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Health care provider's gestational weight gain counselling practices and the influence of knowledge and attitudes: A cross-sectional mixed methods study

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Abstract

Objective: To understand current gestational weight gain counselling practices of health care providers, and the relationships between practices, knowledge and attitudes.

Design: Concurrent mixed methods with data integration: cross-sectional survey and semi-structured interviews.

Participants: Prenatal health care providers in Canada: general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings.

Results: Typically, weight gain information was provided early in pregnancy, but not discussed again unless there was a concern. 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 identified that the priority level that health care providers place on gestational weight gain was most strongly related to providing weight gain advice and discussing risks of weight gain outside recommendations ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of GWG to length of appointments, compensation methods for health care providers, and the midwifery versus medical model of care.

Conclusions: 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.

Strengths and Limitations Of This Study: (max 5 bullet points)

- This is a large and in-depth examination and comparison of health care providers' practices related to monitoring and discussing gestational weight gain with pregnant women, and is enhanced by the use of mixed methods.
- The topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.
- It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks.
- While these methods allowed for a wider reach and more responses, those who responded may be more likely to engage in activities related to GWG counselling, which is concerning since the rates of some counselling practices are quite low.

Introduction

Supporting all women to achieve healthy gestational weight gain (GWG) is of clinical importance because weight gain lower or higher than recommended is linked with a range of poor maternal, fetal, and childhood outcomes. [1] For mothers, excess GWG increases the risk of gestational diabetes mellitus and hypertensive disorders in pregnancy, and this is of special concern if excessive GWG occurs early in pregnancy. [2-4] Excess GWG also poses risks at delivery for the mother including increased likelihood of needing an instrumental delivery or a Caesarean section, and surgical morbidity and mortality. [1, 3] Further, these factors result in an increased risk for the fetus and neonate including the adverse consequences of macrosomia and shoulder dystocia, need for intensive care unit admission, and the risk of perinatal death. [1, 3] [5] In the long term, the child is at risk of an altered growth trajectory that may lead to obesity. [6, 7] Excess GWG 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. [1] [8] The cycle of excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to increased risk in each subsequent pregnancy.[9] These risks act synergistically resulting in a higher risk of metabolic and cardiovascular disease in later life for the mother as well as the child.[10] Thus, excess GWG has a short term, long term and intergenerational effects. [11]

To mitigate the risks of inappropriate GWG, many countries, including Canada, have released GWG guidelines. [12] [13] Many of these are based on the Institute of Medicine (USA) guidelines for weight gain in pregnancy, which outline a range of total weight gain over the course of pregnancy that is associated with optimal health outcomes for mother and child. [14] In order for these guidelines to be of benefit to pregnant women, the Institute of Medicine recommends that health care providers advise women on the recommended range of weight gain

based on pre-pregnancy BMI, track and discuss weight progress over the course of pregnancy, as well as offer tailored counselling on dietary intake and physical activity. [15] Many countries provide guidance to health care providers in the form of evidence-based guidelines in order to support them in providing physical activity and nutrition counselling to pregnant women. [16] [17-19]

There is growing evidence to suggest that the quality of GWG counselling interactions needs improvement, as women and health care providers report conflicting views of these interactions. [20] Many women report that their health care provider did not provide recommendations for GWG during their prenatal care, nor provide counselling about nutrition and physical activity behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive approach, initiating a discussion about weight in pregnancy only after weight exceeds the recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical prenatal visit.[23]

Women may see a variety of health care provider disciplines for prenatal care including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is some evidence to suggest that the approach to GWG counselling may vary by health care provider discipline [28, 29]; however, this area has not been fully explored. In order to better support health care providers to have positive GWG counselling interactions with women, there needs to be a detailed understanding of current practices, and what is influencing these practices. This information can be used to develop interventions to promote appropriate GWG in routine prenatal care. As such, the objectives of this study were to characterize and compare the GWG

counselling practices of health care providers who provide prenatal care; and to examine potential influences on advice and counselling practices.

Methods

Study design

This study was conducted using a concurrent mixed methods design, consisting of an online survey and semi-structured qualitative interviews. Qualitative and quantitative data were collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well suited for research questions that call for real-life contextual understandings and multi-level influences, and lends well to the development of complex interventions. [31]

Ethics approval for this study was obtained from the Health Research Ethics Board at the University of Alberta. All participants provided informed consent to participate in this study.

Quantitative methods

Survey development

A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health promotion, and health psychology.

Recruitment and data collection

Health care providers including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings from across Canada were recruited through professional associations and networks who agreed to distribute survey information to

their members. All health care providers who provided prenatal care were eligible to participate. The survey was available from December 2014 to May 2015 on Research Electronic Data Capture (REDCap) software hosted at the University of Alberta.[32]

Outcomes

Survey participants provided information about their professional characteristics, and were asked to respond to questions regarding their practices, knowledge, and attitudes related to GWG, nutrition and physical activity. Specifically, participants were asked about the proportion of their pregnant patients with whom they undertook selected GWG counselling practices as outlined in the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients) to 5 (>90% of pregnant patients). Respondents were also asked about their general knowledge to support GWG counselling, their detailed knowledge of practice guidelines related to GWG (specifically the IOM/Health Canada GWG guidelines[33], and Health Canada's nutrition guidelines[34] and physical activity guidelines[35]), and the priority level they placed on discussing, assessing, and assisting women with GWG (e.g., *Given all the issues of concern during a typical prenatal visit, I consider discussing GWG a high priority*). These questions assessed agreement with each statement on a scale from 1 (strongly disagree) to 5 (strongly agree). The survey also examined whether health care providers considered themselves to be the most appropriate person within their practice setting to provide GWG counselling (*I am the most appropriate provider in my practice setting to discuss GWG*).

Data analysis

GWG counselling practices of each health care provider group were calculated as frequency and percentage of responses, dichotomized into "Routine (undertaken with >90% of pregnant

patients)" and "Not routine" (all other response choices) based on the Institute of Medicine recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with missing data were removed from analyses. Principal components analysis was used to reduce the numerous survey questions into a smaller number of factors. The mean score of the items loading onto each factor was used to represent that factor score for respondents. [36] For example, four questions loaded onto a factor that was named "Providing Weight Gain Advice and Discussing Risks" and were averaged together into a composite score for that factor. Mean scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar manner. Differences in mean composite scores were compared among health care provider disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite scores were normally distributed. Mean scores for each factor were used in multiple linear regression models to evaluate the relationship between the predictors of interest and GWG counselling practices. For all models, multicollinearity was not an issue with all tolerance values >0.36 and variance inflation factors <2.8.

Qualitative methods

Outcomes

An interview guide was developed by the study team based on the study objectives and included questions and prompts regarding health care provider practices in relation to GWG, as well as the reasons behind these practices. The interview guide also included questions regarding provider knowledge in and attitudes towards GWG.

Recruitment and data collection

Potential participants were identified through collaborating members of the study team. A sample of maximum variation was recruited to gather the perspectives of health care providers from the different of disciplines practicing in urban or rural locations in two Canadian provinces (Alberta and British Columbia). Interviews were conducted over the telephone, audio-recorded and transcribed verbatim.

Data analysis

Qualitative content analysis was used to describe and inductively interpret the data.[37, 38] Audio recordings and transcripts were reviewed and transcripts were coded line by line. Codes were categorized and re-categorized as patterns emerged. Data analysis occurred concurrently with data collection, and sampling adequacy was demonstrated by saturation of the data, as replication occurred in categories as new participants were included in the analysis.[39] Findings were discussed and approved by the study team.

Data integration

The categories emerging inductively from the interviews were compared with the results from the quantitative survey to determine if findings from each method confirmed the other, as well as to expand the strength of each type of data to better explain the phenomenon.[40]

Results

Participant characteristics

Overall, 1189 health care providers responded to the survey. Of these, 122 did not meet the eligibility criteria, 27 did not specify their health care provider discipline, 155 did not answer any questions beyond practice characteristics, and 377 indicated a health care provider discipline that was outside the scope of these analyses. Thus, 508 responses from general practitioners, obstetricians, midwives, nurse practitioners and registered nurses in primary care settings from across Canada are included in this analysis (Table 1). Twenty-three health care providers from these same disciplines participated in the interviews.

Gestational weight gain counselling practices of health care providers

Providing weight gain advice and discussing risks

A small proportion of health care providers routinely provided women with a weight gain target based on their pre-pregnancy BMI and discussed the recommended rate of weight gain based on their weight gain target (21% and 16%; Table 2). Few indicated that they routinely discussed the impacts of inappropriate weight gain on mother (20%) and baby (19%). The composite score for "Providing weight gain advice and discussing the risks" did not differ between health care provider disciplines (Table 3).

Key concepts and quotes relating to counselling practices that emerged from the interviews are outlined in Table 4. Interviewees described that the first prenatal visit includes measurement of weight, calculation of BMI, and a large amount of information sharing, including general information on GWG. Some health care providers advised women on a total weight gain target; however, this was not always congruent with guidelines. The amount of information provided in the first visit was perceived by the health care providers to be overwhelming for women.

Weight assessment

Approximately three-quarters of health care providers weighed women at every visit (76%), while half would routinely relay weight gain information to women every time they are weighed (Table 2). Midwives reported measuring weight at every visit less frequently than all other disciplines (Table 3).

Interviewees noted that weight was typically measured at each visit, except for midwives who generally measured women's weight if clinically necessary, or if women requested them to do so (Table 4). After the first visit, interview participants indicated that they revisited the topic to varying levels of depth, typically only when the health care provider or woman expressed concern about her weight.

Discussing physical activity and food requirements

Nearly half (46%)of health care providers reported routinely discussing physical activity with women while about one-third routinely discussed appropriate extra food requirements (28%), and only about one-third felt they could routinely give examples of appropriate changes that women could make to meet extra food requirements (32%) (Table 2). In contrast, over two-thirds would discuss the importance of prenatal vitamins (67%). The composite score for the three survey questions regarding discussing physical activity and food requirements differed between health care provider disciplines (Table 3). Midwives did this more frequently than all other disciplines except for nurse practitioners.

Health care providers of all disciplines described providing general information on GWG, physical activity, and nutrition in the early stages of pregnancy, and many indicated providing women with print resources in this area (Table 4). The midwives interviewed described spending more time assessing women's current lifestyle and providing individualized advice than did physicians (Table 4).

Predictors of counselling practices

Health care providers, regardless of discipline, reported similar responses for having appropriate general knowledge of GWG, physical activity, and nutrition, as well as knowledge of related practice guidelines (Table 3); the difference between midwives and registered nurses responses was significant. However, there were significant differences in the level of priority placed on GWG. Midwives and obstetricians had lower composite scores for the priority level they place on GWG than general practitioners and nurse practitioners, but did not differ significantly from each other (Table 3). The majority of health care providers considered discussing GWG with women to be within their role (77%).

Predictors of providing weight gain advice and discussing risks

The composite score for providing weight gain advice and discussing risks of inappropriate weight gain was most strongly related to the priority level that health care providers placed on GWG (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition guidelines.

Many health care providers in the interviews reported that GWG discussions may receive lower priority due to the time constraints in a typical appointment (Table 4). This was related to their compensation method, as general practitioners and obstetricians were remunerated in a fee-for-service model that resulted in restriction on the length of appointments, as well as the topics covered. Midwives were compensated by course-of-care, which resulted in longer and more flexible appointments. However, midwives described a lower priority level placed on GWG, as their practice was less focussed on weight, in particular weight assessment, and more focussed on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity of discussing GWG with pregnant women were also related to their providing weight gain advice and discussing risks (Table 4). Some health care providers noted their discomfort with initiating GWG discussions, or discussing GWG too frequently, as they were concerned that this may cause psychological distress for the woman.

