain on the baby		
< 10% of pregnant patients	194	22%
10-30% of pregnant patients	198	23%
30-60% of pregnant patients	181	21%
60-90% of pregnant patients	142	16%
>90% of pregnant patients	153	18%
I weigh women at every visit		
< 10% of pregnant patients	242	28%
10-30% of pregnant patients	38	4%
30-60% of pregnant patients	43	5%
60-90% of pregnant patients	74	9%
>90% of pregnant patients	474	54%
I relay weight gain information to women every time I weigh them		
< 10% of pregnant patients	266	31%
10-30% of pregnant patients	70	8%
30-60% of pregnant patients	73	9%
60-90% of pregnant patients	130	15%
>90% of pregnant patients	324	38%
I discuss appropriate physical activity with pregnant women		
< 10% of pregnant patients	87	10%
10-30% of pregnant patients	108	12%

30-60% of pregnant patients	154	18%
60-90% of pregnant patients	217	25%
>90% of pregnant patients	304	35%
I discuss appropriate extra food requirements with pregnant women		
< 10% of pregnant patients	136	16%
10-30% of pregnant patients	142	16%
30-60% of pregnant patients	166	19%
60-90% of pregnant patients	191	22%
>90% of pregnant patients	236	27%
I can easily give examples of appropriate changes that women could make to meet extra food requirements		
< 10% of pregnant patients	157	18%
10-30% of pregnant patients	119	14%
30-60% of pregnant patients	137	16%
60-90% of pregnant patients	187	22%
>90% of pregnant patients	269	31%
I discuss the importance of taking prenatal vitamins		
< 10% of pregnant patients	53	6%
10-30% of pregnant patients	45	5%
30-60% of pregnant patients	76	9%
60-90% of pregnant patients	160	18%
>90% of pregnant patients	538	62%

Appendix 4.3. Knowledge and access to resources related to gestational weight gain

	All respondents	
	n	%
I am confident I could accurately summarize at least 80% of the content of the following guidelines to my colleagues in the next week:		
Health Canada's 2010 guidelines for pregnancy weight gain		
Strongly disagree	100	12%
Disagree	164	19%
Neither disagree nor agree	137	16%
Agree	359	42%
Strongly agree	90	11%
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy		
Strongly disagree	112	13%
Disagree	226	27%
Neither disagree nor agree	169	20%
Agree	276	33%
Strongly agree	63	7%
Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy		
Strongly disagree	220	26%
Disagree	292	35%
Neither disagree nor agree	148	18%
Agree	137	16%
Strongly agree	48	6%
Health Canada's prenatal nutrition guidelines for health professionals		
Strongly disagree	116	14%
Disagree	191	23%
Neither disagree nor agree	170	20%
Agree	272	32%
Strongly agree	95	11%
I have appropriate knowledge to recommend guideline concordant weight gain		
Strongly disagree	30	4%
Disagree	92	12%
Neither disagree nor agree	96	13%
Agree	393	53%
Strongly agree	138	18%
I have appropriate knowledge to recommend guideline concordant physical activity		
Strongly disagree	30	4%
Disagree	114	15%
Neither disagree nor agree	153	21%
Agree	371	50%
Strongly agree	77	10%

I have appropriate knowledge to recommend guideline concordant healthy eating during pregnancy		
Strongly disagree	23	3%
Disagree	82	11%
Neither disagree nor agree	99	13%
Agree	409	55%
Strongly agree	128	17%
I have appropriate information resources to support recommending guideline concordant pregnancy weight gain		
Strongly disagree	33	4%
Disagree	175	23%
Neither disagree nor agree	129	17%
Agree	317	42%
Strongly agree	94	13%
I have appropriate information resources to support recommending guideline concordant physical activity		
Strongly disagree	42	6%
Disagree	199	27%
Neither disagree nor agree	174	24%
Agree	263	36%
Strongly agree	63	9%
I have appropriate information resources to support recommending guideline concordant healthy eating during pregnancy		
Strongly disagree	32	4%
Disagree	142	19%
Neither disagree nor agree	130	18%
Agree	337	46%
Strongly agree	99	13%
I have appropriate programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)		
Strongly disagree	78	11%
Disagree	143	19%
Neither disagree nor agree	113	15%
Agree	278	37%
Strongly agree	132	18%

Appendix 4.4. Priority level of discussing, assessing, assisting and following up with gestational weight gain in the context of a typical prenatal visit

	All respondents	
	n	**%**
Given all of the issues of concern during a typical prenatal visit, I consider: Discussing appropriate gestational weight gain with women a high priority		
Strongly disagree	24	3%
Disagree	65	8%
Neither disagree nor agree	149	19%
Agree	397	50%
Strongly agree	167	21%
Assessing gestational weight gain a high priority		
Strongly disagree	26	3%
Disagree	63	8%
Neither disagree nor agree	119	15%
Agree	383	48%
Strongly agree	210	26%
Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators, providing resources, referrals to appropriate providers, etc.) a high priority		
Strongly disagree	22	3%
Disagree	34	4%
Neither disagree nor agree	126	16%
Agree	417	52%
Strongly agree	198	25%

Appendix 4.5. Most suitable health care provider discipline to discuss, assess, assist and follow up with gestational weight gain

	All respondents	
	n	%
In your practice setting, who do you think is the most suitable person to discuss gestational weight gain with women?		
Myself	601	77%
General practitioner/family physician	423	54%
Obstetrician/gynecologist	373	48%
Dietitian	386	49%
Nurse	362	46%
Nurse practitioner	350	45%
Midwife	396	50%
Behavioural health consultant	146	19%
Physical activity specialist	171	22%
Other	15	2%
In your practice setting, who do you think is the most suitable person to assess gestational weight gain with women?		
Myself	464	59%
General practitioner/family physician	382	49%
Obstetrician/gynecologist	345	44%
Dietitian	381	49%
Nurse	308	39%
Nurse practitioner	347	44%
Midwife	359	46%
Behavioural health consultant	117	15%
Physical activity specialist	158	20%
Other	9	1%
In your practice setting, who do you think is the most suitable person to assist women with gestational weight gain?		
Myself	422	54%
General practitioner/family physician	511	65%
Obstetrician/gynecologist	238	30%
Dietitian	532	68%
Nurse	330	42%
Nurse practitioner	313	40%
Midwife	318	41%
Behavioural health consultant	254	32%
Physical activity specialist	299	38%
Other	12	2%
In your practice setting, who do you think is the most suitable person to follow-up with gestational weight gain with women?		
Myself	412	53%

General practitioner/family physician	413	53%
Obstetrician/gynecologist	280	36%
Dietitian	423	54%
Nurse	277	35%
Nurse practitioner	312	40%
Midwife	315	40%
Behavioural health consultant	161	21%
Physical activity specialist	183	23%
Other	13	2%
Missing		