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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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018527
Article Type:	Research
Date Submitted by the Author:	05-Jul-2017
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Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	General practice / Family practice
Keywords:	Pregnancy, Health Care, Gestational Weight Gain, Counselling

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Manuscripts

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3 1 **Health care provider's gestational weight gain counselling practices and the influence of**
4 **knowledge and attitudes: A cross-sectional mixed methods study**
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46 27 **Word count**

47 28 Manuscript: 3635
48
49
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54 30 **Keywords:** Pregnancy, health care, gestational weight gain, counselling (*3-5 keywords*)
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1
2
3 **Abstract**
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5

6 **Objective:** To understand current gestational weight gain counselling practices of health care
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8
9 providers, and the relationships between practices, knowledge and attitudes.
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11 **Design:** Concurrent mixed methods with data integration: cross-sectional survey and semi-
12
13
14 structured interviews.
15

16 **Participants:** Prenatal health care providers in Canada: general practitioners, obstetricians,
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18
19 midwives, nurse practitioners, and registered nurses in primary care settings.
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21 **Results:** Typically, weight gain information was provided early in pregnancy, but not discussed
22
23
24 again unless there was a concern. Few routinely provided women with individualized weight
25
26
27 gain advice (21%), rate of weight gain (16%), or discussed the risks of inappropriate weight gain
28
29
30 to mother and baby (20% and 19%). More routinely discussed physical activity (46%) and food
31
32
33 requirements (28%); midwives did these two activities more frequently than all other disciplines
34
35
36 (p<0.001). Midwives interviewed noted a focus on overall wellness instead of weight, and had
37
38
39 longer appointments for in-depth counselling. Regression results identified that the priority level
40
41
42 that health care providers place on gestational weight gain was most strongly related to providing
43
44
45 weight gain advice and discussing risks of weight gain outside recommendations ($\beta=0.71$,
46
47
48 p<0.001) and discussing physical activity and food requirements ($\beta=0.341$, p<0.001). Interview
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50
51 data linked the priority level of GWG to length of appointments, compensation methods for
52
53
54 health care providers, and the midwifery versus medical model of care.
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58 **Conclusions:** Interventions for health care providers to enhance gestational weight gain
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61 counselling practices should consider the range of factors that influence the priority level health
62
63
64 care providers place on gestational weight gain counselling.
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3 54 **Strengths and Limitations Of This Study: (max 5 bullet points)**
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- 5 55 • This is a large and in-depth examination and comparison of health care providers'
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7
8 56 practices related to monitoring and discussing gestational weight gain with pregnant
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10 57 women, and is enhanced by the use of mixed methods.
11
12 58 • The topics covered in this survey are considered routine and are undertaken as part of
13
14 59 standard prenatal care in most developed countries.
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16
17 60 • It was not possible to calculate a true response rate for the survey since the survey was
18
19 61 distributed using email lists and social media through professional associations and
20
21 62 networks.
22
23 63 • While these methods allowed for a wider reach and more responses, those who responded
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25 64 may be more likely to engage in activities related to GWG counselling, which is
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27 65 concerning since the rates of some counselling practices are quite low.
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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

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2
3 based on pre-pregnancy BMI, track and discuss weight progress over the course of pregnancy, as
4 well as offer tailored counselling on dietary intake and physical activity. [15] Many countries
5
6 provide guidance to health care providers in the form of evidence-based guidelines in order to
7
8 support them in providing physical activity and nutrition counselling to pregnant women. [16]
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12 [17-19]

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16 There is growing evidence to suggest that the quality of GWG counselling interactions needs
17
18 improvement, as women and health care providers report conflicting views of these interactions.
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20 [20] Many women report that their health care provider did not provide recommendations for
21
22 GWG during their prenatal care, nor provide counselling about nutrition and physical activity
23
24 behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive
25
26 approach, initiating a discussion about weight in pregnancy only after weight exceeds the
27
28 recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this
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30 type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical
31
32 prenatal visit.[23]

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39 Women may see a variety of health care provider disciplines for prenatal care including general
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41 practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is
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43 some evidence to suggest that the approach to GWG counselling may vary by health care
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45 provider discipline [28, 29]; however, this area has not been fully explored. In order to better
46
47 support health care providers to have positive GWG counselling interactions with women, there
48
49 needs to be a detailed understanding of current practices, and what is influencing these practices.
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51 This information can be used to develop interventions to promote appropriate GWG in routine
52
53 prenatal care. As such, the objectives of this study were to characterize and compare the GWG
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3 counselling practices of health care providers who provide prenatal care; and to examine
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5 potential influences on advice and counselling practices.
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10 11 **Methods**

12 Study design

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15 This study was conducted using a concurrent mixed methods design, consisting of an online
16
17 survey and semi-structured qualitative interviews. Qualitative and quantitative data were
18
19 collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well
20
21 suited for research questions that call for real-life contextual understandings and multi-level
22
23 influences, and lends well to the development of complex interventions. [31]
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30 Ethics approval for this study was obtained from the Health Research Ethics Board at the
31
32 University of Alberta. All participants provided informed consent to participate in this study.
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36 Quantitative methods

37 *Survey development*

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40 A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team
41
42 of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health
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44 promotion, and health psychology.
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48 *Recruitment and data collection*

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51 Health care providers including general practitioners, obstetricians, midwives, nurse
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53 practitioners, and registered nurses in primary care settings from across Canada were recruited
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55 through professional associations and networks who agreed to distribute survey information to
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3 their members. All health care providers who provided prenatal care were eligible to participate.
4
5 The survey was available from December 2014 to May 2015 on Research Electronic Data
6
7 Capture (REDCap) software hosted at the University of Alberta.[32]
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9

10 *Outcomes*

11
12 Survey participants provided information about their professional characteristics, and were asked
13
14 to respond to questions regarding their practices, knowledge, and attitudes related to GWG,
15
16 nutrition and physical activity. Specifically, participants were asked about the proportion of their
17
18 pregnant patients with whom they undertook selected GWG counselling practices as outlined in
19
20 the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients)
21
22 to 5 (>90% of pregnant patients). Respondents were also asked about their general knowledge to
23
24 support GWG counselling, their detailed knowledge of practice guidelines related to GWG
25
26 (specifically the IOM/Health Canada GWG guidelines[33], and Health Canada's nutrition
27
28 guidelines[34] and physical activity guidelines[35]), and the priority level they placed on
29
30 discussing, assessing, and assisting women with GWG (e.g., *Given all the issues of concern*
31
32 *during a typical prenatal visit, I consider discussing GWG a high priority*). These questions
33
34 assessed agreement with each statement on a scale from 1 (strongly disagree) to 5 (strongly
35
36 agree). The survey also examined whether health care providers considered themselves to be the
37
38 most appropriate person within their practice setting to provide GWG counselling (*I am the most*
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40 *appropriate provider in my practice setting to discuss GWG*).
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50 *Data analysis*

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52 GWG counselling practices of each health care provider group were calculated as frequency and
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54 percentage of responses, dichotomized into "Routine (undertaken with >90% of pregnant
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3 patients)” and “Not routine” (all other response choices) based on the Institute of Medicine
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5 recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with
6
7 missing data were removed from analyses. Principal components analysis was used to reduce
8
9 the numerous survey questions into a smaller number of factors. The mean score of the items
10
11 loading onto each factor was used to represent that factor score for respondents. [36] For
12
13 example, four questions loaded onto a factor that was named “Providing Weight Gain Advice
14
15 and Discussing Risks” and were averaged together into a composite score for that factor. Mean
16
17 scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of
18
19 Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar
20
21 manner. Differences in mean composite scores were compared among health care provider
22
23 disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite
24
25 scores were normally distributed. Mean scores for each factor were used in multiple linear
26
27 regression models to evaluate the relationship between the predictors of interest and GWG
28
29 counselling practices. For all models, multicollinearity was not an issue with all tolerance values
30
31 >0.36 and variance inflation factors <2.8 .

32 33 34 35 36 37 38 39 40 41 Qualitative methods

42 43 44 *Outcomes*

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

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

23 *Providing weight gain advice and discussing risks*

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25 A small proportion of health care providers routinely provided women with a weight gain target
26 based on their pre-pregnancy BMI and discussed the recommended rate of weight gain based on
27 their weight gain target (21% and 16%; Table 2). Few indicated that they routinely discussed the
28 impacts of inappropriate weight gain on mother (20%) and baby (19%). The composite score for
29 “Providing weight gain advice and discussing the risks” did not differ between health care
30 provider disciplines (Table 3).
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43 Key concepts and quotes relating to counselling practices that emerged from the interviews are
44 outlined in Table 4. Interviewees described that the first prenatal visit includes measurement of
45 weight, calculation of BMI, and a large amount of information sharing, including general
46 information on GWG. Some health care providers advised women on a total weight gain target;
47 however, this was not always congruent with guidelines. The amount of information provided in
48 the first visit was perceived by the health care providers to be overwhelming for women.
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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.

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

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

42 The composite score for providing weight gain advice and discussing risks of inappropriate
43 weight gain was most strongly related to the priority level that health care providers placed on
44 GWG (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition
45 guidelines.
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3 Many health care providers in the interviews reported that GWG discussions may receive lower
4 priority due to the time constraints in a typical appointment (Table 4). This was related to their
5 compensation method, as general practitioners and obstetricians were remunerated in a fee-for-
6 service model that resulted in restriction on the length of appointments, as well as the topics
7 covered. Midwives were compensated by course-of-care, which resulted in longer and more
8 flexible appointments. However, midwives described a lower priority level placed on GWG, as
9 their practice was less focussed on weight, in particular weight assessment, and more focussed
10 on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity
11 of discussing GWG with pregnant women were also related to their providing weight gain advice
12 and discussing risks (Table 4). Some health care providers noted their discomfort with initiating
13 GWG discussions, or discussing GWG too frequently, as they were concerned that this may
14 cause psychological distress for the woman.
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34 *Predictors of discussing physical activity and food requirements*

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36 The priority level that health care providers place on GWG, their detailed knowledge of GWG,
37 nutrition, and physical activity guidelines, and their general knowledge of this area were all
38 significantly related to their discussing physical activity and food requirements with women
39 during a prenatal visit. After adjustment for practice characteristics, being a midwife remained a
40 significant predictor of this activity within a prenatal visit.
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51 Midwifery practices in relation to discussing physical activity and food requirements also
52 emerged from the interview data (Table 4). Midwives reported that their approach focussed on
53 overall health and wellness, and centred on support for women. Knowledge was another key
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3 factor that came to light in the interviews, as some health care providers noted a need for
4 additional knowledge, particularly in nutrition and maternal obesity. For health care providers
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6 additional knowledge, particularly in nutrition and maternal obesity. For health care providers
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8 working within a multidisciplinary team, access to dietitian services was an important
9
10 enhancement to GWG counselling practices.
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12 13 14 15 16 **Discussion**