Predictors of discussing physical activity and food requirements

The priority level that health care providers place on GWG, their detailed knowledge of GWG, nutrition, and physical activity guidelines, and their general knowledge of this area were all significantly related to their discussing physical activity and food requirements with women during a prenatal visit. After adjustment for practice characteristics, being a midwife remained a significant predictor of this activity within a prenatal visit.

Midwifery practices in relation to discussing physical activity and food requirements also emerged from the interview data (Table 4). Midwives reported that their approach focussed on overall health and wellness, and centred on support for women. Knowledge was another key

factor that came to light in the interviews, as some health care providers noted a need for additional knowledge, particularly in nutrition and maternal obesity. For health care providers working within a multidisciplinary team, access to dietitian services was an important enhancement to GWG counselling practices.

Discussion

GWG counselling by health care providers falls below the recommendations from the Institute of Medicine and other national health agencies. [15] Although many of the health care providers interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few survey respondents from any discipline routinely provided women with a comprehensive GWG recommendation and advice on rate of weight gain based on their pre-pregnancy BMI. In addition, few survey respondents reported discussing the risks of inappropriate weight gain with women. While many health care providers reported providing a general message of the importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate extra food requirements. Weight was typically measured at each prenatal appointment, but not discussed unless it was a concern.

This study identified that the priority level that health care providers placed on GWG had the strongest relationship with their practices. The qualitative results provided context to this finding, linking the priority level of GWG to the time available in a typical prenatal appointment, and the compensation that health care providers receive for their time. As well, this study identified the importance of detailed knowledge of practice guidelines, which also was strongly associated with counselling practices.

A novel finding was documentation of the different approach reported by midwives. Midwives noted that their focus on the overall wellbeing of the women meant they discussed physical activity and nutrition in more depth than did physicians, and they measured weight less frequently. Even after controlling for multiple other predictors, being a midwife remained a significant predictor of discussing physical activity and food requirements with women during routine prenatal care. Future studies should focus on learning about the quality of these discussions and evaluating their impact on gestational weight gain, health behaviours, and women's perceptions of support. This additional information could help guide or refine approaches to antenatal care undertaken by different groups of care providers.

A major strength of this study is the use of mixed research methods. This allowed for verification of findings between methods, and provided a broader picture of "who is doing what", as well as "why and how are they doing it". To our knowledge, this is the largest and most comprehensive survey on this topic to date. While prenatal care varies between countries, the topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.

This study has limitations that should be considered. It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks. While this method of recruitment allowed for a wider reach, and ultimately more responses, those who responded may be more likely to engage in activities related to GWG counselling. This could lead to inflation of the reported frequency

of specific GWG counselling practices. This is concerning as they are already quite low for some counselling practices and further highlights the need for targeted interventions in this area.

The qualitative interviews were only conducted in two provinces, and there is the potential that this does not accurately capture the practices and predictors in other geographic areas. However, the congruency of the qualitative and quantitative findings suggests that this is unlikely. Furthermore, a recent systematic review found few differences in barriers and facilitators to pregnancy weight management in studies from around the world, suggesting that the findings of the current study may help inform practice in various health care systems.[41]

To our knowledge, this is the first mixed methods study to examine GWG counselling, in particular for the specific counselling practices recommended by the Institute of Medicine. While survey and qualitative research studies from various parts of the world have also found low rates of GWG counselling as reported by patients, other surveys of health care providers have found high self-reported rates of counselling.[20, 28] This discrepancy may due to the frequency with which health care providers undertake counselling, as studies from the US have found that health care providers report discussing GWG more often with women who are overweight or obese to begin pregnancy.[24] Therefore, they may report that they provide GWG counselling, but not to every pregnant woman. Further, when the depth of this counselling is explored, the self-reported rates are likely to diminish.

In other research, patients of midwives were more likely to recall having discussed physical activity with their health care provider as compared to patients of general practitioners and

obstetricians,[29] and midwives themselves report providing physical activity counselling to women more frequently than other disciplines.[20, 28] While the present study considered physical activity and nutrition counselling practices as one composite score, there seems to be growing evidence that midwives provide more lifestyle counselling than other health care provider disciplines. Expanding discussions on GWG to a healthier lifestyle is highly relevant given the growing body of evidence related to their impact on disease in later life.[10] Whether other health care providers can adopt similar practices remains to be determined, but regardless, providers across disciplines require knowledge of GWG, physical activity, and nutrition guidelines and may need system-level changes such as more time in an appointment to help them make it a priority in their practice. A different model for dissemination of this knowledge needs consideration. Multidisciplinary clinics that include professionals with a background in nutrition and physical activity, and group educational sessions may be important in this regard. The latter approach could allow participants to discuss these issues amongst themselves and may provide positive reinforcement of new knowledge and help to shift old beliefs.[42] Further, discussion of healthy GWG and maintenance of a healthy weight trajectory with women by health providers is a missed opportunity for positive feedback for a healthy and potentially long-term behavior.

This study identified predictors of GWG counselling at the individual and health care system level. At the individual level, health care providers' attitudes towards GWG was related to practices, including the level of priority they placed on GWG, and their perception of GWG as a sensitive topic to discuss. As well, health care providers' knowledge, and in particular their detailed knowledge of practice guidelines, was related to the frequency of GWG counselling. At the system level, the compensation method impacted the amount of time they had in a typical

prenatal appointment, which in turn was related to the priority level they placed on GWG and ultimately the frequency and depth of their counselling. Another important consideration is the differences in practices, and influences on practices, by health care provider discipline. Interventions to implement best practices should consider the multi-level influences on GWG counselling practices, as well as the discipline of the health care provider, in order to be effective at changing health care provider behaviours.

While the Institute of Medicine's recommendations for implementing their GWG guidelines were based on expert consensus, research is needed to elucidate the most effective counselling methods and promising practices to recommend and help women achieve in order to promote appropriate GWG. Supporting health care providers to better counsel their pregnant patients on appropriate GWG is one important step towards improving the health of generations to come.

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Authors' contributions

RCB and HN designed the study, and with MV and HPV developed the interview guide and survey questionnaire. JM and HN recruited interview participants and conducted the interviews. JM recruited survey participants, conducted the qualitative and quantitative analyses and wrote the first draft of the manuscript. HN and RCB contributed to the qualitative analysis and TB and RCB contributed to quantitative analysis. VJ contributed to recruitment of interview participants. All authors made significant contributions to the critical review and revisions of the manuscript. JM and RCB are the guarantors of the manuscript. All authors had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JM affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted.

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Conflict of interest

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

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Data Sharing:

The data used for these analyses are not currently available for public use.

Table 1. Characteristics of participating Canadian health care providers.

	Survey Participants N=508		Interview Participants N=23	
	n	%	n	%
Health care provider discipline				
General Practitioner	159	31%	7	30%
Obstetrician	139	27%	5	22%
Midwife	97	19%	5	22%
Nurse Practitioner	38	7%	2	9%
Registered Nurse - Primary Care	75	15%	4	17%
Province				
British Columbia	55	11%	9	39%
Alberta	149	30%	14	61%
Saskatchewan and Manitoba	56	11%		N/A
Ontario	168	33%		
Quebec	17	3%		
Maritimes*	47	9%		
Territories*	11	2%		
Location of practice				
Urban	296	58%		N/C
Rural	125	25%		
Urban and rural	86	17%		
Proportion of all patients who are pregnant women				
<10%	103	20%		N/C
10-30%	94	19%		
30-60%	119	23%		
60-90%	46	9%		
>90%	146	29%		
Stage of pregnancy at first visit				
Before pregnancy	30	6%		N/C
First trimester	328	65%		
Second trimester	74	15%		
Third trimester	34	7%		
Don't know/too variable to say	41	8%		

**Maritimes=Newfoundland and Labrador, New Brunswick, Nova Scotia*
**Territories=Northwest Territories, Yukon Territory (no respondents from Nunavut)*
N/A=Not applicable
N/C=Data not collected

Table 2. Survey responses regarding gestational weight gain counselling practices routinely undertaken (with >90% of pregnant patients) by Canadian health care providers.

	Health care provider discipline[1]										All	
	GP		OB		MW		NP		RN			
	n	%	n	%	n	%	n	%	n	%	n	%
I provide women with a weight gain target based on their pre-pregnancy BMI												
	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												
	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												
	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												
	21	13%	30	22%	21	22%	15	40%	10	14%	97	19%
										Missing	7	1%
I weigh women at every visit												
	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												
	82	52%	62	45%	38	40%	25	66%	41	57%	248	50%
										Missing	7	1%
I discuss appropriate physical activity with pregnant women												
	75	48%	53	38%	61	64%	20	53%	22	31%	231	46%
										Missing	7	1%
I discuss appropriate extra food requirements with pregnant women												
	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												
	40	26%	30	22%	48	50%	17	46%	23	32%	158	32%
										Missing	9	2%
I discuss the importance of taking prenatal vitamins												
	124	79%	85	61%	49	51%	34	90%	44	61%	336	67%
										Missing	6	1%

[1]*GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse*

Table 3. Composite scores for gestational weight gain counselling practices and influences on practices compared by health care provider discipline

	Health care provider discipline[1] Mean (Standard Deviation)					All	Sig.	Post-hoc
	GP	OB	MW	NP	RN			
Providing weight gain advice and discussing the risks	2.95 (1.1)	3.03 (1.2)	2.95 (1.2)	2.91 (1.5)	2.54 (1.3)	2.91 (1.2)	0.072	N/A
Weighing women at every visit	4.87 (0.54)	4.75 (0.80)	3.36 (1.56)	4.61 (1.10)	4.03 (1.55)	4.41 (1.22)	<0.001	MW < All**
Discussing physical activity and food requirements	3.65 (1.1)	3.37 (1.1)	4.23 (0.8)	3.81 (1.1)	3.31 (1.4)	3.65 (1.1)	<0.001	MW> (GP, OB, RN)**
General knowledge in GWG, physical activity, and nutrition	3.50 (0.75)	3.61 (0.75)	3.77 (0.70)	3.42 (0.80)	3.36 (0.94)	3.56 (0.78)	0.017	MW > RN*
Detailed knowledge of GWG, physical activity, and nutrition guidelines	2.85 (0.98)	2.96 (0.91)	3.22 (0.88)	2.85 (1.02)	3.00 (1.01)	2.97 (0.95)	0.047	MW > GP*
Priority level of discussing, assessing, and assisting women with appropriate weight gain	4.09 (0.61)	3.82 (0.82)	3.59 (0.86)	3.8 (0.87)	4.25 (0.65)	3.89 (0.78)	<0.001	MW< (GP, NP)** OB- (GP, NP)*

*[1]GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse; *Significant at 0.05; **Significant at 0.01; Scale of 1=lowest to 5=highest score*
Compared by one-way ANOVA

Table 4. Overarching categories and key concepts emerging from qualitative content analysis of interviews with health care providers.