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18 GWG counselling by health care providers falls below the recommendations from the Institute of
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20 Medicine and other national health agencies. [15] Although many of the health care providers
21
22 interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few
23
24 survey respondents from any discipline routinely provided women with a comprehensive GWG
25
26 recommendation and advice on rate of weight gain based on their pre-pregnancy BMI. In
27
28 addition, few survey respondents reported discussing the risks of inappropriate weight gain with
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30 women. While many health care providers reported providing a general message of the
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32 importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate
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34 extra food requirements. Weight was typically measured at each prenatal appointment, but not
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36 discussed unless it was a concern.
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45 This study identified that the priority level that health care providers placed on GWG had the
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47 strongest relationship with their practices. The qualitative results provided context to this
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49 finding, linking the priority level of GWG to the time available in a typical prenatal appointment,
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51 and the compensation that health care providers receive for their time. As well, this study
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53 identified the importance of detailed knowledge of practice guidelines, which also was strongly
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55 associated with counselling practices.
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6 A novel finding was documentation of the different approach reported by midwives. Midwives
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8 noted that their focus on the overall wellbeing of the women meant they discussed physical
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10 activity and nutrition in more depth than did physicians, and they measured weight less
11
12 frequently. Even after controlling for multiple other predictors, being a midwife remained a
13
14 significant predictor of discussing physical activity and food requirements with women during
15
16 routine prenatal care. Future studies should focus on learning about the quality of these
17
18 discussions and evaluating their impact on gestational weight gain, health behaviours, and
19
20 women's perceptions of support. This additional information could help guide or refine
21
22 approaches to antenatal care undertaken by different groups of care providers.
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29 A major strength of this study is the use of mixed research methods. This allowed for
30
31 verification of findings between methods, and provided a broader picture of "who is doing
32
33 what", as well as "why and how are they doing it". To our knowledge, this is the largest and
34
35 most comprehensive survey on this topic to date. While prenatal care varies between countries,
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37 the topics covered in this survey are considered routine and are undertaken as part of standard
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39 prenatal care in most developed countries.
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46 This study has limitations that should be considered. It was not possible to calculate a true
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48 response rate for the survey since the survey was distributed using email lists and social media
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50 through professional associations and networks. While this method of recruitment allowed for a
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52 wider reach, and ultimately more responses, those who responded may be more likely to engage
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54 in activities related to GWG counselling. This could lead to inflation of the reported frequency
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3 of specific GWG counselling practices. This is concerning as they are already quite low for
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5 some counselling practices and further highlights the need for targeted interventions in this area.
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10 The qualitative interviews were only conducted in two provinces, and there is the potential that
11
12 this does not accurately capture the practices and predictors in other geographic areas. However,
13
14 the congruency of the qualitative and quantitative findings suggests that this is unlikely.
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16 Furthermore, a recent systematic review found few differences in barriers and facilitators to
17
18 pregnancy weight management in studies from around the world, suggesting that the findings of
19
20 the current study may help inform practice in various health care systems.[41]
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26 To our knowledge, this is the first mixed methods study to examine GWG counselling, in
27
28 particular for the specific counselling practices recommended by the Institute of Medicine.
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30 While survey and qualitative research studies from various parts of the world have also found
31
32 low rates of GWG counselling as reported by patients, other surveys of health care providers
33
34 have found high self-reported rates of counselling.[20, 28] This discrepancy may due to the
35
36 frequency with which health care providers undertake counselling, as studies from the US have
37
38 found that health care providers report discussing GWG more often with women who are
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40 overweight or obese to begin pregnancy.[24] Therefore, they may report that they provide GWG
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42 counselling, but not to every pregnant woman. Further, when the depth of this counselling is
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44 explored, the self-reported rates are likely to diminish.
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53 In other research, patients of midwives were more likely to recall having discussed physical
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55 activity with their health care provider as compared to patients of general practitioners and
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3 obstetricians,[29] and midwives themselves report providing physical activity counselling to
4 women more frequently than other disciplines.[20, 28] While the present study considered
5 physical activity and nutrition counselling practices as one composite score, there seems to be
6 growing evidence that midwives provide more lifestyle counselling than other health care
7 provider disciplines. Expanding discussions on GWG to a healthier lifestyle is highly relevant
8 given the growing body of evidence related to their impact on disease in later life.[10] Whether
9 other health care providers can adopt similar practices remains to be determined, but regardless,
10 providers across disciplines require knowledge of GWG, physical activity, and nutrition
11 guidelines and may need system-level changes such as more time in an appointment to help them
12 make it a priority in their practice. A different model for dissemination of this knowledge needs
13 consideration. Multidisciplinary clinics that include professionals with a background in nutrition
14 and physical activity, and group educational sessions may be important in this regard. The latter
15 approach could allow participants to discuss these issues amongst themselves and may provide
16 positive reinforcement of new knowledge and help to shift old beliefs.[42] Further, discussion of
17 healthy GWG and maintenance of a healthy weight trajectory with women by health providers is
18 a missed opportunity for positive feedback for a healthy and potentially long-term behavior.

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43 This study identified predictors of GWG counselling at the individual and health care system
44 level. At the individual level, health care providers' attitudes towards GWG was related to
45 practices, including the level of priority they placed on GWG, and their perception of GWG as a
46 sensitive topic to discuss. As well, health care providers' knowledge, and in particular their
47 detailed knowledge of practice guidelines, was related to the frequency of GWG counselling. At
48 the system level, the compensation method impacted the amount of time they had in a typical
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3 prenatal appointment, which in turn was related to the priority level they placed on GWG and
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5 ultimately the frequency and depth of their counselling. Another important consideration is the
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7 differences in practices, and influences on practices, by health care provider discipline.
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10 Interventions to implement best practices should consider the multi-level influences on GWG
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12 counselling practices, as well as the discipline of the health care provider, in order to be effective
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14 at changing health care provider behaviours.
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19 While the Institute of Medicine's recommendations for implementing their GWG guidelines
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21 were based on expert consensus, research is needed to elucidate the most effective counselling
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23 methods and promising practices to recommend and help women achieve in order to promote
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25 appropriate GWG. Supporting health care providers to better counsel their pregnant patients on
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27 appropriate GWG is one important step towards improving the health of generations to come.
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For peer review only

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.

Acknowledgements

We would like to thank all of the participants in both components of the study for their time and insight. We would also like to thank Melisa Spaling for her contribution to the analysis of the qualitative data and Adam King for his help with recruiting participants to interview from British Columbia.

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.

Funding:

This study was funded by grants from Alberta Innovates – Health Solutions and the Danone Institute of Canada. The funders had no involvement in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; nor the decision to submit the article for publication.

Data Sharing:

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

For peer review only

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					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)*

¹GP=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	<p>“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.”</p> <p>- General Practitioner</p>
	Weight is assessed routinely, but not discussed in detail unless there is a concern	<p>“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.’”</p> <p>- General Practitioner</p>
	Midwives have a different approach to gestational weight gain	<p>“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.”</p> <p>- Midwife</p> <p>“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.”</p> <p>- Midwife</p>
Individual level influences on practice	Priority level	<p>“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.”</p> <p>- Midwife</p>
	Sensitivity of the discussion	<p>“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.”</p> <p>- General Practitioner, British Columbia</p>
	General knowledge of gestational weight gain, nutrition, and	<p>“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</p>

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4	physical activity	every two years for an hour on it.”
5		- Obstetrician
6		“I have to know so many rules about all sorts of things. I
7		always kind of go by, you know, 5, 10, 15. So those three
8		numbers I remember, 5, 10, 15. If you're overweight, if
9	Detailed knowledge	your BMI is higher than, you know, 26 or 27, or higher
10	of practice	than 28 or so, I would say, 5 kilos. If your weight is pretty
11	guidelines	well normal I'd say 10 kilos. And if your weight is under I'd
12		say 15 kilos.”
13		- General Practitioner
14		
15		“And that's a different model for us because we're not
16		billing per fee code. So when I see a woman, I can talk to
17		her or counsel her or do anything in that visit, it doesn't –
18		so, it's different than the physicians, I guess, because they're
19		constrained by billing for what they're talking to the people
20		about.”
21	Time and	- Midwife
22	compensation	
23		“I guess the biggest structural problem is the short prenatal
24		visit and the amount of information that has to be gathered
25		and disseminated in that visit, which is typically anything
26	System	from ten to 15 minutes long.”
27	level	- General Practitioner
28	influences	
29	on	
30	practice	
31		<i>“So I find the most successful story of patients</i>
32		<i>achieving their [weight] goals and continuing</i>
33		<i>postpartum, were women who I initially brought</i>
34		<i>up the topic [with], referred to our dietitian and</i>
35	Access to allied	<i>psychologist and they [women] continued to</i>
36	health services	<i>follow up with me and with them. So they had that</i>
37		<i>longer term follow-up and this goal setting and</i>
38		<i>checking in with someone.”</i>
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40		- 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 (<i>reference</i>)			
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

¹Model 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 (<i>reference</i>)			
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

¹Model 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

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018527.R1
Article Type:	Research
Date Submitted by the Author:	08-Sep-2017
Complete List of Authors:	Morris, Jillian; University of Alberta, Agricultural, Food and Nutritional Science Nikolopoulos, Hara; University of Alberta, Agricultural, Food and Nutritional Science Berry, Tanya; University of Alberta, Faculty of Physical Education and Recreation Jain, Venu; University of Alberta, Department of Obstetrics & Gynecology Vallis, Michael; Dalhousie University, Behaviour Change Institute, Dept of Family Medicine Piccinini-Vallis, Helena; Dalhousie University, Family Medicine Bell, R; University of Alberta, Agricultural, Food and Nutritional Science
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	General practice / Family practice
Keywords:	Pregnancy, Health Care, Gestational Weight Gain, Counselling

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4 **knowledge and attitudes: A cross-sectional mixed methods study**
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43 24 **Word count**

44 25 Manuscript: 3866
45
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53 29
54 30 **Keywords:** Pregnancy, health care, gestational weight gain, counselling (*3-5 keywords*)
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3 31 **Abstract**
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7 32 **Objective:** To understand current gestational weight gain (GWG) counselling practices of health
8
9 33 care providers, and the relationships between practices, knowledge and attitudes.

10
11 34 **Design:** Concurrent mixed methods with data integration: cross-sectional survey and semi-
12
13 35 structured interviews.

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15
16 36 **Participants:** Prenatal health care providers in Canada: general practitioners, obstetricians,
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18 37 midwives, nurse practitioners, and registered nurses in primary care settings.