Category	Concept	Representative quote(s)
Practices	The first visit involves a large amount of information sharing	"That's the trouble with prenatal care. There's so much information that women need, especially in the first trimester. Genetic screening, and lifestyle, and alcohol, and smoking, and family, and you know, on and on and on." - General Practitioner
	Weight is assessed routinely, but not discussed in detail unless there is a concern	"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
	Midwives have a different approach to gestational weight gain	"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 they can be empowered to make healthy choices." - Midwife "I feel like it's really important to discuss healthy eating and exercise, but the actual focus on the weight gain and the number of pounds that a woman should gain, I don't really feel that's important at all, that piece of it." - Midwife
Individual level influences on practice	Priority level	"But certainly there are definitely times where I feel constricted by time. I think nutrition and exercise is a huge priority, so that's just my personal opinion. I think that I wouldn't - I don't know, I would make the time." - Midwife
	Sensitivity of the discussion	"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
	General knowledge of gestational weight gain, nutrition, and	"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

	physical activity	every two years for an hour on it." - Obstetrician
	Detailed knowledge of practice guidelines	"I have to know so many rules about all sorts of things. I always kind of go by, you know, 5, 10, 15. So those three numbers I remember, 5, 10, 15. If you're overweight, if your BMI is higher than, you know, 26 or 27, or higher than 28 or so, I would say, 5 kilos. If your weight is pretty well normal I'd say 10 kilos. And if your weight is under I'd say 15 kilos." - General Practitioner
System level influences on practice	Time and compensation	"And that's a different model 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." - Midwife "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 ten to 15 minutes long." - General Practitioner
	Access to allied health services	*"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

Table 5. Predictors of Canadian health care providers providing advice to pregnant women about gestational weight gain and discussing risks of inappropriate weight gain during a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	-1.14**	0.38	
General practitioner *(reference)*			
Obstetrician	0.242	0.145	0.093
Midwife	-0.076	0.199	-0.026
Primary care RN	-0.029	0.177	-0.008
Nurse Practitioner	-0.057	0.206	-0.012
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.26**	0.069	0.202
General knowledge in GWG, physical activity, and nutrition	0.098	0.081	0.065
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.71**	0.071	0.459
Role (I am the most appropriate provider to discuss gestational weight gain)	0.172	0.133	0.056
R^2	0.392		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, Proportion of all patients who are pregnant, and trimester of pregnancy at first visit.*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

Table 6. Predictors of Canadian health care providers discussing physical activity and food requirements with women as part of a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	0.688	0.345	
General practitioner *(reference)*			
Obstetrician	0.022	0.13	0.009
Midwife	0.518**	0.179	0.192
Primary care RN	0	0.160	0
Nurse Practitioner	0.342	0.189	0.077
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.277**	0.063	0.229
General knowledge in GWG, physical activity, and nutrition	0.311**	0.073	0.22
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.341**	0.064	0.236
Role (I am the most appropriate provider to discuss gestational weight gain)	0.18	0.12	0.063
R^2	0.434		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, proportion of all patients who are pregnant, and trimester of pregnancy at first visit*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

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Health care provider's gestational weight gain counselling practices and the influence of knowledge and attitudes: A cross-sectional mixed methods study

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Health care provider's gestational weight gain counselling practices and the influence of knowledge and attitudes: A cross-sectional mixed methods study

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Abstract

Objective: To understand current gestational weight gain (GWG) counselling practices of health care providers, and the relationships between practices, knowledge and attitudes.

Design: Concurrent mixed methods with data integration: cross-sectional survey and semi-structured interviews.

Participants: Prenatal health care providers in Canada: general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings.

Results: Typically, GWG information was provided early in pregnancy, but not discussed again unless there was a concern. Few routinely provided women with individualized GWG advice (21%), rate of GWG (16%), or discussed the risks of inappropriate GWG 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 appointment times which allowed them to provide more in-depth counselling. Regression results identified that the higher priority level that health care providers place on GWG, the more likely they were to report providing GWG advice and discussing risks of GWG outside recommendations ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of GWG to length of appointments, financial compensation methods for health care providers, and the midwifery versus medical model of care.

Conclusions: Interventions for health care providers to enhance GWG counselling practices should consider the range of factors that influence the priority level health care providers place on GWG counselling.

Strengths and Limitations Of This Study: (max 5 bullet points)

- This is a large and in-depth examination and comparison of health care providers' practices related to monitoring and discussing GWG with pregnant women,
- This study is enhanced by the use of mixed methods. Mixed methods research is well suited for health services, which are complex and influenced by multiple factors.
- The findings from this study may have a wide applicability, as the topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.
- It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks although these methods allowed for wider reach and more responses.
- Those who responded may be more likely to engage in activities related to GWG counselling which could lead to inflation of the reported frequency of specific GWG counselling practices.. Nevertheless, the rates of some counselling practices reported in this study are quite low.

Introduction

Supporting all women to achieve healthy gestational weight gain (GWG) is of clinical importance because GWG lower or higher than recommended is linked to a range of poor maternal, fetal, and childhood outcomes. [1] For mothers, excess GWG increases the risk of gestational diabetes mellitus and hypertensive disorders in pregnancy, and this is of special concern if excessive GWG occurs early in pregnancy. [2-4] Excess GWG also poses risks at delivery for the mother including increased likelihood of needing an instrumental delivery or a Caesarean section, and surgical morbidity and mortality. [1, 3] Further, these factors result in an increased risk for the fetus and neonate including the adverse consequences of macrosomia and shoulder dystocia, need for intensive care unit admission, and the risk of perinatal death. [1, 3] [5] In the long term, the child is at risk of an altered growth trajectory that may lead to obesity. [6, 7] Excess GWG 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. [1] [8] The cycle of excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to increased risk in each subsequent pregnancy.[9] These risks act synergistically resulting in a higher risk of metabolic and cardiovascular disease in later life for the mother as well as the child.[10] Thus, excess GWG has short term, long term and intergenerational effects. [11]

To mitigate the risks of inappropriate GWG, many countries, including Canada, have released GWG guidelines. [12] [13] Many of these are based on the Institute of Medicine (USA) guidelines for GWG in pregnancy, which outline a range of total GWG over the course of pregnancy that is associated with optimal health outcomes for mother and child. [14] In order for these guidelines to be of benefit to pregnant women, the Institute of Medicine recommends that health care providers advise women on the recommended range of GWG based on pre-

pregnancy BMI, and that they track and discuss weight progress over the course of pregnancy, as well as offering tailored counselling on dietary intake and physical activity. [15] Many countries provide guidance to health care providers in the form of evidence-based guidelines in order to support them in providing physical activity and nutrition counselling to pregnant women. [16] [17-19]

There is growing evidence to suggest that the quality of GWG counselling interactions needs improvement, as women and health care providers report conflicting views of these interactions. [20] Many women report that their health care provider did not provide recommendations for GWG during their prenatal care, nor provide counselling about nutrition and physical activity behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive approach, initiating a discussion about weight in pregnancy only after weight exceeds the recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical prenatal visit.[23]

Women may see a variety of health care provider disciplines for prenatal care including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is some evidence to suggest that the approach to GWG counselling may vary by health care provider discipline [28, 29]; however, this area has not been fully explored. In order to better support health care providers to have positive GWG counselling interactions with women, there needs to be a detailed understanding of current practices, and what is influencing these practices. This information can be used to develop interventions to promote appropriate GWG in routine prenatal care. As such, the objectives of this study were to characterize and compare the GWG

counselling practices of health care providers who provide prenatal care; and to examine potential influences on advice and counselling practices.

Methods

Study design

This study was conducted using a concurrent mixed methods design, consisting of an online survey and semi-structured qualitative interviews. Qualitative and quantitative data were collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well suited for research questions that call for real-life contextual understandings and multi-level influences, and lends itself well to the development of complex interventions. [31]

Ethics approval for this study was obtained from the Health Research Ethics Board at the University of Alberta (Study Identification Pro00045899). All participants provided informed consent to participate in this study.

Quantitative methods

Survey development

A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health promotion, and health psychology (Supplementary file).

Recruitment and data collection

Health care providers including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings from across Canada were recruited

through professional associations and networks who agreed to distribute survey information to their members. All health care providers who provided prenatal care were eligible to participate. The survey was available from December 2014 to May 2015 on Research Electronic Data Capture (REDCap) software hosted at the University of Alberta.[32]

Outcomes

Survey participants provided information about their professional characteristics, and were asked to respond to questions regarding their practices, knowledge, and attitudes related to GWG, nutrition and physical activity. Specifically, participants were asked about the proportion of their pregnant patients with whom they undertook selected GWG counselling practices as outlined in the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients) to 5 (>90% of pregnant patients). Respondents were also asked for their self-assessment of their general knowledge to support GWG counselling, their detailed knowledge of the content of practice guidelines related to GWG (specifically the IOM/Health Canada GWG guidelines[33], and Health Canada's nutrition guidelines[34] and physical activity guidelines[35]), and the priority level they placed on discussing, assessing, and assisting women with GWG (e.g., *Given all the issues of concern during a typical prenatal visit, I consider discussing GWG a high priority*). Responses indicated level of agreement with each statement on a scale from 1 (strongly disagree) to 5 (strongly agree). The survey also examined whether health care providers considered themselves to be the most appropriate person within their practice setting to provide GWG counselling (*I am the most appropriate provider in my practice setting to discuss GWG*).

Data analysis

GWG counselling practices of each health care provider group were calculated as frequency and percentage of responses, dichotomized into "Routine (undertaken with >90% of pregnant patients)" and "Not routine" (all other response choices) based on the Institute of Medicine recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with missing data were removed from analyses. Principal components analysis was used to reduce the numerous survey questions into a smaller number of factors. The mean score of the items loading onto each factor was used to represent that factor score for respondents. [36] For example, four questions loaded onto a factor that was named "Providing Weight Gain Advice and Discussing Risks" and were averaged together into a composite score for that factor. Mean scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar manner. Differences in mean composite scores were compared among health care provider disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite scores were normally distributed. Mean scores for each factor were used in multiple linear regression models to evaluate the relationship between the predictors of interest and GWG counselling practices. For all models, multicollinearity was not an issue with all tolerance values >0.36 and variance inflation factors <2.8.

Qualitative methods

Materials

A semi-structured interview guide was developed by the study team based on the study objectives and included questions and prompts regarding health care provider practices in

relation to GWG, as well as the reasons behind these practices. The interview guide also included questions regarding provider knowledge in and attitudes towards GWG.

Recruitment and data collection

Potential participants were identified through collaborating members of the study team. A purposive sample of maximum variation was recruited to gather the perspectives of health care providers from the different disciplines practicing in urban or rural locations in two Canadian provinces (Alberta and British Columbia). When these contacts were exhausted, an advertisement was distributed by email to medical clinics relevant to the requirements for variability in the sample. Interviews were conducted over the telephone, audio-recorded and transcribed verbatim.

Data analysis

Qualitative content analysis was used to describe and inductively interpret the data.[37, 38] 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". [39](p.45) Audio recordings and transcripts were reviewed, and reviewed again while making notes about key words and phrases. Key concepts were categorized and re-categorized as patterns emerged. Data analysis occurred concurrently with data collection, and sampling adequacy was demonstrated by saturation of the data, as replication occurred in categories as new participants were included in the analysis.[40] Findings were discussed and approved by the study team.

Data integration

The categories emerging inductively from the interviews were compared with the results from the quantitative survey to determine if findings from each method confirmed the other, as well as to expand the strength of each type of data to better explain the phenomenon.[41]

Results

Participant characteristics

Overall, 1189 health care providers responded to the survey. Of these, 122 did not meet the eligibility criteria (i.e. did not see pregnant women in their practice), 27 did not specify their health care provider discipline, 155 did not answer any questions beyond practice characteristics, and 377 indicated a health care provider discipline that was outside the scope of these analyses. Thus, 508 responses from general practitioners, obstetricians, midwives, nurse practitioners and registered nurses in primary care settings from across Canada are included in this analysis (Table 1). Twenty-three health care providers from these same disciplines participated in the interviews.