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20
21 38 **Results:** Typically, GWG information was provided early in pregnancy, but not discussed again
22
23 39 unless there was a concern. Few routinely provided women with individualized GWG advice
24
25 40 (21%), rate of GWG (16%), or discussed the risks of inappropriate GWG to mother and baby
26
27 41 (20% and 19%). More routinely discussed physical activity (46%) and food requirements (28%);
28
29 42 midwives did these two activities more frequently than all other disciplines ($p<0.001$).
30
31 43 Midwives interviewed noted a focus on overall wellness instead of weight, and had longer
32
33 44 appointment times which allowed them to provide more in-depth counselling. Regression results
34
35 45 identified that the higher priority level that health care providers place on GWG, the more likely
36
37 46 they were to report providing GWG advice and discussing risks of GWG outside
38
39 47 recommendations ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements
40
41 48 ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of GWG to length of appointments,
42
43 49 financial compensation methods for health care providers, and the midwifery versus medical
44
45 50 model of care.

51
52 51 **Conclusions:** Interventions for health care providers to enhance GWG counselling practices
53
54 52 should consider the range of factors that influence the priority level health care providers place
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56 53 on GWG counselling.
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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.

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71

72 **Introduction**

73 Supporting all women to achieve healthy gestational weight gain (GWG) is of clinical
74 importance because GWG lower or higher than recommended is linked to a range of poor
75 maternal, fetal, and childhood outcomes. [1] For mothers, excess GWG increases the risk of
76 gestational diabetes mellitus and hypertensive disorders in pregnancy, and this is of special
77 concern if excessive GWG occurs early in pregnancy. [2-4] Excess GWG also poses risks at
78 delivery for the mother including increased likelihood of needing an instrumental delivery or a
79 Caesarean section, and surgical morbidity and mortality. [1, 3] Further, these factors result in an
80 increased risk for the fetus and neonate including the adverse consequences of macrosomia and
81 shoulder dystocia, need for intensive care unit admission, and the risk of perinatal death. [1, 3]
82 [5] In the long term, the child is at risk of an altered growth trajectory that may lead to obesity.
83 [6, 7] Excess GWG also increases the risk of postpartum weight retention, which may leave a
84 woman at an increased Body Mass Index (BMI) to begin her next pregnancy. [1] [8] The cycle of
85 excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to
86 increased risk in each subsequent pregnancy.[9] These risks act synergistically resulting in a
87 higher risk of metabolic and cardiovascular disease in later life for the mother as well as the
88 child.[10] Thus, excess GWG has short term, long term and intergenerational effects. [11]

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

1
2
3 95 pregnancy BMI, and that they track and discuss weight progress over the course of pregnancy, as
4
5 96 well as offering tailored counselling on dietary intake and physical activity. [15] Many countries
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7
8 97 provide guidance to health care providers in the form of evidence-based guidelines in order to
9
10 98 support them in providing physical activity and nutrition counselling to pregnant women. [16]
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12
13 99 [17-19]

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15
16 100 There is growing evidence to suggest that the quality of GWG counselling interactions needs
17
18 101 improvement, as women and health care providers report conflicting views of these interactions.
19
20 102 [20] Many women report that their health care provider did not provide recommendations for
21
22
23 103 GWG during their prenatal care, nor provide counselling about nutrition and physical activity
24
25 104 behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive
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28 105 approach, initiating a discussion about weight in pregnancy only after weight exceeds the
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30 106 recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this
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32
33 107 type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical
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35 108 prenatal visit.[23]

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40 110 Women may see a variety of health care provider disciplines for prenatal care including general
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42 111 practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is
43
44 112 some evidence to suggest that the approach to GWG counselling may vary by health care
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46
47 113 provider discipline [28, 29]; however, this area has not been fully explored. In order to better
48
49 114 support health care providers to have positive GWG counselling interactions with women, there
50
51 115 needs to be a detailed understanding of current practices, and what is influencing these practices.
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54 116 This information can be used to develop interventions to promote appropriate GWG in routine
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56 117 prenatal care. As such, the objectives of this study were to characterize and compare the GWG
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3 118 counselling practices of health care providers who provide prenatal care; and to examine
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5
6 119 potential influences on advice and counselling practices.
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11 121 **Methods**

12
13 122 Study design

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16 123 This study was conducted using a concurrent mixed methods design, consisting of an online
17
18 124 survey and semi-structured qualitative interviews. Qualitative and quantitative data were
19
20
21 125 collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well
22
23 126 suited for research questions that call for real-life contextual understandings and multi-level
24
25 127 influences, and lends itself well to the development of complex interventions. [31]
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30 129 Ethics approval for this study was obtained from the Health Research Ethics Board at the
31
32 130 University of Alberta (Study Identification Pro00045899). All participants provided informed
33
34 131 consent to participate in this study.
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39 133 Quantitative methods

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41 134 *Survey development*

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44 135 A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team
45
46 136 of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health
47
48 137 promotion, and health psychology (Supplementary file).
49
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51 138 *Recruitment and data collection*

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54 139 Health care providers including general practitioners, obstetricians, midwives, nurse
55
56 140 practitioners, and registered nurses in primary care settings from across Canada were recruited
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3 141 through professional associations and networks who agreed to distribute survey information to
4
5 142 their members. All health care providers who provided prenatal care were eligible to participate.
6
7
8 143 The survey was available from December 2014 to May 2015 on Research Electronic Data
9
10 144 Capture (REDCap) software hosted at the University of Alberta.[32]
11

12 145 *Outcomes*

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14
15 146 Survey participants provided information about their professional characteristics, and were asked
16
17 147 to respond to questions regarding their practices, knowledge, and attitudes related to GWG,
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19
20 148 nutrition and physical activity. Specifically, participants were asked about the proportion of their
21
22 149 pregnant patients with whom they undertook selected GWG counselling practices as outlined in
23
24 150 the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients)
25
26 151 to 5 (>90% of pregnant patients). Respondents were also asked for their self-assessment of their
27
28 152 general knowledge to support GWG counselling, their detailed knowledge of the content of
29
30 153 practice guidelines related to GWG (specifically the IOM/Health Canada GWG guidelines[33],
31
32 154 and Health Canada's nutrition guidelines[34] and physical activity guidelines[35]), and the
33
34 155 priority level they placed on discussing, assessing, and assisting women with GWG (e.g., *Given*
35
36 156 *all the issues of concern during a typical prenatal visit, I consider discussing GWG a high*
37
38 157 *priority*). Responses indicated level of agreement with each statement on a scale from 1
39
40 158 (strongly disagree) to 5 (strongly agree). The survey also examined whether health care
41
42 159 providers considered themselves to be the most appropriate person within their practice setting to
43
44 160 provide GWG counselling (*I am the most appropriate provider in my practice setting to discuss*
45
46 161 *GWG*).
47

48 162 49 50 51 163 *Data analysis*

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2
3 164 GWG counselling practices of each health care provider group were calculated as frequency and
4
5 165 percentage of responses, dichotomized into “Routine (undertaken with >90% of pregnant
6
7 166 patients)” and “Not routine” (all other response choices) based on the Institute of Medicine
8
9 167 recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with
10
11 168 missing data were removed from analyses. Principal components analysis was used to reduce
12
13 169 the numerous survey questions into a smaller number of factors. The mean score of the items
14
15 170 loading onto each factor was used to represent that factor score for respondents. [36] For
16
17 171 example, four questions loaded onto a factor that was named “Providing Weight Gain Advice
18
19 172 and Discussing Risks” and were averaged together into a composite score for that factor. Mean
20
21 173 scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of
22
23 174 Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar
24
25 175 manner. Differences in mean composite scores were compared among health care provider
26
27 176 disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite
28
29 177 scores were normally distributed. Mean scores for each factor were used in multiple linear
30
31 178 regression models to evaluate the relationship between the predictors of interest and GWG
32
33 179 counselling practices. For all models, multicollinearity was not an issue with all tolerance values
34
35 >0.36 and variance inflation factors <2.8.
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182 Qualitative methods

183 *Materials*

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

1
2
3 186 relation to GWG, as well as the reasons behind these practices. The interview guide also
4
5 187 included questions regarding provider knowledge in and attitudes towards GWG.
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9
10 189 *Recruitment and data collection*
11

12 190 Potential participants were identified through collaborating members of the study team. A
13
14 191 purposive sample of maximum variation was recruited to gather the perspectives of health care
15
16 192 providers from the different disciplines practicing in urban or rural locations in two Canadian
17
18 193 provinces (Alberta and British Columbia). When these contacts were exhausted, an advertisement
19
20 194 was distributed by email to medical clinics relevant to the requirements for variability in the sample.
21
22 195 Interviews were conducted over the telephone, audio-recorded and transcribed verbatim.
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25 196

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28
29 197 *Data analysis*
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31 198 Qualitative content analysis was used to describe and inductively interpret the data.[37, 38]
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33 199 Qualitative content analysis is a process that is a “reduction and sense making effort that takes a
34
35 200 volume of qualitative material and attempts to identify core consistencies and meanings”. [39](p.45)
36
37 201 Audio recordings and transcripts were reviewed, and reviewed again while making notes about
38
39 202 key words and phrases. Key concepts were categorized and re-categorized as patterns emerged.
40
41 203 Data analysis occurred concurrently with data collection, and sampling adequacy was
42
43 204 demonstrated by saturation of the data, as replication occurred in categories as new participants
44
45 205 were included in the analysis.[40] Findings were discussed and approved by the study team.
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50 206

51
52 207 Data integration
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3 208 The categories emerging inductively from the interviews were compared with the results from
4
5 209 the quantitative survey to determine if findings from each method confirmed the other, as well as
6
7
8 210 to expand the strength of each type of data to better explain the phenomenon.[41]
9

10 211

14 212 **Results**

16 213 Participant characteristics

18 214 Overall, 1189 health care providers responded to the survey. Of these, 122 did not meet the
19
20
21 215 eligibility criteria (i.e. did not see pregnant women in their practice), 27 did not specify their
22
23 216 health care provider discipline, 155 did not answer any questions beyond practice characteristics,
24
25 217 and 377 indicated a health care provider discipline that was outside the scope of these analyses.
26
27
28 218 Thus, 508 responses from general practitioners, obstetricians, midwives, nurse practitioners and
29
30 219 registered nurses in primary care settings from across Canada are included in this analysis (Table
31
32
33 220 1). Twenty-three health care providers from these same disciplines participated in the interviews.
34

35 221

37 222 Gestational weight gain counselling practices of health care providers

40 223 *Providing weight gain advice and discussing risks*

42 224 A small proportion of health care providers routinely provided women with a GWG target based
43
44 225 on their pre-pregnancy BMI and discussed the recommended rate of GWG based on their GWG
45
46
47 226 target (21% and 16%; Table 2). Few indicated that they routinely discussed the impacts of
48
49 227 inappropriate GWG on mother (20%) and baby (19%). The composite score for “Providing
50
51 228 weight gain advice and discussing the risks” did not differ between health care provider
52
53
54 229 disciplines (Table 3).

56 230

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3 231 Key concepts and quotes relating to counselling practices that emerged from the interviews are
4
5 232 outlined in Table 4. Interviewees described the first prenatal visit as including measurement of
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8 233 weight, calculation of BMI, and a large amount of information sharing, including general
9
10 234 information on GWG. Some health care providers advised women on a total GWG target;
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12 235 however, this was not always congruent with guidelines. The amount of information provided in
13
14 236 the first visit was perceived by the health care providers to be overwhelming for women.
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20 238 *Weight assessment*

21
22 239 Approximately three-quarters of respondents weighed women at every visit (76%), while half of
23
24 240 respondents would routinely relay GWG information to women every time they are weighed
25
26
27 241 (Table 2). Midwives reported measuring weight at every visit less frequently than all other
28
29 242 disciplines (Table 3).
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32 243
33
34 244 Interviewees noted that weight was typically measured at each visit, except for midwives who
35
36 245 generally measured women's weight if clinically necessary, or if women requested them to do so
37
38 246 (Table 4). After the first visit, interview participants indicated that they revisited the topic to
39
40 247 varying levels of depth, typically only when the health care provider or woman expressed
41
42 248 concern about her weight.
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48 250 *Discussing physical activity and food requirements*

49
50 251 Nearly half (46%) of health care providers reported routinely discussing physical activity with
51
52 252 women while about one-third routinely discussed appropriate extra food requirements (28%),
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54
55 253 and only about one-third felt they could routinely give examples of appropriate changes that
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3 254 women could make to meet extra food requirements (32%) (Table 2). In contrast, over two-
4
5 255 thirds would discuss the importance of prenatal vitamins (67%). The composite score for the
6
7
8 256 three survey questions regarding discussing physical activity and food requirements differed
9
10
11 257 between health care provider disciplines (Table 3). Midwives did this more frequently than all
12
13 258 other disciplines except for nurse practitioners.

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15 259
16
17 260 Health care providers of all disciplines described providing general information on GWG,
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19
20 261 physical activity, and nutrition in the early stages of pregnancy, and many indicated providing
21
22 262 women with printed resources in this area (Table 4). The midwives interviewed described
23
24 263 spending more time assessing women's current lifestyle and providing individualized advice
25
26
27 264 than did physicians (Table 4).

28
29 265

30 31 32 266 Predictors of counselling practices

33
34 267 Health care providers, regardless of discipline, reported similar responses for having appropriate
35
36 268 general knowledge of GWG, physical activity, and nutrition, as well as knowledge of related
37
38
39 269 practice guidelines (Table 3); only the difference between midwives and registered nurses
40
41 270 responses was significant. There were significant differences in the level of priority placed on
42
43 271 GWG. Midwives and obstetricians had lower composite scores for the priority level they place
44
45
46 272 on GWG than general practitioners and nurse practitioners, but did not differ significantly from
47
48 273 each other (Table 3). The majority of health care providers considered discussing GWG with
49
50
51 274 women to be within their role (77%).

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53 275

54 55 276 *Predictors of providing weight gain advice and discussing risks*

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3 277 The composite score for providing weight gain advice and discussing risks of inappropriate
4
5 278 GWG was most strongly related to the priority level that health care providers placed on GWG
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8 279 (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition
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10 280 guidelines.
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15 282 Generally, health care providers in the interviews reported that GWG discussions may receive
16
17 283 lower priority due to the time constraints in a typical appointment (Table 4). This was related to
18
19
20 284 their compensation method, as general practitioners and obstetricians were remunerated in a fee-
21
22 285 for-service model that resulted in restriction on the length of appointments, as well as the topics
23
24 286 covered. Midwives were compensated by course-of-care, which resulted in longer and more
25
26
27 287 flexible appointments. However, midwives described a lower priority level placed on GWG, as
28
29 288 their practice was less focussed on weight, in particular weight assessment, and more focussed
30
31 289 on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity
32
33 290 of discussing GWG with pregnant women were also related to their providing weight gain advice
34
35 291 and discussing risks (Table 4). Some health care providers noted their discomfort with initiating
36
37 292 GWG discussions, or discussing GWG too frequently, as they were concerned that this may
38
39 293 cause psychological distress for the woman.
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43 294

44 295 *Predictors of discussing physical activity and food requirements*

45
46 296 The priority level that health care providers place on GWG, their detailed knowledge of GWG,
47
48 297 nutrition, and physical activity guidelines, and their general knowledge of this area were all
49
50
51 298 significantly related to their discussing physical activity and food requirements with women
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3 299 during a prenatal visit (Table 6). After adjustment for practice characteristics, being a midwife
4
5 300 remained a significant predictor of this activity within a prenatal visit.
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9
10 302 Midwifery practices in relation to discussing physical activity and food requirements also
11
12 303 emerged from the interview data (Table 4). Midwives reported that their approach focussed on
13
14 304 overall health and wellness, and centred on support for women. Knowledge was another key
15
16 305 factor that came to light in the interviews, as some health care providers noted a need for
17
18 306 additional knowledge, particularly in nutrition and maternal obesity. For health care providers
19
20 307 working within a multidisciplinary team, access to dietetic services was an important
21
22 308 enhancement to GWG counselling practices.
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27 309

30 310 **Discussion**

31
32 311 GWG counselling by health care providers falls below the recommendations from the Institute of
33
34 312 Medicine and other national health agencies. [15] Although many of the health care providers
35
36 313 interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few
37
38 314 survey respondents from any discipline routinely provided women with a comprehensive GWG
39
40 315 recommendation and advice on their rate of GWG based on their pre-pregnancy BMI. In
41
42 316 addition, few survey respondents reported discussing the risks of inappropriate GWG with
43
44 317 women. While many health care providers reported providing a general message of the
45
46 318 importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate
47
48 319 extra food requirements. Weight was typically measured at each prenatal appointment, but not
49
50 320 discussed unless it was a concern. This is in contrast with what women report they need from
51
52 321 their health care provider, as other studies from our research group have indicated that women
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3 322 would like their health care provider to initiate a discussion about GWG early in pregnancy, and
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5 323 continue the discussions throughout pregnancy and postpartum so that they are updated on their
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7
8 324 GWG progress. [22]
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11
12 326 The low rates of some of these counselling practices are concerning since it is possible that
13
14 327 survey respondents are those most likely to counsel women about GWG. There is evidence
15
16 328 suggesting that women who's health care providers discuss GWG and related lifestyle
17
18 329 behaviours in pregnancy with them have lower GWG and lower likelihood of having a baby that
19
20 330 is large for gestational age. [42-44] This underlines the potential level of influence that health
21
22 331 care providers have with pregnant women and the importance of refining health care providers
23
24 332 training or antenatal care pathways to support such conversations.
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31 334 To our knowledge, this is the first mixed methods study to examine GWG counselling, in
32
33 335 particular for the specific counselling practices recommended by the Institute of Medicine.
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35 336 While survey and qualitative research studies from various parts of the world have also found
36
37 337 low rates of GWG counselling as reported by patients, other surveys of health care providers
38
39 338 have found high self-reported rates of counselling.[20, 28] This discrepancy may due to the
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41 339 frequency with which health care providers undertake counselling, as studies from the US have
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43 340 found that health care providers report discussing GWG more often with women who are
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45 341 overweight or obese to at the start of their pregnancy.[24] Therefore, they may report that they
46
47 342 provide GWG counselling, but not to every pregnant woman. Further, when the depth of this
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49 343 counselling is explored, the self-reported rates are likely to diminish. Future studies should
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51 344 objectively assess the quality of these discussions and evaluate their impact on GWG, health
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3 345 behaviours like physical activity and diet, and women's perceptions of support. Furthermore,
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5 346 research is needed to elucidate the most effective counselling methods that will help women
6
7 347 achieve appropriate GWG. This additional information could help guide or refine approaches to
8
9 348 antenatal care undertaken by different groups of care providers.
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12 349
13
14 350 This study identified multi-level influences on GWG counselling. Most notably, the priority
15
16 351 level that health care providers placed on GWG had the strongest relationship with their
17
18 352 practices. The qualitative results provided context to this finding, linking the priority level of
19
20 353 GWG to factors at the health care system level, such as the time available in a typical prenatal
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22 354 appointment, and the compensation that health care providers receive for their time.
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26 355 Additionally, this study identified factors at the individual level. This included the importance of
27
28 356 detailed knowledge of practice guidelines, which also was strongly associated with counselling
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30 357 practices.
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35 359 One novel finding was the new insights into the different approach reported by midwives.
36
37 360 Midwives noted that their focus on the overall wellbeing of the women meant they discussed
38
39 361 physical activity and nutrition in more depth than did physicians, and they measured weight less
40
41 362 frequently. Even after controlling for multiple other predictors, midwives were significantly
42
43 363 more likely than other health care providers to report discussing physical activity and food
44
45 364 requirements with women during routine prenatal care. In other research, patients of midwives
46
47 365 were more likely to recall having discussed physical activity with their health care provider as
48
49 366 compared to patients of general practitioners and obstetricians,[29] and midwives themselves
50
51 367 report providing physical activity counselling to women more frequently than other
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3 368 disciplines.[20, 28] While the present study considered physical activity and nutrition
4
5 369 counselling practices as one composite score, there seems to be growing evidence that midwives
6
7
8 370 provide more lifestyle counselling than other health care provider disciplines. The impact of
9
10 371 counselling by a midwife as compared to other disciplines on the health outcomes for women is
11
12 372 an area for future exploration.

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14 15 16 17 374 *Strengths and Limitations*

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19
20 375 A major strength of this study is the use of mixed research methods. This allowed for some
21
22 376 verification of findings between methods, and provided a broader picture of “who is doing
23
24 377 what”, as well as “why and how are they doing it”. To our knowledge, this is the largest and
25
26
27 378 most comprehensive survey on this topic to date. While prenatal care varies between countries,
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29 379 the topics covered in this survey are considered routine and are undertaken as part of standard
30
31 380 prenatal care in most developed countries.