Gestational weight gain counselling practices of health care providers

Providing weight gain advice and discussing risks

A small proportion of health care providers routinely provided women with a GWG target based on their pre-pregnancy BMI and discussed the recommended rate of GWG based on their GWG target (21% and 16%; Table 2). Few indicated that they routinely discussed the impacts of inappropriate GWG on mother (20%) and baby (19%). The composite score for "Providing weight gain advice and discussing the risks" did not differ between health care provider disciplines (Table 3).

Key concepts and quotes relating to counselling practices that emerged from the interviews are outlined in Table 4. Interviewees described the first prenatal visit as including measurement of weight, calculation of BMI, and a large amount of information sharing, including general information on GWG. Some health care providers advised women on a total GWG target; however, this was not always congruent with guidelines. The amount of information provided in the first visit was perceived by the health care providers to be overwhelming for women.

Weight assessment

Approximately three-quarters of respondents weighed women at every visit (76%), while half of respondents would routinely relay GWG information to women every time they are weighed (Table 2). Midwives reported measuring weight at every visit less frequently than all other disciplines (Table 3).

Interviewees noted that weight was typically measured at each visit, except for midwives who generally measured women's weight if clinically necessary, or if women requested them to do so (Table 4). After the first visit, interview participants indicated that they revisited the topic to varying levels of depth, typically only when the health care provider or woman expressed concern about her weight.

Discussing physical activity and food requirements

Nearly half (46%)of health care providers reported routinely discussing physical activity with women while about one-third routinely discussed appropriate extra food requirements (28%), and only about one-third felt they could routinely give examples of appropriate changes that

women could make to meet extra food requirements (32%) (Table 2). In contrast, over two-thirds would discuss the importance of prenatal vitamins (67%). The composite score for the three survey questions regarding discussing physical activity and food requirements differed between health care provider disciplines (Table 3). Midwives did this more frequently than all other disciplines except for nurse practitioners.

Health care providers of all disciplines described providing general information on GWG, physical activity, and nutrition in the early stages of pregnancy, and many indicated providing women with printed resources in this area (Table 4). The midwives interviewed described spending more time assessing women's current lifestyle and providing individualized advice than did physicians (Table 4).

Predictors of counselling practices

Health care providers, regardless of discipline, reported similar responses for having appropriate general knowledge of GWG, physical activity, and nutrition, as well as knowledge of related practice guidelines (Table 3); only the difference between midwives and registered nurses responses was significant. There were significant differences in the level of priority placed on GWG. Midwives and obstetricians had lower composite scores for the priority level they place on GWG than general practitioners and nurse practitioners, but did not differ significantly from each other (Table 3). The majority of health care providers considered discussing GWG with women to be within their role (77%).

Predictors of providing weight gain advice and discussing risks

The composite score for providing weight gain advice and discussing risks of inappropriate GWG was most strongly related to the priority level that health care providers placed on GWG (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition guidelines.

Generally, health care providers in the interviews reported that GWG discussions may receive lower priority due to the time constraints in a typical appointment (Table 4). This was related to their compensation method, as general practitioners and obstetricians were remunerated in a fee-for-service model that resulted in restriction on the length of appointments, as well as the topics covered. Midwives were compensated by course-of-care, which resulted in longer and more flexible appointments. However, midwives described a lower priority level placed on GWG, as their practice was less focussed on weight, in particular weight assessment, and more focussed on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity of discussing GWG with pregnant women were also related to their providing weight gain advice and discussing risks (Table 4). Some health care providers noted their discomfort with initiating GWG discussions, or discussing GWG too frequently, as they were concerned that this may cause psychological distress for the woman.

Predictors of discussing physical activity and food requirements

The priority level that health care providers place on GWG, their detailed knowledge of GWG, nutrition, and physical activity guidelines, and their general knowledge of this area were all significantly related to their discussing physical activity and food requirements with women

during a prenatal visit (Table 6). After adjustment for practice characteristics, being a midwife remained a significant predictor of this activity within a prenatal visit.

Midwifery practices in relation to discussing physical activity and food requirements also emerged from the interview data (Table 4). Midwives reported that their approach focussed on overall health and wellness, and centred on support for women. Knowledge was another key factor that came to light in the interviews, as some health care providers noted a need for additional knowledge, particularly in nutrition and maternal obesity. For health care providers working within a multidisciplinary team, access to dietetic services was an important enhancement to GWG counselling practices.

Discussion

GWG counselling by health care providers falls below the recommendations from the Institute of Medicine and other national health agencies. [15] Although many of the health care providers interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few survey respondents from any discipline routinely provided women with a comprehensive GWG recommendation and advice on their rate of GWG based on their pre-pregnancy BMI. In addition, few survey respondents reported discussing the risks of inappropriate GWG with women. While many health care providers reported providing a general message of the importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate extra food requirements. Weight was typically measured at each prenatal appointment, but not discussed unless it was a concern. This is in contrast with what women report they need from their health care provider, as other studies from our research group have indicated that women

would like their health care provider to initiate a discussion about GWG early in pregnancy, and continue the discussions throughout pregnancy and postpartum so that they are updated on their GWG progress. [22]

The low rates of some of these counselling practices are concerning since it is possible that survey respondents are those most likely to counsel women about GWG. There is evidence suggesting that women who's health care providers discuss GWG and related lifestyle behaviours in pregnancy with them have lower GWG and lower likelihood of having a baby that is large for gestational age. [42-44] This underlines the potential level of influence that health care providers have with pregnant women and the importance of refining health care providers training or antenatal care pathways to support such conversations.

To our knowledge, this is the first mixed methods study to examine GWG counselling, in particular for the specific counselling practices recommended by the Institute of Medicine. While survey and qualitative research studies from various parts of the world have also found low rates of GWG counselling as reported by patients, other surveys of health care providers have found high self-reported rates of counselling.[20, 28] This discrepancy may due to the frequency with which health care providers undertake counselling, as studies from the US have found that health care providers report discussing GWG more often with women who are overweight or obese to at the start of their pregnancy.[24] Therefore, they may report that they provide GWG counselling, but not to every pregnant woman. Further, when the depth of this counselling is explored, the self-reported rates are likely to diminish. Future studies should objectively assess the quality of these discussions and evaluate their impact on GWG, health

behaviours like physical activity and diet, and women's perceptions of support. Furthermore, research is needed to elucidate the most effective counselling methods that will help women achieve appropriate GWG. This additional information could help guide or refine approaches to antenatal care undertaken by different groups of care providers.

This study identified multi-level influences on GWG counselling. Most notably, the priority level that health care providers placed on GWG had the strongest relationship with their practices. The qualitative results provided context to this finding, linking the priority level of GWG to factors at the health care system level, such as the time available in a typical prenatal appointment, and the compensation that health care providers receive for their time. Additionally, this study identified factors at the individual level. This included the importance of detailed knowledge of practice guidelines, which also was strongly associated with counselling practices.

One novel finding was the new insights into the different approach reported by midwives. Midwives noted that their focus on the overall wellbeing of the women meant they discussed physical activity and nutrition in more depth than did physicians, and they measured weight less frequently. Even after controlling for multiple other predictors, midwives were significantly more likely than other health care providers to report discussing physical activity and food requirements with women during routine prenatal care. In other research, patients of midwives were more likely to recall having discussed physical activity with their health care provider as compared to patients of general practitioners and obstetricians,[29] and midwives themselves report providing physical activity counselling to women more frequently than other

disciplines.[20, 28] While the present study considered physical activity and nutrition counselling practices as one composite score, there seems to be growing evidence that midwives provide more lifestyle counselling than other health care provider disciplines. The impact of counselling by a midwife as compared to other disciplines on the health outcomes for women is an area for future exploration.

Strengths and Limitations

A major strength of this study is the use of mixed research methods. This allowed for some verification of findings between methods, and provided a broader picture of "who is doing what", as well as "why and how are they doing it". To our knowledge, this is the largest and most comprehensive survey on this topic to date. While prenatal care varies between countries, the topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.

This study has limitations that should be considered. It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks. While this method of recruitment allowed for a wider reach, and ultimately more responses, those who responded may be more likely to engage in activities related to GWG counselling. This could lead to inflation of the reported frequency of specific GWG counselling practices. This is concerning as they are already quite low for some counselling practices and further highlights the need for targeted interventions in this area.

The qualitative interviews were only conducted in two provinces, and there is the potential that this does not accurately capture the practices and predictors in other geographic areas. However, the congruency of the qualitative and quantitative findings suggests that this is unlikely. Furthermore, a recent systematic review found few differences in barriers and facilitators to pregnancy weight management in studies from around the world, suggesting that the findings of the current study may help inform practice in various health care systems.[45]

Recommendations

Interventions to implement best practices should consider the multi-level influences on GWG counselling practices, as well as the discipline of the health care provider, in order to be effective at changing health care provider behaviours. Providers across disciplines require knowledge of GWG, physical activity, and nutrition guidelines and some may need system-level changes such as more time in an appointment to help them make it a priority in their practice. A different model for dissemination of this knowledge needs consideration. Multidisciplinary clinics that include professionals with a background in nutrition and physical activity, and group educational sessions may be important in this regard. The latter approach could allow participants to discuss these issues amongst themselves and may provide positive reinforcement of new knowledge and help to shift old beliefs.[42] Furthermore, discussion of healthy GWG and maintenance of a healthy weight trajectory with women by health providers is a missed opportunity for positive feedback for a healthy and potentially long-term behaviour.

Expanding discussions on GWG to a healthier lifestyle is highly relevant given the growing body of evidence related to its impact on disease in later life.[10] Health care providers are well

positioned to help women identify plans to help change behaviour and improve health outcomes. Strong communication between health care providers and pregnant women is a key component to moving forward. Supporting health care providers to better counsel their pregnant patients on appropriate GWG is one important step towards breaking the intergenerational cycle of obesity, and improving the health of generations to come.

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Authors' contributions

RCB and HN designed the study, and with MV and HPV developed the interview guide and survey questionnaire. JM and HN recruited interview participants and conducted the interviews. JM recruited survey participants, conducted the qualitative and quantitative analyses and wrote the first draft of the manuscript. HN and RCB contributed to the qualitative analysis and TB and RCB contributed to quantitative analysis. VJ contributed to recruitment of interview participants. All authors made significant contributions to the critical review and revisions of the manuscript. JM and RCB are the guarantors of the manuscript. All authors had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JM affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted.

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Conflict of interest

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

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Table 1. Characteristics of participating Canadian health care providers.

	Survey Participants N=508		Interview Participants N=23	
	n	%	n	%
Health care provider discipline				
General Practitioner	159	31%	7	30%
Obstetrician	139	27%	5	22%
Midwife	97	19%	5	22%
Registered Nurse - Primary Care	75	15%	4	17%
Nurse Practitioner	38	7%	2	9%
Province				
British Columbia	55	11%	9	39%
Alberta	149	30%	14	61%
Saskatchewan and Manitoba	56	11%		N/A
Ontario	168	33%		
Quebec	17	3%		
Maritimes*	47	9%		
Territories*	11	2%		
Location of practice				
Urban	296	58%		N/C
Rural	125	25%		
Urban and rural	86	17%		
Proportion of all patients who are pregnant women				
<10%	103	20%		N/C
10-30%	94	19%		
30-60%	119	23%		
60-90%	46	9%		
>90%	146	29%		
Stage of pregnancy at first visit				
Before pregnancy	30	6%		N/C
First trimester	328	65%		
Second trimester	74	15%		
Third trimester	34	7%		
Don't know/too variable to say	41	8%		

**Maritimes=Newfoundland and Labrador, New Brunswick, Nova Scotia*
**Territories=Northwest Territories, Yukon Territory (no respondents from Nunavut)*
N/A=Not applicable
N/C=Data not collected

Table 2. Survey responses regarding gestational weight gain counselling practices routinely undertaken (with >90% of pregnant patients) by Canadian health care providers.

	Health care provider discipline[1]										All	
	GP		OB		MW		NP		RN			
	n	%	n	%	n	%	n	%	n	%	n	%
I provide women with a weight gain target based on their pre-pregnancy BMI												
	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												
	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												
	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												
	21	13%	30	22%	21	22%	15	40%	10	14%	97	19%
										Missing	7	1%
I weigh women at every visit												
	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												
	82	52%	62	45%	38	40%	25	66%	41	57%	248	50%
										Missing	7	1%
I discuss appropriate physical activity with pregnant women												
	75	48%	53	38%	61	64%	20	53%	22	31%	231	46%
										Missing	7	1%
I discuss appropriate extra food requirements with pregnant women												
	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												
	40	26%	30	22%	48	50%	17	46%	23	32%	158	32%
										Missing	9	2%
I discuss the importance of taking prenatal vitamins												
	124	79%	85	61%	49	51%	34	90%	44	61%	336	67%
										Missing	6	1%

[1]*GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse*

Table 3. Composite scores for gestational weight gain counselling practices and influences on practices compared by health care provider discipline

	Health care provider discipline[1] Mean (Standard Deviation)					All	Sig.	Post-hoc
	GP	OB	MW	NP	RN			
Providing weight gain advice and discussing the risks	2.95 (1.1)	3.03 (1.2)	2.95 (1.2)	2.91 (1.5)	2.54 (1.3)	2.91 (1.2)	0.072	N/A
Weighing women at every visit	4.87 (0.54)	4.75 (0.80)	3.36 (1.56)	4.61 (1.10)	4.03 (1.55)	4.41 (1.22)	<0.001	MW < All**
Discussing physical activity and food requirements	3.65 (1.1)	3.37 (1.1)	4.23 (0.8)	3.81 (1.1)	3.31 (1.4)	3.65 (1.1)	<0.001	MW> (GP, OB, RN)**
General knowledge in GWG, physical activity, and nutrition	3.50 (0.75)	3.61 (0.75)	3.77 (0.70)	3.42 (0.80)	3.36 (0.94)	3.56 (0.78)	0.017	MW > RN*
Detailed knowledge of GWG, physical activity, and nutrition guidelines	2.85 (0.98)	2.96 (0.91)	3.22 (0.88)	2.85 (1.02)	3.00 (1.01)	2.97 (0.95)	0.047	MW > GP*
Priority level of discussing, assessing, and assisting women with appropriate weight gain	4.09 (0.61)	3.82 (0.82)	3.59 (0.86)	3.8 (0.87)	4.25 (0.65)	3.89 (0.78)	<0.001	MW< (GP, NP)** OB- (GP, NP)*

*[1]GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse; *Significant at 0.05; **Significant at 0.01; Scale of 1=lowest to 5=highest score*
Compared by one-way ANOVA

Table 4. Overarching categories and key concepts emerging from qualitative content analysis of interviews with health care providers.

Category	Concept	Representative quote(s)
Practices	The first visit involves a large amount of information sharing	"That's the trouble with prenatal care. There's so much information that women need, especially in the first trimester. Genetic screening, and lifestyle, and alcohol, and smoking, and family, and you know, on and on and on." - General Practitioner
	Weight is assessed routinely, but not discussed in detail unless there is a concern	"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
	Midwives have a different approach to gestational weight gain	"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 they can be empowered to make healthy choices." - Midwife "I feel like it's really important to discuss healthy eating and exercise, but the actual focus on the weight gain and the number of pounds that a woman should gain, I don't really feel that's important at all, that piece of it." - Midwife
Individual level influences on practice	Priority level	"But certainly there are definitely times where I feel constricted by time. I think nutrition and exercise is a huge priority, so that's just my personal opinion. I think that I wouldn't - I don't know, I would make the time." - Midwife
	Sensitivity of the discussion	"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
	General knowledge of gestational weight gain, nutrition, and	"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

	physical activity	every two years for an hour on it." - Obstetrician
	Detailed knowledge of practice guidelines	"I have to know so many rules about all sorts of things. I always kind of go by, you know, 5, 10, 15. So those three numbers I remember, 5, 10, 15. If you're overweight, if your BMI is higher than, you know, 26 or 27, or higher than 28 or so, I would say, 5 kilos. If your weight is pretty well normal I'd say 10 kilos. And if your weight is under I'd say 15 kilos." - General Practitioner
System level influences on practice	Time and compensation	"And that's a different model 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." - Midwife "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 ten to 15 minutes long." - General Practitioner
	Access to allied health services	"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

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Table 5. Predictors of Canadian health care providers providing advice to pregnant women about gestational weight gain and discussing risks of inappropriate weight gain during a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	-1.14**	0.38	
General practitioner *(reference)*			
Obstetrician	0.242	0.145	0.093
Midwife	-0.076	0.199	-0.026
Primary care RN	-0.029	0.177	-0.008
Nurse Practitioner	-0.057	0.206	-0.012
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.26**	0.069	0.202
General knowledge in GWG, physical activity, and nutrition	0.098	0.081	0.065
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.71**	0.071	0.459
Role (I am the most appropriate provider to discuss gestational weight gain)	0.172	0.133	0.056
R^2	0.392		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, Proportion of all patients who are pregnant, and trimester of pregnancy at first visit.*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

582 Table 6. Predictors of Canadian health care providers discussing physical activity and food
583 requirements with women as part of a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	0.688	0.345	
General practitioner *(reference)*			
Obstetrician	0.022	0.13	0.009
Midwife	0.518**	0.179	0.192
Primary care RN	0	0.160	0
Nurse Practitioner	0.342	0.189	0.077
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.277**	0.063	0.229
General knowledge in GWG, physical activity, and nutrition	0.311**	0.073	0.22
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.341**	0.064	0.236
Role (I am the most appropriate provider to discuss gestational weight gain)	0.18	0.12	0.063
R^2	0.434		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, proportion of all patients who are pregnant, and trimester of pregnancy at first visit*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

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Healthy Pregnancy Weight Gain Research Study

Do you see pregnant women in your practice?
- ◯ Yes
- ◯ No

In which Canadian province or territory do your work?
- ◯ British Columbia
- ◯ Alberta
- ◯ Saskatchewan
- ◯ Manitoba
- ◯ Ontario
- ◯ Quebec
- ◯ Newfoundland and Labrador
- ◯ New Brunswick
- ◯ Prince Edward Island
- ◯ Nova Scotia
- ◯ Yukon
- ◯ Northwest Territories
- ◯ Nunavut

What best describes the location of your practice?
- ◯ Urban
- ◯ Rural
- ◯ Urban and rural

In what type of practice setting do you work?
(Please select all that apply)
- ☐ Solo
- ☐ Group
- ☐ Interdisciplinary
- ☐ Academic

What is your occupational specialty?
- ◯ General Practitioner/Family Physician
- ◯ Obstetrician/Gynecologist
- ◯ Physician - other
- ◯ Registered Midwife
- ◯ Nurse Practitioner
- ◯ Registered Nurse
- ◯ Prenatal Educator
- ◯ Registered Dietitian
- ◯ Other

My primary practice is:
- ◯ Public/community health
- ◯ Primary care
- ◯ Acute care
- ◯ Other

Please specify:
- ◯ Registered Nurse
- ◯ Perinatal support worker
- ◯ Other

Please specify: _____

What are some common reasons for pregnant women to be referred to you? (Check all that apply)

- ☐ General healthy eating
- ☐ High pre-pregnancy BMI
- ☐ Low pre-pregnancy BMI
- ☐ Excessive weight gain
- ☐ Inadequate weight gain
- ☐ Multiple food restrictions, e.g. vegetarian, food allergies, etc.
- ☐ Nausea/vomiting
- ☐ Twin/multiple pregnancy
- ☐ Adolescent pregnancy
- ☐ Concurrent medical condition, e.g. diabetes in pregnancy
- ☐ All pregnant women in my health care setting are referred to me
- ☐ I see pregnant women in a group setting
- ☐ Other (Please specify)

Of all the patient/clients you see in your practice, what proportion are pregnant women?

◯ < 10% ◯ 10-30% ◯ 30-60% ◯ 60-90% ◯ >90%

At what stage during pregnancy do you typically see women for the first time?

◯ Before they become pregnant, i.e. planning to become pregnant
◯ First trimester
◯ Second trimester
◯ Third trimester
◯ Don't know/too variable to say

Given all of the issues of concern during a typical prenatal visit, how often do women ask you about:

	Almost never(< 10%)	Rarely(10-30%)	Sometimes(30-60%)	Often(60-90%)	Almost always(>90%)
How much weight to gain during pregnancy	○	○	○	○	○
Healthy eating during pregnancy	○	○	○	○	○
How much they should be eating during pregnancy	○	○	○	○	○
Where to find resources about healthy eating for pregnancy	○	○	○	○	○

With what percentage of pregnant women do you undertake the following activities?

	< 10%	10-30%	30-60%	60-90%	>90%
I provide pregnant women with a weight gain target based on their pre-pregnancy BMI	○	○	○	○	○
I discuss the recommended rate of weight gain (kg/wk) based on their weight gain target	○	○	○	○	○
I discuss the impact that inappropriate weight gain can have on the mother during pregnancy	○	○	○	○	○
I discuss the impact that inappropriate weight gain can have on the baby	○	○	○	○	○
I weigh women at every visit	○	○	○	○	○
I relay weight gain information to women every time I weigh them	○	○	○	○	○
I discuss appropriate physical activity with pregnant women	○	○	○	○	○
I discuss appropriate extra food requirements with pregnant women	○	○	○	○	○
I can easily give examples of appropriate changes that women could make to meet extra food requirements	○	○	○	○	○
I discuss the importance of taking prenatal vitamins	○	○	○	○	○

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

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Health Canada 2010 guidelines for pregnancy weight gain	○	○	○	○	○
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	○	○	○	○	○
Physicial Activity Readiness Medical Examination (PARMed-X) for Pregnancy	○	○	○	○	○
Health Canada's Prenatal Nutrition Guidelines for Health Professionals	○	○	○	○	○

Given all of the issues of concern during a typical prenatal visit, I consider...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Discussing appropriate gestational weight gain with women a high priority	◯	◯	◯	◯	◯
Assessing gestational weight gain a high priority	◯	◯	◯	◯	◯
Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators; providing resources; referrals to appropriate providers; etc.) a high priority	◯	◯	◯	◯	◯

Is there anything that could increase the level of priority you place on discussing, assessing, or assisting gestational weight gain with pregnant women?

Are there any changes you would suggest to increase the likelihood of discussing, assessing or assisting women with gestational weight gain? (Please select all that apply)

☐ Including "gestational weight gain" on the prenatal form
☐ Including "calculate cumulative gestational weight gain" on the antenatal record
☐ Increase your knowledge of consequences of inappropriate gestational weight gain
☐ Having resources that will prompt/remind me to discuss, assess or assist women
☐ Change in fee schedule
☐ Other

Please specify:

_____

Is the fee schedule appropriate for the workload in prenatal visits?

◯ Yes
◯ No
◯ Not applicable

Please explain: _____

In your practice setting, who do you think is the most suitable person to discuss, assess, assist, and follow-up with gestational weight gain with women?