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36 382 This study has limitations that should be considered. It was not possible to calculate a true
37
38 383 response rate for the survey since the survey was distributed using email lists and social media
39
40 384 through professional associations and networks. While this method of recruitment allowed for a
41
42 385 wider reach, and ultimately more responses, those who responded may be more likely to engage
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44 386 in activities related to GWG counselling. This could lead to inflation of the reported frequency
45
46 387 of specific GWG counselling practices. This is concerning as they are already quite low for
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48
49 388 some counselling practices and further highlights the need for targeted interventions in this area.

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3 390 The qualitative interviews were only conducted in two provinces, and there is the potential that
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5 391 this does not accurately capture the practices and predictors in other geographic areas. However,
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8 392 the congruency of the qualitative and quantitative findings suggests that this is unlikely.
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10 393 Furthermore, a recent systematic review found few differences in barriers and facilitators to
11
12 394 pregnancy weight management in studies from around the world, suggesting that the findings of
13
14 395 the current study may help inform practice in various health care systems.[45]
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19
20 397 *Recommendations*

21
22 398 Interventions to implement best practices should consider the multi-level influences on GWG
23
24 399 counselling practices, as well as the discipline of the health care provider, in order to be effective
25
26 400 at changing health care provider behaviours. Providers across disciplines require knowledge of
27
28 401 GWG, physical activity, and nutrition guidelines and some may need system-level changes such
29
30 402 as more time in an appointment to help them make it a priority in their practice. A different
31
32 403 model for dissemination of this knowledge needs consideration. Multidisciplinary clinics that
33
34 404 include professionals with a background in nutrition and physical activity, and group educational
35
36 405 sessions may be important in this regard. The latter approach could allow participants to discuss
37
38 406 these issues amongst themselves and may provide positive reinforcement of new knowledge and
39
40 407 help to shift old beliefs.[42] Furthermore, discussion of healthy GWG and maintenance of a
41
42 408 healthy weight trajectory with women by health providers is a missed opportunity for positive
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44 409 feedback for a healthy and potentially long-term behaviour.
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52 411 Expanding discussions on GWG to a healthier lifestyle is highly relevant given the growing body
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54 412 of evidence related to its impact on disease in later life.[10] Health care providers are well
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413 positioned to help women identify plans to help change behaviour and improve health outcomes.
414 Strong communication between health care providers and pregnant women is a key component
415 to moving forward. Supporting health care providers to better counsel their pregnant patients on
416 appropriate GWG is one important step towards breaking the intergenerational cycle of obesity,
417 and improving the health of generations to come.

418

For peer review only

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3 535 **Authors' contributions**
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5 536 RCB and HN designed the study, and with MV and HPV developed the interview guide and
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7
8 537 survey questionnaire. JM and HN recruited interview participants and conducted the interviews.
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10 538 JM recruited survey participants, conducted the qualitative and quantitative analyses and wrote
11
12 539 the first draft of the manuscript. HN and RCB contributed to the qualitative analysis and TB and
13
14 540 RCB contributed to quantitative analysis. VJ contributed to recruitment of interview
15
16
17 541 participants. All authors made significant contributions to the critical review and revisions of the
18
19 542 manuscript. JM and RCB are the guarantors of the manuscript. All authors had full access to all
20
21 543 of the data (including statistical reports and tables) in the study and can take responsibility for the
22
23 544 integrity of the data and the accuracy of the data analysis. JM affirms that the manuscript is an
24
25 545 honest, accurate, and transparent account of the study being reported; that no important aspects
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27 546 of the study have been omitted.
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32
33 547 **Acknowledgements**
34

35 548 We would like to thank all of the participants in both components of the study for their time and
36
37 549 insight. We would also like to thank Melisa Spaling for her contribution to the analysis of the
38
39 550 qualitative data and Adam King for his help with recruiting participants to interview from British
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41 551 Columbia.
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44 552 **Conflict of interest**
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47 553 All authors have completed the ICMJE uniform disclosure form at
48
49 554 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the
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51 555 submitted work; no financial relationships with any organisations that might have an interest in
52
53 556 the submitted work in the previous three years; no other relationships or activities that could
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55 557 appear to have influenced the submitted work.
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6 559 **Funding:**
7
8 560 This study was funded by grants from Alberta Innovates – Health Solutions and the Danone
9
10 561 Institute of Canada. The funders had no involvement in the study design; in the collection,
11
12 562 analysis, and interpretation of data; in the writing of the report; nor the decision to submit the
13
14 563 article for publication.
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565 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

566

567 Table 2. Survey responses regarding gestational weight gain counselling practices routinely
 568 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												

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

	Health care provider discipline ¹					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)*

¹GP=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

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

575

Category	Concept	Representative quote(s)
Practices	The first visit involves a large amount of information sharing	<p>“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.”</p> <p>- General Practitioner</p>
	Weight is assessed routinely, but not discussed in detail unless there is a concern	<p>“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.’”</p> <p>- General Practitioner</p>
	Midwives have a different approach to gestational weight gain	<p>“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.”</p> <p>- Midwife</p> <p>"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.”</p> <p>- Midwife</p>
Individual level influences on practice	Priority level	<p>“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.”</p> <p>- Midwife</p>
	Sensitivity of the discussion	<p>“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.”</p> <p>- General Practitioner</p>
	General knowledge of gestational weight gain, nutrition, and	<p>“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</p>

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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

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

System
level
influences
on
practice

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

Variable	Model ¹		
	Unstd β	S.E. of β	Std Beta
(Constant)	-1.14**	0.38	
General practitioner (<i>reference</i>)			
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

¹Model 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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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 (<i>reference</i>)			
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

¹Model 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

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For peer review only

1 Do you see pregnant women in your practice? Yes
2 No
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4 In which Canadian province or territory do you work? British Columbia
5 Alberta
6 Saskatchewan
7 Manitoba
8 Ontario
9 Quebec
10 Newfoundland and Labrador
11 New Brunswick
12 Prince Edward Island
13 Nova Scotia
14 Yukon
15 Northwest Territories
16 Nunavut
17 What best describes the location of your practice? Urban
18 Rural
19 Urban and rural
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21 In what type of practice setting do you work? Solo
22 (Please select all that apply) Group
23 Interdisciplinary
24 Academic
25
26 What is your occupational specialty? General Practitioner/Family Physician
27 Obstetrician/Gynecologist
28 Physician - other
29 Registered Midwife
30 Nurse Practitioner
31 Registered Nurse
32 Prenatal Educator
33 Registered Dietitian
34 Other
35
36 My primary practice is: Public/community health
37 Primary care
38 Acute care
39 Other
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41 Please specify: Registered Nurse
42 Perinatal support worker
43 Other
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45 Please specify: _____
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1 What are some common reasons for pregnant women to be referred to you? (Check all that apply)

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- 3 General healthy eating
- 4 High pre-pregnancy BMI
- 5 Low pre-pregnancy BMI
- 6 Excessive weight gain
- 7 Inadequate weight gain
- 8 Multiple food restrictions, e.g. vegetarian, food allergies, etc.
- 9 Nausea/vomiting
- 10 Twin/multiple pregnancy
- 11 Adolescent pregnancy
- 12 Concurrent medical condition, e.g. diabetes in pregnancy
- 13 All pregnant women in my health care setting are referred to me
- 14 I see pregnant women in a group setting
- 15 Other (Please specify)
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For peer review only

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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

For peer review only

1
2 **Given all of the issues of concern during a typical prenatal visit, how often do women ask you**
3 **about:**

	Almost never(< 10%)	Rarely(10-30%)	Sometimes(30-60%)	Often(60-90%)	Almost always(>90%)
4 5 6 7 8 How much weight to gain during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9 10 11 Healthy eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12 13 How much they should be eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14 15 Where to find resources about healthy eating for pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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For peer review only

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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss the recommended rate of weight gain (kg/wk) based on their weight gain target	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss the impact that inappropriate weight gain can have on the mother during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss the impact that inappropriate weight gain can have on the baby	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I weigh women at every visit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I relay weight gain information to women every time I weigh them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss appropriate physical activity with pregnant women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss appropriate extra food requirements with pregnant women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily give examples of appropriate changes that women could make to meet extra food requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I discuss the importance of taking prenatal vitamins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health Canada's Prenatal Nutrition Guidelines for Health Professionals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

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

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
7 Discussing appropriate gestational weight gain with women a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11 Assessing gestational weight gain a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14 Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators; providing resources; referrals to appropriate providers; etc.) a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

29 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

39 Please specify:

40 _____

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

- Yes
- No
- Not applicable

46 Please explain:

47 _____

1
2 **In your practice setting, who do you think is the most suitable person to discuss, assess,**
3 **assist, and follow-up with gestational weight gain with women?**
4

	Discuss	Assess	Assist	Follow-up
5				
6				
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8				
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12				
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16				
17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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23
24 Please specify provider: _____
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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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant pregnancy weight gain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge to recommend guideline concordant physical activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant physical activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge to recommend guideline concordant healthy eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant healthy eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018527.R2
Article Type:	Research
Date Submitted by the Author:	04-Oct-2017
Complete List of Authors:	Morris, Jillian; University of Alberta, Agricultural, Food and Nutritional Science Nikolopoulos, Hara; University of Alberta, Agricultural, Food and Nutritional Science Berry, Tanya; University of Alberta, Faculty of Physical Education and Recreation Jain, Venu; University of Alberta, Department of Obstetrics & Gynecology Vallis, Michael; Dalhousie University, Behaviour Change Institute, Dept of Family Medicine Piccinini-Vallis, Helena; Dalhousie University, Family Medicine Bell, R; University of Alberta, Agricultural, Food and Nutritional Science; University of Alberta
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	General practice / Family practice
Keywords:	Counselling, Gestational Weight Gain, Health Care Providers, Pregnancy

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Manuscripts

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3 **1 Health care provider's gestational weight gain counselling practices and the influence of**
4 **knowledge and attitudes: A cross-sectional mixed methods study**
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43 27 **Word count**

44 28 Manuscript: 3866
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1
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3 30 **Keywords:** Counselling, gestational weight gain, health care providers, pregnancy
4
5

6 31 **Abstract**
7
8

9 32 **Objective:** To understand current gestational weight gain (GWG) counselling practices of health
10
11 33 care providers, and the relationships between practices, knowledge and attitudes.
12

13 34 **Design:** Concurrent mixed methods with data integration: cross-sectional survey and semi-
14
15 35 structured interviews.
16
17

18 36 **Participants:** Prenatal health care providers in Canada: general practitioners, obstetricians,
19
20 37 midwives, nurse practitioners, and registered nurses in primary care settings.
21
22

23 38 **Results:** Typically, GWG information was provided early in pregnancy, but not discussed again
24
25 39 unless there was a concern. Few routinely provided women with individualized GWG advice
26
27 40 (21%), rate of GWG (16%), or discussed the risks of inappropriate GWG to mother and baby
28
29 41 (20% and 19%). More routinely discussed physical activity (46%) and food requirements (28%);
30
31 42 midwives did these two activities more frequently than all other disciplines ($p<0.001$).
32
33