	Discuss	Assess	Assist	Follow-up
Myself	☐	☐	☐	☐
General practitioner/family physician	☐	☐	☐	☐
Obstetrician/gynecologist	☐	☐	☐	☐
Dietitian	☐	☐	☐	☐
Nurse	☐	☐	☐	☐
Nurse practitioner	☐	☐	☐	☐
Midwife	☐	☐	☐	☐
Behavioural health consultant	☐	☐	☐	☐
Physical activity specialist	☐	☐	☐	☐
Other	☐	☐	☐	☐

Please specify provider: _____

To what extent do you agree or disagree with the following statements? I have appropriate...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Knowledge to recommend guideline concordant pregnancy weight gain	○	○	○	○	○
Information resources to support recommending guideline concordant pregnancy weight gain	○	○	○	○	○
Knowledge to recommend guideline concordant physical activity	○	○	○	○	○
Information resources to support recommending guideline concordant physical activity	○	○	○	○	○
Knowledge to recommend guideline concordant healthy eating during pregnancy	○	○	○	○	○
Information resources to support recommending guideline concordant healthy eating during pregnancy	○	○	○	○	○
Programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	○	○	○	○	○

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Health care provider's gestational weight gain counselling practices and the influence of knowledge and attitudes: A cross-sectional mixed methods study

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Health care provider's gestational weight gain counselling practices and the influence of knowledge and attitudes: A cross-sectional mixed methods study

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Abstract

Objective: To understand current gestational weight gain (GWG) counselling practices of health care providers, and the relationships between practices, knowledge and attitudes.

Design: Concurrent mixed methods with data integration: cross-sectional survey and semi-structured interviews.

Participants: Prenatal health care providers in Canada: general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings.

Results: Typically, GWG information was provided early in pregnancy, but not discussed again unless there was a concern. Few routinely provided women with individualized GWG advice (21%), rate of GWG (16%), or discussed the risks of inappropriate GWG 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 appointment times which allowed them to provide more in-depth counselling. Regression results identified that the higher priority level that health care providers place on GWG, the more likely they were to report providing GWG advice and discussing risks of GWG outside recommendations ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of GWG to length of appointments, financial compensation methods for health care providers, and the midwifery versus medical model of care.

Conclusions: Interventions for health care providers to enhance GWG counselling practices should consider the range of factors that influence the priority level health care providers place on GWG counselling.

Strengths and Limitations Of This Study: (max 5 bullet points)

- This is a large and in-depth examination and comparison of health care providers' practices related to monitoring and discussing GWG with pregnant women,
- This study is enhanced by the use of mixed methods. Mixed methods research is well suited for health services, which are complex and influenced by multiple factors.
- The findings from this study may have a wide applicability, as the topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.
- It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks although these methods allowed for wider reach and more responses.
- Those who responded may be more likely to engage in activities related to GWG counselling which could lead to inflation of the reported frequency of specific GWG counselling practices.. Nevertheless, the rates of some counselling practices reported in this study are quite low.

Introduction

Supporting all women to achieve healthy gestational weight gain (GWG) is of clinical importance because GWG lower or higher than recommended is linked to a range of poor maternal, fetal, and childhood outcomes. [1] For mothers, excess GWG increases the risk of gestational diabetes mellitus and hypertensive disorders in pregnancy, and this is of special concern if excessive GWG occurs early in pregnancy. [2-4] Excess GWG also poses risks at delivery for the mother including increased likelihood of needing an instrumental delivery or a Caesarean section, and surgical morbidity and mortality. [1, 3] Further, these factors result in an increased risk for the fetus and neonate including the adverse consequences of macrosomia and shoulder dystocia, need for intensive care unit admission, and the risk of perinatal death. [1, 3] [5] In the long term, the child is at risk of an altered growth trajectory that may lead to obesity. [6, 7] Excess GWG 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. [1] [8] The cycle of excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to increased risk in each subsequent pregnancy.[9] These risks act synergistically resulting in a higher risk of metabolic and cardiovascular disease in later life for the mother as well as the child.[10] Thus, excess GWG has short term, long term and intergenerational effects. [11]

To mitigate the risks of inappropriate GWG, many countries, including Canada, have released GWG guidelines. [12] [13] Many of these are based on the Institute of Medicine (USA) guidelines for GWG in pregnancy, which outline a range of total GWG over the course of pregnancy that is associated with optimal health outcomes for mother and child. [14] In order for these guidelines to be of benefit to pregnant women, the Institute of Medicine recommends that health care providers advise women on the recommended range of GWG based on pre-

pregnancy BMI, and that they track and discuss weight progress over the course of pregnancy, as well as offering tailored counselling on dietary intake and physical activity. [15] Many countries provide guidance to health care providers in the form of evidence-based guidelines in order to support them in providing physical activity and nutrition counselling to pregnant women. [16] [17-19]

There is growing evidence to suggest that the quality of GWG counselling interactions needs improvement, as women and health care providers report conflicting views of these interactions. [20] Many women report that their health care provider did not provide recommendations for GWG during their prenatal care, nor provide counselling about nutrition and physical activity behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive approach, initiating a discussion about weight in pregnancy only after weight exceeds the recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical prenatal visit.[23]

Women may see a variety of health care provider disciplines for prenatal care including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is some evidence to suggest that the approach to GWG counselling may vary by health care provider discipline [28, 29]; however, this area has not been fully explored. In order to better support health care providers to have positive GWG counselling interactions with women, there needs to be a detailed understanding of current practices, and what is influencing these practices. This information can be used to develop interventions to promote appropriate GWG in routine prenatal care. As such, the objectives of this study were to characterize and compare the GWG

counselling practices of health care providers who provide prenatal care; and to examine potential influences on advice and counselling practices.

Methods

Study design

This study was conducted using a concurrent mixed methods design, consisting of an online survey and semi-structured qualitative interviews. Qualitative and quantitative data were collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well suited for research questions that call for real-life contextual understandings and multi-level influences, and lends itself well to the development of complex interventions. [31]

Ethics approval for this study was obtained from the Health Research Ethics Board at the University of Alberta (Study Identification Pro00045899). All participants provided informed consent to participate in this study.

Quantitative methods

Survey development

A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health promotion, and health psychology (Supplementary file).

Recruitment and data collection

Health care providers including general practitioners, obstetricians, midwives, nurse practitioners, and registered nurses in primary care settings from across Canada were recruited

through professional associations and networks who agreed to distribute survey information to their members. All health care providers who provided prenatal care were eligible to participate. The survey was available from December 2014 to May 2015 on Research Electronic Data Capture (REDCap) software hosted at the University of Alberta.[32]

Outcomes

Survey participants provided information about their professional characteristics, and were asked to respond to questions regarding their practices, knowledge, and attitudes related to GWG, nutrition and physical activity. Specifically, participants were asked about the proportion of their pregnant patients with whom they undertook selected GWG counselling practices as outlined in the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients) to 5 (>90% of pregnant patients). Respondents were also asked for their self-assessment of their general knowledge to support GWG counselling, their detailed knowledge of the content of practice guidelines related to GWG (specifically the IOM/Health Canada GWG guidelines[33], and Health Canada's nutrition guidelines[34] and physical activity guidelines[35]), and the priority level they placed on discussing, assessing, and assisting women with GWG (e.g., *Given all the issues of concern during a typical prenatal visit, I consider discussing GWG a high priority*). Responses indicated level of agreement with each statement on a scale from 1 (strongly disagree) to 5 (strongly agree). The survey also examined whether health care providers considered themselves to be the most appropriate person within their practice setting to provide GWG counselling (*I am the most appropriate provider in my practice setting to discuss GWG*).

Data analysis

GWG counselling practices of each health care provider group were calculated as frequency and percentage of responses, dichotomized into "Routine (undertaken with >90% of pregnant patients)" and "Not routine" (all other response choices) based on the Institute of Medicine recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with missing data were removed from analyses. Principal components analysis was used to reduce the numerous survey questions into a smaller number of factors. The mean score of the items loading onto each factor was used to represent that factor score for respondents. [36] For example, four questions loaded onto a factor that was named "Providing Weight Gain Advice and Discussing Risks" and were averaged together into a composite score for that factor. Mean scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar manner. Differences in mean composite scores were compared among health care provider disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite scores were normally distributed. Mean scores for each factor were used in multiple linear regression models to evaluate the relationship between the predictors of interest and GWG counselling practices. For all models, multicollinearity was not an issue with all tolerance values >0.36 and variance inflation factors <2.8.

Qualitative methods

Materials

A semi-structured interview guide was developed by the study team based on the study objectives and included questions and prompts regarding health care provider practices in

relation to GWG, as well as the reasons behind these practices. The interview guide also included questions regarding provider knowledge in and attitudes towards GWG.

Recruitment and data collection

Potential participants were identified through collaborating members of the study team. A purposive sample of maximum variation was recruited to gather the perspectives of health care providers from the different disciplines practicing in urban or rural locations in two Canadian provinces (Alberta and British Columbia). When these contacts were exhausted, an advertisement was distributed by email to medical clinics relevant to the requirements for variability in the sample. Interviews were conducted over the telephone, audio-recorded and transcribed verbatim.

Data analysis

Qualitative content analysis was used to describe and inductively interpret the data.[37, 38] 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". [39](p.45) Audio recordings and transcripts were reviewed, and reviewed again while making notes about key words and phrases. Key concepts were categorized and re-categorized as patterns emerged. Data analysis occurred concurrently with data collection, and sampling adequacy was demonstrated by saturation of the data, as replication occurred in categories as new participants were included in the analysis.[40] Findings were discussed and approved by the study team.

Data integration

The categories emerging inductively from the interviews were compared with the results from the quantitative survey to determine if findings from each method confirmed the other, as well as to expand the strength of each type of data to better explain the phenomenon.[41]

Results

Participant characteristics

Overall, 1189 health care providers responded to the survey. Of these, 122 did not meet the eligibility criteria (i.e. did not see pregnant women in their practice), 27 did not specify their health care provider discipline, 155 did not answer any questions beyond practice characteristics, and 377 indicated a health care provider discipline that was outside the scope of these analyses. Thus, 508 responses from general practitioners, obstetricians, midwives, nurse practitioners and registered nurses in primary care settings from across Canada are included in this analysis (Table 1). Twenty-three health care providers from these same disciplines participated in the interviews.

Gestational weight gain counselling practices of health care providers

Providing weight gain advice and discussing risks

A small proportion of health care providers routinely provided women with a GWG target based on their pre-pregnancy BMI and discussed the recommended rate of GWG based on their GWG target (21% and 16%; Table 2). Few indicated that they routinely discussed the impacts of inappropriate GWG on mother (20%) and baby (19%). The composite score for "Providing weight gain advice and discussing the risks" did not differ between health care provider disciplines (Table 3).

Key concepts and quotes relating to counselling practices that emerged from the interviews are outlined in Table 4. Interviewees described the first prenatal visit as including measurement of weight, calculation of BMI, and a large amount of information sharing, including general information on GWG. Some health care providers advised women on a total GWG target; however, this was not always congruent with guidelines. The amount of information provided in the first visit was perceived by the health care providers to be overwhelming for women.

Weight assessment

Approximately three-quarters of respondents weighed women at every visit (76%), while half of respondents would routinely relay GWG information to women every time they are weighed (Table 2). Midwives reported measuring weight at every visit less frequently than all other disciplines (Table 3).

Interviewees noted that weight was typically measured at each visit, except for midwives who generally measured women's weight if clinically necessary, or if women requested them to do so (Table 4). After the first visit, interview participants indicated that they revisited the topic to varying levels of depth, typically only when the health care provider or woman expressed concern about her weight.

Discussing physical activity and food requirements

Nearly half (46%)of health care providers reported routinely discussing physical activity with women while about one-third routinely discussed appropriate extra food requirements (28%), and only about one-third felt they could routinely give examples of appropriate changes that

women could make to meet extra food requirements (32%) (Table 2). In contrast, over two-thirds would discuss the importance of prenatal vitamins (67%). The composite score for the three survey questions regarding discussing physical activity and food requirements differed between health care provider disciplines (Table 3). Midwives did this more frequently than all other disciplines except for nurse practitioners.

Health care providers of all disciplines described providing general information on GWG, physical activity, and nutrition in the early stages of pregnancy, and many indicated providing women with printed resources in this area (Table 4). The midwives interviewed described spending more time assessing women's current lifestyle and providing individualized advice than did physicians (Table 4).

Predictors of counselling practices

Health care providers, regardless of discipline, reported similar responses for having appropriate general knowledge of GWG, physical activity, and nutrition, as well as knowledge of related practice guidelines (Table 3); only the difference between midwives and registered nurses responses was significant. There were significant differences in the level of priority placed on GWG. Midwives and obstetricians had lower composite scores for the priority level they place on GWG than general practitioners and nurse practitioners, but did not differ significantly from each other (Table 3). The majority of health care providers considered discussing GWG with women to be within their role (77%).

Predictors of providing weight gain advice and discussing risks

The composite score for providing weight gain advice and discussing risks of inappropriate GWG was most strongly related to the priority level that health care providers placed on GWG (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition guidelines.

Generally, health care providers in the interviews reported that GWG discussions may receive lower priority due to the time constraints in a typical appointment (Table 4). This was related to their compensation method, as general practitioners and obstetricians were remunerated in a fee-for-service model that resulted in restriction on the length of appointments, as well as the topics covered. Midwives were compensated by course-of-care, which resulted in longer and more flexible appointments. However, midwives described a lower priority level placed on GWG, as their practice was less focussed on weight, in particular weight assessment, and more focussed on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity of discussing GWG with pregnant women were also related to their providing weight gain advice and discussing risks (Table 4). Some health care providers noted their discomfort with initiating GWG discussions, or discussing GWG too frequently, as they were concerned that this may cause psychological distress for the woman.

Predictors of discussing physical activity and food requirements

The priority level that health care providers place on GWG, their detailed knowledge of GWG, nutrition, and physical activity guidelines, and their general knowledge of this area were all significantly related to their discussing physical activity and food requirements with women

during a prenatal visit (Table 6). After adjustment for practice characteristics, being a midwife remained a significant predictor of this activity within a prenatal visit.

Midwifery practices in relation to discussing physical activity and food requirements also emerged from the interview data (Table 4). Midwives reported that their approach focussed on overall health and wellness, and centred on support for women. Knowledge was another key factor that came to light in the interviews, as some health care providers noted a need for additional knowledge, particularly in nutrition and maternal obesity. For health care providers working within a multidisciplinary team, access to dietetic services was an important enhancement to GWG counselling practices.

Discussion

GWG counselling by health care providers falls below the recommendations from the Institute of Medicine and other national health agencies. [15] Although many of the health care providers interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few survey respondents from any discipline routinely provided women with a comprehensive GWG recommendation and advice on their rate of GWG based on their pre-pregnancy BMI. In addition, few survey respondents reported discussing the risks of inappropriate GWG with women. While many health care providers reported providing a general message of the importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate extra food requirements. Weight was typically measured at each prenatal appointment, but not discussed unless it was a concern. This is in contrast with what women report they need from their health care provider, as other studies from our research group have indicated that women

would like their health care provider to initiate a discussion about GWG early in pregnancy, and continue the discussions throughout pregnancy and postpartum so that they are updated on their GWG progress. [22]

The low rates of some of these counselling practices are concerning since it is likely that survey respondents are those who would be most likely to counsel women about GWG. There is evidence suggesting that women whose health care providers discuss GWG and related lifestyle behaviours in pregnancy with them have lower GWG and lower likelihood of having a baby that is large for gestational age. [42-44] This underlines the potential level of influence that health care providers have with pregnant women and the importance of refining their training or antenatal care pathways to support such conversations.

To our knowledge, this is the first mixed methods study to examine GWG counselling, in particular for the specific counselling practices recommended by the Institute of Medicine. While survey and qualitative research studies from various parts of the world have also found low rates of GWG counselling as reported by patients, other surveys of health care providers have found high self-reported rates of counselling.[20, 28] This discrepancy may be due to the frequency with which health care providers undertake counselling, as studies from the US have found that they report discussing GWG more often with women who are overweight or obese at the start of their pregnancy.[24] Therefore, they may report that they provide GWG counselling, but not to every pregnant woman. Further, when the depth of this counselling is explored, the self-reported rates are likely to diminish. Future studies should objectively assess the quality of these discussions and evaluate their impact on GWG, health behaviours like physical activity and

diet, and women's perceptions of support. Furthermore, research is needed to elucidate the most effective counselling methods that will help women achieve appropriate GWG. This additional information could help guide or refine approaches to antenatal care undertaken by different groups of care providers.

This study identified multi-level influences on GWG counselling. Most notably, the priority level that health care providers placed on GWG had the strongest relationship with their practices. The qualitative results provided context to this finding, linking the priority level of GWG to factors at the health care system level, such as the time available in a typical prenatal appointment, and the compensation that health care providers receive for their time. Additionally, this study identified factors at the individual level. This included the importance of detailed knowledge of practice guidelines, which also was strongly associated with counselling practices.

One novel finding was the new insights into the different approach reported by midwives. Midwives noted that their focus on the overall wellbeing of the women meant they discussed physical activity and nutrition in more depth than did physicians, and they measured weight less frequently. Even after controlling for multiple other predictors, midwives were significantly more likely than other health care providers to report discussing physical activity and food requirements with women during routine prenatal care. In other research, patients of midwives were more likely to recall having discussed physical activity with their health care provider as compared to patients of general practitioners and obstetricians,[29] and midwives themselves report providing physical activity counselling to women more frequently than other

disciplines.[20, 28] While the present study considered physical activity and nutrition counselling practices as one composite score, there seems to be growing evidence that midwives provide more lifestyle counselling than other health care provider disciplines. The impact of counselling by a midwife as compared to other disciplines on the health outcomes for women is an area for future exploration.

Strengths and Limitations

A major strength of this study is the use of mixed research methods. This allowed for some verification of findings between methods, and provided a broader picture of "who is doing what", as well as "why and how are they doing it". To our knowledge, this is the largest and most comprehensive survey on this topic to date. While prenatal care varies between countries, the topics covered in this survey are considered routine and are undertaken as part of standard prenatal care in most developed countries.

This study has limitations that should be considered. It was not possible to calculate a true response rate for the survey since the survey was distributed using email lists and social media through professional associations and networks. While this method of recruitment allowed for a wider reach, and ultimately more responses, those who responded may be more likely to engage in activities related to GWG counselling. This could lead to inflation of the reported frequency of specific GWG counselling practices. This is concerning as they are already quite low for some counselling practices and further highlights the need for targeted interventions in this area.

The qualitative interviews were only conducted in two provinces, and there is the potential that this does not accurately capture the practices and predictors in other geographic areas. However, the congruency of the qualitative and quantitative findings suggests that this is unlikely. Furthermore, a recent systematic review found few differences in barriers and facilitators to pregnancy weight management in studies from around the world, suggesting that the findings of the current study may help inform practice in various health care systems.[45]

Recommendations

Interventions to implement best practices should consider the multi-level influences on GWG counselling practices, as well as the discipline of the health care provider, in order to be effective at changing health care provider behaviours. Providers across disciplines require knowledge of GWG, physical activity, and nutrition guidelines and some may need system-level changes such as more time in an appointment to help them make it a priority in their practice. A different model for dissemination of this knowledge needs consideration. Multidisciplinary clinics that include professionals with a background in nutrition and physical activity, and group educational sessions may be important in this regard. The latter approach could allow participants to discuss these issues amongst themselves and may provide positive reinforcement of new knowledge and help to shift old beliefs.[42] Furthermore, discussion of healthy GWG and maintenance of a healthy weight trajectory with women by health providers is a missed opportunity for positive feedback for a healthy and potentially long-term behaviour.

Expanding discussions on GWG to a healthier lifestyle is highly relevant given the growing body of evidence related to its impact on disease in later life.[10] Health care providers are well

positioned to help women identify plans to change behaviour and improve health outcomes. Strong communication between health care providers and pregnant women is a key component to moving forward. Supporting health care providers to better counsel their pregnant patients on appropriate GWG is one important step towards breaking the intergenerational cycle of obesity, and improving the health of generations to come.

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Authors' contributions

RCB and HN designed the study, and with MV and HPV developed the interview guide and survey questionnaire. JM and HN recruited interview participants and conducted the interviews. JM recruited survey participants, conducted the qualitative and quantitative analyses and wrote the first draft of the manuscript. HN and RCB contributed to the qualitative analysis and TB and RCB contributed to quantitative analysis. VJ contributed to recruitment of interview participants. All authors made significant contributions to the critical review and revisions of the manuscript. JM and RCB are the guarantors of the manuscript. All authors had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JM affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted.

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Conflict of interest

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

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Data Sharing Statement

Data used in this study are not currently available for data sharing.

567 Table 1. Characteristics of participating Canadian health care providers.

	Survey Participants N=508		Interview Participants N=23	
	n	%	n	%
Health care provider discipline				
General Practitioner	159	31%	7	30%
Obstetrician	139	27%	5	22%
Midwife	97	19%	5	22%
Registered Nurse - Primary Care	75	15%	4	17%
Nurse Practitioner	38	7%	2	9%
Province				
British Columbia	55	11%	9	39%
Alberta	149	30%	14	61%
Saskatchewan and Manitoba	56	11%		N/A
Ontario	168	33%		
Quebec	17	3%		
Maritimes*	47	9%		
Territories*	11	2%		
Location of practice				
Urban	296	58%		N/C
Rural	125	25%		
Urban and rural	86	17%		
Proportion of all patients who are pregnant women				
<10%	103	20%		N/C
10-30%	94	19%		
30-60%	119	23%		
60-90%	46	9%		
>90%	146	29%		
Stage of pregnancy at first visit				
Before pregnancy	30	6%		N/C
First trimester	328	65%		
Second trimester	74	15%		
Third trimester	34	7%		
Don't know/too variable to say	41	8%		

**Maritimes=Newfoundland and Labrador, New Brunswick, Nova Scotia*
**Territories=Northwest Territories, Yukon Territory (no respondents from Nunavut)*
N/A=Not applicable
N/C=Data not collected

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Table 2. Survey responses regarding gestational weight gain counselling practices routinely undertaken (with >90% of pregnant patients) by Canadian health care providers.