34 43 Midwives interviewed noted a focus on overall wellness instead of weight, and had longer
35
36 44 appointment times which allowed them to provide more in-depth counselling. Regression results
37
38 45 identified that the higher priority level that health care providers place on GWG, the more likely
39
40 46 they were to report providing GWG advice and discussing risks of GWG outside
41
42 47 recommendations ($\beta=0.71$, $p<0.001$) and discussing physical activity and food requirements
43
44 48 ($\beta=0.341$, $p<0.001$). Interview data linked the priority level of GWG to length of appointments,
45
46 49 financial compensation methods for health care providers, and the midwifery versus medical
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48 50 model of care.
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3 51 **Conclusions:** Interventions for health care providers to enhance GWG counselling practices
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6 52 should consider the range of factors that influence the priority level health care providers place
7
8 53 on GWG counselling.
9

10 54

11
12
13 55 **Strengths and Limitations Of This Study: (max 5 bullet points)**

- 14
15 56
- 16 • This is a large and in-depth examination and comparison of health care providers'
17 practices related to monitoring and discussing GWG with pregnant women,
18
 - 19 58 • This study is enhanced by the use of mixed methods. Mixed methods research is well
20 suited for health services, which are complex and influenced by multiple factors.
21
22 59
 - 23 • The findings from this study may have a wide applicability, as the topics covered in this
24 survey are considered routine and are undertaken as part of standard prenatal care in most
25 developed countries.
26
27 61
 - 28 • It was not possible to calculate a true response rate for the survey since the survey was
29 distributed using email lists and social media through professional associations and
30 networks although these methods allowed for wider reach and more responses.
31
32 62
 - 33 • Those who responded may be more likely to engage in activities related to GWG
34 counselling which could lead to inflation of the reported frequency of specific GWG
35 counselling practices.. Nevertheless, the rates of some counselling practices reported in
36 this study are quite low.
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72 **Introduction**

73 Supporting all women to achieve healthy gestational weight gain (GWG) is of clinical
74 importance because GWG lower or higher than recommended is linked to a range of poor
75 maternal, fetal, and childhood outcomes. [1] For mothers, excess GWG increases the risk of
76 gestational diabetes mellitus and hypertensive disorders in pregnancy, and this is of special
77 concern if excessive GWG occurs early in pregnancy. [2-4] Excess GWG also poses risks at
78 delivery for the mother including increased likelihood of needing an instrumental delivery or a
79 Caesarean section, and surgical morbidity and mortality. [1, 3] Further, these factors result in an
80 increased risk for the fetus and neonate including the adverse consequences of macrosomia and
81 shoulder dystocia, need for intensive care unit admission, and the risk of perinatal death. [1, 3]
82 [5] In the long term, the child is at risk of an altered growth trajectory that may lead to obesity.
83 [6, 7] Excess GWG also increases the risk of postpartum weight retention, which may leave a
84 woman at an increased Body Mass Index (BMI) to begin her next pregnancy. [1] [8] The cycle of
85 excess GWG followed by postpartum weight retention and increasing maternal BMI can lead to
86 increased risk in each subsequent pregnancy.[9] These risks act synergistically resulting in a
87 higher risk of metabolic and cardiovascular disease in later life for the mother as well as the
88 child.[10] Thus, excess GWG has short term, long term and intergenerational effects. [11]

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

1
2
3 95 pregnancy BMI, and that they track and discuss weight progress over the course of pregnancy, as
4
5 96 well as offering tailored counselling on dietary intake and physical activity. [15] Many countries
6
7
8 97 provide guidance to health care providers in the form of evidence-based guidelines in order to
9
10 98 support them in providing physical activity and nutrition counselling to pregnant women. [16]
11
12
13 99 [17-19]

14
15
16 100 There is growing evidence to suggest that the quality of GWG counselling interactions needs
17
18 101 improvement, as women and health care providers report conflicting views of these interactions.
19
20 102 [20] Many women report that their health care provider did not provide recommendations for
21
22
23 103 GWG during their prenatal care, nor provide counselling about nutrition and physical activity
24
25 104 behaviours during pregnancy [21, 22] Health care providers have reported taking a reactive
26
27
28 105 approach, initiating a discussion about weight in pregnancy only after weight exceeds the
29
30 106 recommendations. [23, 24] Health care providers may lack knowledge or skills to undertake this
31
32
33 107 type of counselling[25] [26], or consider GWG to be a low priority in the context of a typical
34
35 108 prenatal visit.[23]

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37 109
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40 110 Women may see a variety of health care provider disciplines for prenatal care including general
41
42 111 practitioners, obstetricians, midwives, nurse practitioners, and registered nurses. [27] There is
43
44 112 some evidence to suggest that the approach to GWG counselling may vary by health care
45
46
47 113 provider discipline [28, 29]; however, this area has not been fully explored. In order to better
48
49 114 support health care providers to have positive GWG counselling interactions with women, there
50
51 115 needs to be a detailed understanding of current practices, and what is influencing these practices.
52
53
54 116 This information can be used to develop interventions to promote appropriate GWG in routine
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56 117 prenatal care. As such, the objectives of this study were to characterize and compare the GWG
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3 118 counselling practices of health care providers who provide prenatal care; and to examine
4
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6 119 potential influences on advice and counselling practices.
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11 121 **Methods**

12
13 122 Study design

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15
16 123 This study was conducted using a concurrent mixed methods design, consisting of an online
17
18 124 survey and semi-structured qualitative interviews. Qualitative and quantitative data were
19
20
21 125 collected in tandem, analyzed separately, and integrated.[30] Mixed methods research is well
22
23 126 suited for research questions that call for real-life contextual understandings and multi-level
24
25 127 influences, and lends itself well to the development of complex interventions. [31]
26
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30 129 Ethics approval for this study was obtained from the Health Research Ethics Board at the
31
32 130 University of Alberta (Study Identification Pro00045899). All participants provided informed
33
34
35 131 consent to participate in this study.
36

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39 133 Quantitative methods

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41 134 *Survey development*

42
43
44 135 A survey questionnaire was developed, pilot-tested, and assessed for content validity by a team
45
46 136 of researchers with expertise in the areas of obstetrics, nutrition, exercise physiology, health
47
48
49 137 promotion, and health psychology (Supplementary file).
50

51 138 *Recruitment and data collection*

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53
54 139 Health care providers including general practitioners, obstetricians, midwives, nurse
55
56 140 practitioners, and registered nurses in primary care settings from across Canada were recruited
57
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1
2
3 141 through professional associations and networks who agreed to distribute survey information to
4
5 142 their members. All health care providers who provided prenatal care were eligible to participate.
6
7
8 143 The survey was available from December 2014 to May 2015 on Research Electronic Data
9
10 144 Capture (REDCap) software hosted at the University of Alberta.[32]
11

12 145 *Outcomes*

13
14
15 146 Survey participants provided information about their professional characteristics, and were asked
16
17 147 to respond to questions regarding their practices, knowledge, and attitudes related to GWG,
18
19
20 148 nutrition and physical activity. Specifically, participants were asked about the proportion of their
21
22 149 pregnant patients with whom they undertook selected GWG counselling practices as outlined in
23
24 150 the Institute of Medicine recommendations[15], using a scale from 1 (<10% of pregnant patients)
25
26 151 to 5 (>90% of pregnant patients). Respondents were also asked for their self-assessment of their
27
28 152 general knowledge to support GWG counselling, their detailed knowledge of the content of
29
30 153 practice guidelines related to GWG (specifically the IOM/Health Canada GWG guidelines[33],
31
32 154 and Health Canada's nutrition guidelines[34] and physical activity guidelines[35]), and the
33
34 155 priority level they placed on discussing, assessing, and assisting women with GWG (e.g., *Given*
35
36 156 *all the issues of concern during a typical prenatal visit, I consider discussing GWG a high*
37
38 157 *priority*). Responses indicated level of agreement with each statement on a scale from 1
39
40 158 (strongly disagree) to 5 (strongly agree). The survey also examined whether health care
41
42 159 providers considered themselves to be the most appropriate person within their practice setting to
43
44 160 provide GWG counselling (*I am the most appropriate provider in my practice setting to discuss*
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46 161 *GWG*).
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52 162

53 163 *Data analysis*

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3 164 GWG counselling practices of each health care provider group were calculated as frequency and
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5
6 165 percentage of responses, dichotomized into “Routine (undertaken with >90% of pregnant
7
8 166 patients)” and “Not routine” (all other response choices) based on the Institute of Medicine
9
10 167 recommendations that these practices occur with every woman (IOM, 2013).[15] Cases with
11
12 168 missing data were removed from analyses. Principal components analysis was used to reduce
13
14 169 the numerous survey questions into a smaller number of factors. The mean score of the items
15
16 170 loading onto each factor was used to represent that factor score for respondents. [36] For
17
18 171 example, four questions loaded onto a factor that was named “Providing Weight Gain Advice
19
20 172 and Discussing Risks” and were averaged together into a composite score for that factor. Mean
21
22 173 scores were calculated for the remaining factors of General Knowledge, Detailed Knowledge of
23
24 174 Practice Guidelines, and the Priority Level Health Care Providers Place on GWG, in a similar
25
26 175 manner. Differences in mean composite scores were compared among health care provider
27
28 176 disciplines using one-way ANOVA) with Bonferroni post-hoc tests; residuals for all composite
29
30 177 scores were normally distributed. Mean scores for each factor were used in multiple linear
31
32 178 regression models to evaluate the relationship between the predictors of interest and GWG
33
34 179 counselling practices. For all models, multicollinearity was not an issue with all tolerance values
35
36 180 >0.36 and variance inflation factors <2.8.
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182 Qualitative methods

183 *Materials*

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

1
2
3 186 relation to GWG, as well as the reasons behind these practices. The interview guide also
4
5 187 included questions regarding provider knowledge in and attitudes towards GWG.
6
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8 188

9
10 189 *Recruitment and data collection*
11

12
13 190 Potential participants were identified through collaborating members of the study team. A
14
15 191 purposive sample of maximum variation was recruited to gather the perspectives of health care
16
17 192 providers from the different disciplines practicing in urban or rural locations in two Canadian
18
19 193 provinces (Alberta and British Columbia). When these contacts were exhausted, an advertisement
20
21 194 was distributed by email to medical clinics relevant to the requirements for variability in the sample.
22
23 195 Interviews were conducted over the telephone, audio-recorded and transcribed verbatim.
24
25
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27 196

28
29 197 *Data analysis*
30

31 198 Qualitative content analysis was used to describe and inductively interpret the data.[37, 38]
32
33 199 Qualitative content analysis is a process that is a “reduction and sense making effort that takes a
34
35 200 volume of qualitative material and attempts to identify core consistencies and meanings”. [39](p.45)
36
37 201 Audio recordings and transcripts were reviewed, and reviewed again while making notes about
38
39 202 key words and phrases. Key concepts were categorized and re-categorized as patterns emerged.
40
41 203 Data analysis occurred concurrently with data collection, and sampling adequacy was
42
43 204 demonstrated by saturation of the data, as replication occurred in categories as new participants
44
45 205 were included in the analysis.[40] Findings were discussed and approved by the study team.
46
47
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50 206

51
52 207 Data integration
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3 208 The categories emerging inductively from the interviews were compared with the results from
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5 209 the quantitative survey to determine if findings from each method confirmed the other, as well as
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7
8 210 to expand the strength of each type of data to better explain the phenomenon.[41]
9

10 211

14 212 **Results**

16 213 Participant characteristics

18 214 Overall, 1189 health care providers responded to the survey. Of these, 122 did not meet the
19
20
21 215 eligibility criteria (i.e. did not see pregnant women in their practice), 27 did not specify their
22
23 216 health care provider discipline, 155 did not answer any questions beyond practice characteristics,
24
25 217 and 377 indicated a health care provider discipline that was outside the scope of these analyses.
26
27
28 218 Thus, 508 responses from general practitioners, obstetricians, midwives, nurse practitioners and
29
30 219 registered nurses in primary care settings from across Canada are included in this analysis (Table
31
32
33 220 1). Twenty-three health care providers from these same disciplines participated in the interviews.
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35 221

37 222 Gestational weight gain counselling practices of health care providers

40 223 *Providing weight gain advice and discussing risks*

42 224 A small proportion of health care providers routinely provided women with a GWG target based
43
44 225 on their pre-pregnancy BMI and discussed the recommended rate of GWG based on their GWG
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46
47 226 target (21% and 16%; Table 2). Few indicated that they routinely discussed the impacts of
48
49 227 inappropriate GWG on mother (20%) and baby (19%). The composite score for “Providing
50
51 228 weight gain advice and discussing the risks” did not differ between health care provider
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54 229 disciplines (Table 3).

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3 231 Key concepts and quotes relating to counselling practices that emerged from the interviews are
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5 232 outlined in Table 4. Interviewees described the first prenatal visit as including measurement of
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8 233 weight, calculation of BMI, and a large amount of information sharing, including general
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10 234 information on GWG. Some health care providers advised women on a total GWG target;
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12 235 however, this was not always congruent with guidelines. The amount of information provided in
13
14 236 the first visit was perceived by the health care providers to be overwhelming for women.
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20 238 *Weight assessment*

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22 239 Approximately three-quarters of respondents weighed women at every visit (76%), while half of
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24 240 respondents would routinely relay GWG information to women every time they are weighed
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26
27 241 (Table 2). Midwives reported measuring weight at every visit less frequently than all other
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29 242 disciplines (Table 3).
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34 244 Interviewees noted that weight was typically measured at each visit, except for midwives who
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36 245 generally measured women's weight if clinically necessary, or if women requested them to do so
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38 246 (Table 4). After the first visit, interview participants indicated that they revisited the topic to
39
40 247 varying levels of depth, typically only when the health care provider or woman expressed
41
42 248 concern about her weight.
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48 250 *Discussing physical activity and food requirements*

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50 251 Nearly half (46%) of health care providers reported routinely discussing physical activity with
51
52 252 women while about one-third routinely discussed appropriate extra food requirements (28%),
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54
55 253 and only about one-third felt they could routinely give examples of appropriate changes that
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3 254 women could make to meet extra food requirements (32%) (Table 2). In contrast, over two-
4
5 255 thirds would discuss the importance of prenatal vitamins (67%). The composite score for the
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8 256 three survey questions regarding discussing physical activity and food requirements differed
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10
11 257 between health care provider disciplines (Table 3). Midwives did this more frequently than all
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13 258 other disciplines except for nurse practitioners.

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15 259
16
17 260 Health care providers of all disciplines described providing general information on GWG,
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19
20 261 physical activity, and nutrition in the early stages of pregnancy, and many indicated providing
21
22 262 women with printed resources in this area (Table 4). The midwives interviewed described
23
24 263 spending more time assessing women's current lifestyle and providing individualized advice
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27 264 than did physicians (Table 4).

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32 266 Predictors of counselling practices

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34 267 Health care providers, regardless of discipline, reported similar responses for having appropriate
35
36 268 general knowledge of GWG, physical activity, and nutrition, as well as knowledge of related
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39 269 practice guidelines (Table 3); only the difference between midwives and registered nurses
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41 270 responses was significant. There were significant differences in the level of priority placed on
42
43 271 GWG. Midwives and obstetricians had lower composite scores for the priority level they place
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45
46 272 on GWG than general practitioners and nurse practitioners, but did not differ significantly from
47
48 273 each other (Table 3). The majority of health care providers considered discussing GWG with
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50 274 women to be within their role (77%).

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55 276 *Predictors of providing weight gain advice and discussing risks*

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3 277 The composite score for providing weight gain advice and discussing risks of inappropriate
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5 278 GWG was most strongly related to the priority level that health care providers placed on GWG
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8 279 (Table 5), followed by their detailed knowledge of GWG, physical activity, and nutrition
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10 280 guidelines.
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15 282 Generally, health care providers in the interviews reported that GWG discussions may receive
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17 283 lower priority due to the time constraints in a typical appointment (Table 4). This was related to
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19
20 284 their compensation method, as general practitioners and obstetricians were remunerated in a fee-
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22 285 for-service model that resulted in restriction on the length of appointments, as well as the topics
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24 286 covered. Midwives were compensated by course-of-care, which resulted in longer and more
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27 287 flexible appointments. However, midwives described a lower priority level placed on GWG, as
28
29 288 their practice was less focussed on weight, in particular weight assessment, and more focussed
30
31 289 on a woman's overall health and wellbeing. Health care providers' perceptions of the sensitivity
32
33 290 of discussing GWG with pregnant women were also related to their providing weight gain advice
34
35 291 and discussing risks (Table 4). Some health care providers noted their discomfort with initiating
36
37 292 GWG discussions, or discussing GWG too frequently, as they were concerned that this may
38
39 293 cause psychological distress for the woman.
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44 45 295 *Predictors of discussing physical activity and food requirements*

46
47 296 The priority level that health care providers place on GWG, their detailed knowledge of GWG,
48
49 297 nutrition, and physical activity guidelines, and their general knowledge of this area were all
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51 298 significantly related to their discussing physical activity and food requirements with women
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3 299 during a prenatal visit (Table 6). After adjustment for practice characteristics, being a midwife
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5 300 remained a significant predictor of this activity within a prenatal visit.
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10 302 Midwifery practices in relation to discussing physical activity and food requirements also
11
12 303 emerged from the interview data (Table 4). Midwives reported that their approach focussed on
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14 304 overall health and wellness, and centred on support for women. Knowledge was another key
15
16 305 factor that came to light in the interviews, as some health care providers noted a need for
17
18 306 additional knowledge, particularly in nutrition and maternal obesity. For health care providers
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20 307 working within a multidisciplinary team, access to dietetic services was an important
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22 308 enhancement to GWG counselling practices.
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30 310 **Discussion**

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32 311 GWG counselling by health care providers falls below the recommendations from the Institute of
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34 312 Medicine and other national health agencies. [15] Although many of the health care providers
35
36 313 interviewed indicated that they regularly calculate and record women's pre-pregnancy BMI, few
37
38 314 survey respondents from any discipline routinely provided women with a comprehensive GWG
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40 315 recommendation and advice on their rate of GWG based on their pre-pregnancy BMI. In
41
42 316 addition, few survey respondents reported discussing the risks of inappropriate GWG with
43
44 317 women. While many health care providers reported providing a general message of the
45
46 318 importance of prenatal vitamins, fewer reported routinely discussing topics such as appropriate
47
48 319 extra food requirements. Weight was typically measured at each prenatal appointment, but not
49
50 320 discussed unless it was a concern. This is in contrast with what women report they need from
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52 321 their health care provider, as other studies from our research group have indicated that women
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3 322 would like their health care provider to initiate a discussion about GWG early in pregnancy, and
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5 323 continue the discussions throughout pregnancy and postpartum so that they are updated on their
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8 324 GWG progress. [22]
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11
12 326 The low rates of some of these counselling practices are concerning since it is likely that survey
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15 327 respondents are those who would be most likely to counsel women about GWG. There is
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17 328 evidence suggesting that women whose health care providers discuss GWG and related lifestyle
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20 329 behaviours in pregnancy with them have lower GWG and lower likelihood of having a baby that
21
22 330 is large for gestational age. [42-44] This underlines the potential level of influence that health
23
24 331 care providers have with pregnant women and the importance of refining their training or
25
26 332 antenatal care pathways to support such conversations.
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31 334 To our knowledge, this is the first mixed methods study to examine GWG counselling, in
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33 335 particular for the specific counselling practices recommended by the Institute of Medicine.
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35 336 While survey and qualitative research studies from various parts of the world have also found
36
37 337 low rates of GWG counselling as reported by patients, other surveys of health care providers
38
39 338 have found high self-reported rates of counselling.[20, 28] This discrepancy may be due to the
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41 339 frequency with which health care providers undertake counselling, as studies from the US have
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43 340 found that they report discussing GWG more often with women who are overweight or obese at
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45
46 341 the start of their pregnancy.[24] Therefore, they may report that they provide GWG counselling,
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48 342 but not to every pregnant woman. Further, when the depth of this counselling is explored, the
49
50 343 self-reported rates are likely to diminish. Future studies should objectively assess the quality of
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52 344 these discussions and evaluate their impact on GWG, health behaviours like physical activity and
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3 345 diet, and women's perceptions of support. Furthermore, research is needed to elucidate the most
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5 346 effective counselling methods that will help women achieve appropriate GWG. This additional
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8 347 information could help guide or refine approaches to antenatal care undertaken by different
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10 348 groups of care providers.
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15 350 This study identified multi-level influences on GWG counselling. Most notably, the priority
16
17 351 level that health care providers placed on GWG had the strongest relationship with their
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19 352 practices. The qualitative results provided context to this finding, linking the priority level of
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21
22 353 GWG to factors at the health care system level, such as the time available in a typical prenatal
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24 354 appointment, and the compensation that health care providers receive for their time.
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27 355 Additionally, this study identified factors at the individual level. This included the importance of
28
29 356 detailed knowledge of practice guidelines, which also was strongly associated with counselling
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31 357 practices.
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36 359 One novel finding was the new insights into the different approach reported by midwives.
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38 360 Midwives noted that their focus on the overall wellbeing of the women meant they discussed
39
40 361 physical activity and nutrition in more depth than did physicians, and they measured weight less
41
42 362 frequently. Even after controlling for multiple other predictors, midwives were significantly
43
44 363 more likely than other health care providers to report discussing physical activity and food
45
46 364 requirements with women during routine prenatal care. In other research, patients of midwives
47
48 365 were more likely to recall having discussed physical activity with their health care provider as
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50 366 compared to patients of general practitioners and obstetricians,[29] and midwives themselves
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52
53 367 report providing physical activity counselling to women more frequently than other
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3 368 disciplines.[20, 28] While the present study considered physical activity and nutrition
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6 369 counselling practices as one composite score, there seems to be growing evidence that midwives
7
8 370 provide more lifestyle counselling than other health care provider disciplines. The impact of
9
10 371 counselling by a midwife as compared to other disciplines on the health outcomes for women is
11
12 372 an area for future exploration.