	Health care provider discipline[1]										All	
	GP		OB		MW		NP		RN			
	n	%	n	%	n	%	n	%	n	%	n	%
I provide women with a weight gain target based on their pre-pregnancy BMI												
	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												
	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												
	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												
	21	13%	30	22%	21	22%	15	40%	10	14%	97	19%
										Missing	7	1%
I weigh women at every visit												
	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												
	82	52%	62	45%	38	40%	25	66%	41	57%	248	50%
										Missing	7	1%
I discuss appropriate physical activity with pregnant women												
	75	48%	53	38%	61	64%	20	53%	22	31%	231	46%
										Missing	7	1%
I discuss appropriate extra food requirements with pregnant women												
	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												
	40	26%	30	22%	48	50%	17	46%	23	32%	158	32%
										Missing	9	2%
I discuss the importance of taking prenatal vitamins												
	124	79%	85	61%	49	51%	34	90%	44	61%	336	67%
										Missing	6	1%
[1]*GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse*												

Table 3. Composite scores for gestational weight gain counselling practices and influences on practices compared by health care provider discipline

	Health care provider discipline[1] Mean (Standard Deviation)					All	Sig.	Post-hoc
	GP	OB	MW	NP	RN			
Providing weight gain advice and discussing the risks	2.95 (1.1)	3.03 (1.2)	2.95 (1.2)	2.91 (1.5)	2.54 (1.3)	2.91 (1.2)	0.072	N/A
Weighing women at every visit	4.87 (0.54)	4.75 (0.80)	3.36 (1.56)	4.61 (1.10)	4.03 (1.55)	4.41 (1.22)	<0.001	MW < All**
Discussing physical activity and food requirements	3.65 (1.1)	3.37 (1.1)	4.23 (0.8)	3.81 (1.1)	3.31 (1.4)	3.65 (1.1)	<0.001	MW> (GP, OB, RN)**
General knowledge in GWG, physical activity, and nutrition	3.50 (0.75)	3.61 (0.75)	3.77 (0.70)	3.42 (0.80)	3.36 (0.94)	3.56 (0.78)	0.017	MW > RN*
Detailed knowledge of GWG, physical activity, and nutrition guidelines	2.85 (0.98)	2.96 (0.91)	3.22 (0.88)	2.85 (1.02)	3.00 (1.01)	2.97 (0.95)	0.047	MW > GP*
Priority level of discussing, assessing, and assisting women with appropriate weight gain	4.09 (0.61)	3.82 (0.82)	3.59 (0.86)	3.8 (0.87)	4.25 (0.65)	3.89 (0.78)	<0.001	MW< (GP, NP)** OB- (GP, NP)*

*[1]GP=General Practitioner, OB=Obstetrician, MW=midwife, NP=Nurse Practitioner, RN=Primary Care Registered Nurse; *Significant at 0.05; **Significant at 0.01; Scale of 1=lowest to 5=highest score*
Compared by one-way ANOVA

Table 4. Overarching categories and key concepts emerging from qualitative content analysis of interviews with health care providers.

Category	Concept	Representative quote(s)
Practices	The first visit involves a large amount of information sharing	"That's the trouble with prenatal care. There's so much information that women need, especially in the first trimester. Genetic screening, and lifestyle, and alcohol, and smoking, and family, and you know, on and on and on." - General Practitioner
	Weight is assessed routinely, but not discussed in detail unless there is a concern	"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
	Midwives have a different approach to gestational weight gain	"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 they can be empowered to make healthy choices." - Midwife "I feel like it's really important to discuss healthy eating and exercise, but the actual focus on the weight gain and the number of pounds that a woman should gain, I don't really feel that's important at all, that piece of it." - Midwife
Individual level influences on practice	Priority level	"But certainly there are definitely times where I feel constricted by time. I think nutrition and exercise is a huge priority, so that's just my personal opinion. I think that I wouldn't - I don't know, I would make the time." - Midwife
	Sensitivity of the discussion	"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
	General knowledge of gestational weight gain, nutrition, and	"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

	physical activity	every two years for an hour on it." - Obstetrician
	Detailed knowledge of practice guidelines	"I have to know so many rules about all sorts of things. I always kind of go by, you know, 5, 10, 15. So those three numbers I remember, 5, 10, 15. If you're overweight, if your BMI is higher than, you know, 26 or 27, or higher than 28 or so, I would say, 5 kilos. If your weight is pretty well normal I'd say 10 kilos. And if your weight is under I'd say 15 kilos." - General Practitioner
System level influences on practice	Time and compensation	"And that's a different model 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." - Midwife "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 ten to 15 minutes long." - General Practitioner
	Access to allied health services	"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

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Table 5. Predictors of Canadian health care providers providing advice to pregnant women about gestational weight gain and discussing risks of inappropriate weight gain during a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	-1.14**	0.38	
General practitioner *(reference)*			
Obstetrician	0.242	0.145	0.093
Midwife	-0.076	0.199	-0.026
Primary care RN	-0.029	0.177	-0.008
Nurse Practitioner	-0.057	0.206	-0.012
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.26**	0.069	0.202
General knowledge in GWG, physical activity, and nutrition	0.098	0.081	0.065
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.71**	0.071	0.459
Role (I am the most appropriate provider to discuss gestational weight gain)	0.172	0.133	0.056
R^2	0.392		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, Proportion of all patients who are pregnant, and trimester of pregnancy at first visit.*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

584 Table 6. Predictors of Canadian health care providers discussing physical activity and food
585 requirements with women as part of a prenatal visit.

Variable	Model[1] Unstd β	S.E. of β	Std Beta
(Constant)	0.688	0.345	
General practitioner *(reference)*			
Obstetrician	0.022	0.13	0.009
Midwife	0.518**	0.179	0.192
Primary care RN	0	0.160	0
Nurse Practitioner	0.342	0.189	0.077
Detailed knowledge of GWG, physical activity, and nutrition guidelines	0.277**	0.063	0.229
General knowledge in GWG, physical activity, and nutrition	0.311**	0.073	0.22
Priority level of discussing, assessing, and assisting women with appropriate weight gain	0.341**	0.064	0.236
Role (I am the most appropriate provider to discuss gestational weight gain)	0.18	0.12	0.063
R^2	0.434		

*p<0.05 **p<0.01

[1]*Model is adjusted for: urban/rural location, proportion of all patients who are pregnant, and trimester of pregnancy at first visit*

Unstd=Unstandardized, S.E.=Standard Error, Std=Standardized

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Healthy Pregnancy Weight Gain Research Study

Do you see pregnant women in your practice?
- ◯ Yes
- ◯ No

In which Canadian province or territory do your work?
- ◯ British Columbia
- ◯ Alberta
- ◯ Saskatchewan
- ◯ Manitoba
- ◯ Ontario
- ◯ Quebec
- ◯ Newfoundland and Labrador
- ◯ New Brunswick
- ◯ Prince Edward Island
- ◯ Nova Scotia
- ◯ Yukon
- ◯ Northwest Territories
- ◯ Nunavut

What best describes the location of your practice?
- ◯ Urban
- ◯ Rural
- ◯ Urban and rural

In what type of practice setting do you work?
(Please select all that apply)
- ☐ Solo
- ☐ Group
- ☐ Interdisciplinary
- ☐ Academic

What is your occupational specialty?
- ◯ General Practitioner/Family Physician
- ◯ Obstetrician/Gynecologist
- ◯ Physician - other
- ◯ Registered Midwife
- ◯ Nurse Practitioner
- ◯ Registered Nurse
- ◯ Prenatal Educator
- ◯ Registered Dietitian
- ◯ Other

My primary practice is:
- ◯ Public/community health
- ◯ Primary care
- ◯ Acute care
- ◯ Other

Please specify:
- ◯ Registered Nurse
- ◯ Perinatal support worker
- ◯ Other

Please specify: _____

What are some common reasons for pregnant women to be referred to you? (Check all that apply)

- ☐ General healthy eating
- ☐ High pre-pregnancy BMI
- ☐ Low pre-pregnancy BMI
- ☐ Excessive weight gain
- ☐ Inadequate weight gain
- ☐ Multiple food restrictions, e.g. vegetarian, food allergies, etc.
- ☐ Nausea/vomiting
- ☐ Twin/multiple pregnancy
- ☐ Adolescent pregnancy
- ☐ Concurrent medical condition, e.g. diabetes in pregnancy
- ☐ All pregnant women in my health care setting are referred to me
- ☐ I see pregnant women in a group setting
- ☐ Other (Please specify)

Of all the patient/clients you see in your practice, what proportion are pregnant women?

◯ < 10% ◯ 10-30% ◯ 30-60% ◯ 60-90% ◯ >90%

At what stage during pregnancy do you typically see women for the first time?

◯ Before they become pregnant, i.e. planning to become pregnant
◯ First trimester
◯ Second trimester
◯ Third trimester
◯ Don't know/too variable to say

Given all of the issues of concern during a typical prenatal visit, how often do women ask you about:

	Almost never(< 10%)	Rarely(10-30%)	Sometimes(30-60%)	Often(60-90%)	Almost always(>90%)
How much weight to gain during pregnancy	○	○	○	○	○
Healthy eating during pregnancy	○	○	○	○	○
How much they should be eating during pregnancy	○	○	○	○	○
Where to find resources about healthy eating for pregnancy	○	○	○	○	○

With what percentage of pregnant women do you undertake the following activities?

	< 10%	10-30%	30-60%	60-90%	>90%
I provide pregnant women with a weight gain target based on their pre-pregnancy BMI	○	○	○	○	○
I discuss the recommended rate of weight gain (kg/wk) based on their weight gain target	○	○	○	○	○
I discuss the impact that inappropriate weight gain can have on the mother during pregnancy	○	○	○	○	○
I discuss the impact that inappropriate weight gain can have on the baby	○	○	○	○	○
I weigh women at every visit	○	○	○	○	○
I relay weight gain information to women every time I weigh them	○	○	○	○	○
I discuss appropriate physical activity with pregnant women	○	○	○	○	○
I discuss appropriate extra food requirements with pregnant women	○	○	○	○	○
I can easily give examples of appropriate changes that women could make to meet extra food requirements	○	○	○	○	○
I discuss the importance of taking prenatal vitamins	○	○	○	○	○

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

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Health Canada 2010 guidelines for pregnancy weight gain	○	○	○	○	○
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	○	○	○	○	○
Physicial Activity Readiness Medical Examination (PARMed-X) for Pregnancy	○	○	○	○	○
Health Canada's Prenatal Nutrition Guidelines for Health Professionals	○	○	○	○	○

Given all of the issues of concern during a typical prenatal visit, I consider...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Discussing appropriate gestational weight gain with women a high priority	◯	◯	◯	◯	◯
Assessing gestational weight gain a high priority	◯	◯	◯	◯	◯
Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators; providing resources; referrals to appropriate providers; etc.) a high priority	◯	◯	◯	◯	◯

Is there anything that could increase the level of priority you place on discussing, assessing, or assisting gestational weight gain with pregnant women?

Are there any changes you would suggest to increase the likelihood of discussing, assessing or assisting women with gestational weight gain? (Please select all that apply)

☐ Including "gestational weight gain" on the prenatal form
☐ Including "calculate cumulative gestational weight gain" on the antenatal record
☐ Increase your knowledge of consequences of inappropriate gestational weight gain
☐ Having resources that will prompt/remind me to discuss, assess or assist women
☐ Change in fee schedule
☐ Other

Please specify:

_____

Is the fee schedule appropriate for the workload in prenatal visits?

◯ Yes
◯ No
◯ Not applicable

Please explain: _____

In your practice setting, who do you think is the most suitable person to discuss, assess, assist, and follow-up with gestational weight gain with women?

	Discuss	Assess	Assist	Follow-up
Myself	☐	☐	☐	☐
General practitioner/family physician	☐	☐	☐	☐
Obstetrician/gynecologist	☐	☐	☐	☐
Dietitian	☐	☐	☐	☐
Nurse	☐	☐	☐	☐
Nurse practitioner	☐	☐	☐	☐
Midwife	☐	☐	☐	☐
Behavioural health consultant	☐	☐	☐	☐
Physical activity specialist	☐	☐	☐	☐
Other	☐	☐	☐	☐

Please specify provider: _____

To what extent do you agree or disagree with the following statements? I have appropriate...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Knowledge to recommend guideline concordant pregnancy weight gain	○	○	○	○	○
Information resources to support recommending guideline concordant pregnancy weight gain	○	○	○	○	○
Knowledge to recommend guideline concordant physical activity	○	○	○	○	○
Information resources to support recommending guideline concordant physical activity	○	○	○	○	○
Knowledge to recommend guideline concordant healthy eating during pregnancy	○	○	○	○	○
Information resources to support recommending guideline concordant healthy eating during pregnancy	○	○	○	○	○
Programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	○	○	○	○	○