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14 15 16 17 374 *Strengths and Limitations*

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19
20 375 A major strength of this study is the use of mixed research methods. This allowed for some
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22 376 verification of findings between methods, and provided a broader picture of “who is doing
23
24 377 what”, as well as “why and how are they doing it”. To our knowledge, this is the largest and
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26
27 378 most comprehensive survey on this topic to date. While prenatal care varies between countries,
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29 379 the topics covered in this survey are considered routine and are undertaken as part of standard
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31 380 prenatal care in most developed countries.

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36 382 This study has limitations that should be considered. It was not possible to calculate a true
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38 383 response rate for the survey since the survey was distributed using email lists and social media
39
40 384 through professional associations and networks. While this method of recruitment allowed for a
41
42 385 wider reach, and ultimately more responses, those who responded may be more likely to engage
43
44 386 in activities related to GWG counselling. This could lead to inflation of the reported frequency
45
46 387 of specific GWG counselling practices. This is concerning as they are already quite low for
47
48 388 some counselling practices and further highlights the need for targeted interventions in this area.

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3 390 The qualitative interviews were only conducted in two provinces, and there is the potential that
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5 391 this does not accurately capture the practices and predictors in other geographic areas. However,
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7
8 392 the congruency of the qualitative and quantitative findings suggests that this is unlikely.
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10 393 Furthermore, a recent systematic review found few differences in barriers and facilitators to
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12 394 pregnancy weight management in studies from around the world, suggesting that the findings of
13
14 395 the current study may help inform practice in various health care systems.[45]
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19
20 397 *Recommendations*

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22 398 Interventions to implement best practices should consider the multi-level influences on GWG
23
24 399 counselling practices, as well as the discipline of the health care provider, in order to be effective
25
26 400 at changing health care provider behaviours. Providers across disciplines require knowledge of
27
28 401 GWG, physical activity, and nutrition guidelines and some may need system-level changes such
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30 402 as more time in an appointment to help them make it a priority in their practice. A different
31
32 403 model for dissemination of this knowledge needs consideration. Multidisciplinary clinics that
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34 404 include professionals with a background in nutrition and physical activity, and group educational
35
36 405 sessions may be important in this regard. The latter approach could allow participants to discuss
37
38 406 these issues amongst themselves and may provide positive reinforcement of new knowledge and
39
40 407 help to shift old beliefs.[42] Furthermore, discussion of healthy GWG and maintenance of a
41
42 408 healthy weight trajectory with women by health providers is a missed opportunity for positive
43
44 409 feedback for a healthy and potentially long-term behaviour.
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52 411 Expanding discussions on GWG to a healthier lifestyle is highly relevant given the growing body
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54 412 of evidence related to its impact on disease in later life.[10] Health care providers are well
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3 413 positioned to help women identify plans to change behaviour and improve health outcomes.
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6 414 Strong communication between health care providers and pregnant women is a key component
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8 415 to moving forward. Supporting health care providers to better counsel their pregnant patients on
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10 416 appropriate GWG is one important step towards breaking the intergenerational cycle of obesity,
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12 417 and improving the health of generations to come.
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For peer review only

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3 535 **Authors' contributions**
4

5 536 RCB and HN designed the study, and with MV and HPV developed the interview guide and
6
7
8 537 survey questionnaire. JM and HN recruited interview participants and conducted the interviews.
9
10 538 JM recruited survey participants, conducted the qualitative and quantitative analyses and wrote
11
12 539 the first draft of the manuscript. HN and RCB contributed to the qualitative analysis and TB and
13
14 540 RCB contributed to quantitative analysis. VJ contributed to recruitment of interview
15
16
17 541 participants. All authors made significant contributions to the critical review and revisions of the
18
19 542 manuscript. JM and RCB are the guarantors of the manuscript. All authors had full access to all
20
21 543 of the data (including statistical reports and tables) in the study and can take responsibility for the
22
23 544 integrity of the data and the accuracy of the data analysis. JM affirms that the manuscript is an
24
25 545 honest, accurate, and transparent account of the study being reported; that no important aspects
26
27 546 of the study have been omitted.
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32
33 547 **Acknowledgements**
34

35 548 We would like to thank all of the participants in both components of the study for their time and
36
37 549 insight. We would also like to thank Melisa Spaling for her contribution to the analysis of the
38
39 550 qualitative data and Adam King for his help with recruiting participants to interview from British
40
41 551 Columbia.
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44 552 **Conflict of interest**
45

46
47 553 All authors have completed the ICMJE uniform disclosure form at
48
49 554 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the
50
51 555 submitted work; no financial relationships with any organisations that might have an interest in
52
53 556 the submitted work in the previous three years; no other relationships or activities that could
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55 557 appear to have influenced the submitted work.
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6 559 **Funding:**
7
8 560 This study was funded by grants from Alberta Innovates – Health Solutions and the Danone
9
10 561 Institute of Canada. The funders had no involvement in the study design; in the collection,
11
12 562 analysis, and interpretation of data; in the writing of the report; nor the decision to submit the
13
14 563 article for publication.
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20 565 Data Sharing Statement
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22 566 Data used in this study are not currently available for data sharing.
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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

568

569 Table 2. Survey responses regarding gestational weight gain counselling practices routinely
 570 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												

571

572

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

	Health care provider discipline ¹					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)*

¹GP=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

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

577

Category	Concept	Representative quote(s)
Practices	The first visit involves a large amount of information sharing	<p>“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.”</p> <p>- General Practitioner</p>
	Weight is assessed routinely, but not discussed in detail unless there is a concern	<p>“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.’”</p> <p>- General Practitioner</p>
	Midwives have a different approach to gestational weight gain	<p>“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.”</p> <p>- Midwife</p> <p>"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.”</p> <p>- Midwife</p>
Individual level influences on practice	Priority level	<p>“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.”</p> <p>- Midwife</p>
	Sensitivity of the discussion	<p>“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.”</p> <p>- General Practitioner</p>
	General knowledge of gestational weight gain, nutrition, and	<p>“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</p>

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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

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

System
level
influences
on
practice

“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

578

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

Variable	Model ¹		
	Unstd β	S.E. of β	Std Beta
(Constant)	-1.14**	0.38	
General practitioner (<i>reference</i>)			
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

¹Model 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

583

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 (<i>reference</i>)			
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

¹Model 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

586

Healthy Pregnancy Weight Gain Research Study

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For peer review only

1 Do you see pregnant women in your practice? Yes
2 No
3
4 In which Canadian province or territory do you work? British Columbia
5 Alberta
6 Saskatchewan
7 Manitoba
8 Ontario
9 Quebec
10 Newfoundland and Labrador
11 New Brunswick
12 Prince Edward Island
13 Nova Scotia
14 Yukon
15 Northwest Territories
16 Nunavut
17 What best describes the location of your practice? Urban
18 Rural
19 Urban and rural
20
21 In what type of practice setting do you work? Solo
22 (Please select all that apply) Group
23 Interdisciplinary
24 Academic
25
26 What is your occupational specialty? General Practitioner/Family Physician
27 Obstetrician/Gynecologist
28 Physician - other
29 Registered Midwife
30 Nurse Practitioner
31 Registered Nurse
32 Prenatal Educator
33 Registered Dietitian
34 Other
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36 My primary practice is: Public/community health
37 Primary care
38 Acute care
39 Other
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41 Please specify: Registered Nurse
42 Perinatal support worker
43 Other
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45 Please specify: _____
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1 What are some common reasons for pregnant women to be referred to you? (Check all that apply)

- 2
- 3 General healthy eating
- 4 High pre-pregnancy BMI
- 5 Low pre-pregnancy BMI
- 6 Excessive weight gain
- 7 Inadequate weight gain
- 8 Multiple food restrictions, e.g. vegetarian, food allergies, etc.
- 9 Nausea/vomiting
- 10 Twin/multiple pregnancy
- 11 Adolescent pregnancy
- 12 Concurrent medical condition, e.g. diabetes in pregnancy
- 13 All pregnant women in my health care setting are referred to me
- 14 I see pregnant women in a group setting
- 15 Other (Please specify)
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For peer review only

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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

For peer review only

1 **Given all of the issues of concern during a typical prenatal visit, how often do women ask you**
 2 **about:**
 3
 4

	Almost never(< 10%)	Rarely(10-30%)	Sometimes(30-60%)	Often(60-90%)	Almost always(>90%)
5					
6					
7					
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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For peer review only

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

	< 10%	10-30%	30-60%	60-90%	>90%
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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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Joint Society of Obstetricians and Gynecologists of Canada (SOGC) and Canadian Society for Exercise Physiology (CSEP) guidelines for exercise in pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical Activity Readiness Medical Examination (PARMed-X) for Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health Canada's Prenatal Nutrition Guidelines for Health Professionals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

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

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
7 Discussing appropriate gestational weight gain with women a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11 Assessing gestational weight gain a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14 Assisting women with appropriate gestational weight gain (e.g. addressing barriers and facilitators; providing resources; referrals to appropriate providers; etc.) a high priority	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

29 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

39 Please specify:

40 _____

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

- Yes
- No
- Not applicable

46 Please explain:

47 _____

1
2 **In your practice setting, who do you think is the most suitable person to discuss, assess,**
3 **assist, and follow-up with gestational weight gain with women?**
4

	Discuss	Assess	Assist	Follow-up
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6				
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant pregnancy weight gain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge to recommend guideline concordant physical activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant physical activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge to recommend guideline concordant healthy eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information resources to support recommending guideline concordant healthy eating during pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Programs for referral to promote healthy nutrition during pregnancy (e.g. dietitian, prenatal nutrition education classes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>