

# Recall of Prenatal Counselling Among Obese and Overweight Women from a Canadian Population: A Population Based Study

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**Abstract** *Objective* The objective of this study was to evaluate the recall of prenatal counselling received among overweight and obese women in primary care settings. *Methods* A sample of 1996 women with singleton, term deliveries and pre-pregnancy BMI >18.5 kg/m<sup>2</sup> were identified from the All Our Babies pregnancy cohort. Information on socio-demographic characteristics and women's experiences with prenatal counselling on nutrition, vitamin and mineral supplements, exercise, weight gain, employment, alcohol and drug use, and smoking during pregnancy were collected through questionnaires administered at <25 weeks and 34–36 weeks gestation. Multivariable logistic regression analyses explored the associations between pre-pregnancy BMI and the domains of prenatal counselling, controlling for confounders. *Results* Women reported high levels of comfort asking questions and satisfaction with their health care provider. Women reported getting information about nutrition (69.3%), weight gain (67.8%), exercise (64.4%), vitamins and minerals supplementation (86.1%). Obese women (211, 10.6%) were more likely than normal weight women (1313, 65.8%) to be Caucasian (p=0.004), less educated (p=0.001), and to have been born or lived in Canada for at least 5 years (p=0.01). There was no difference in the prenatal advice received on

nutrition, weight gain and exercise in pregnancy between obese, overweight, and normal weight women. *Conclusions for Practice* Pre-pregnancy BMI did not appear to influence the recall of prenatal counselling women receive in community health care centers. Given the importance of nutrition and weight gain during pregnancy, and guidelines for weight gain based on pre-pregnancy BMI, there are missed opportunities in knowledge exchange between women and providers in the prenatal period.

**Keywords** Prenatal counselling · Obesity in pregnancy · Nutrition · Prenatal care · Women experiences · Patient education

## Abbreviations

BMI Body mass index

## Significance Statement

Pre-pregnancy BMI is not associated with women's recall across domains of prenatal counselling in primary care settings, including nutrition, vitamin and mineral supplements, exercise, weight gain and substance misuse during pregnancy.

## Introduction

The incidence of obesity is increasing among women of childbearing age, with more women entering into pregnancy overweight or obese than ever before. In the USA, nearly 60% of women of childbearing age are either overweight or obese, with one-third having a Body Mass Index (BMI) > 30.0 kg/m<sup>2</sup> (Siega-Riz 2012; Rasmussen and

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Yaktine 2009). Currently in Canada, 23 and 21% of women ages 20–39 years old are overweight and obese, respectively. A similar trend is reported for less developed countries (Villamor et al. 2006; Chigbu and Aja 2011; El-Gilany and Hammad 2010; Wang et al. 2009).

The increasing rate of maternal obesity is a major challenge for obstetric practice. There is growing evidence that obesity in pregnancy is associated with adverse perinatal outcomes for both women and fetuses (Vinturache et al. 2014, 2015, 2016). Obesity in pregnancy can also affect health later in life for both mother and child (Siega-Riz 2012). Mothers are at increased risk of developing metabolic syndrome, heart disease and hypertensive disorders, whereas children born to obese mothers are at risk of future obesity, diabetes and heart disease (Vinturache et al. 2014, 2015, 2016; Oken and Gillman 2003; Chu et al. 2007a, b).

Evidence suggest that obesity is a barrier in obtaining non-obstetrical health care services (Forhan and Salas 2013). Obese individuals receive fewer preventive health care measures, but have an increased risk of health complications (Phelan et al. 2015). For example, it has been demonstrated that women who are obese received fewer preventative health care measures such as gynecologist examinations, pap smear tests and breast evaluations than women of normal weight (Friedman et al. 2012; Hellmann et al. 2015). Several factors have been hypothesized to be associated with the lower preventative health measures being taken by obese individuals, such as poor body image and embarrassment (Friedman et al. 2012). This has also been shown to be associated with race, with Caucasian women tending to be more concerned with their body image than African-American women (Brooten et al. 2012; Whitaker et al. 2016). Furthermore, lower socio-economic status may influence the uptake of preventative health visits (Bambra et al. 2013).

Emerging evidence has shown that prenatal care, one of the most widely used preventive health care services in developed countries, may mitigate poor outcomes for women and their babies (Alexander and Korenbrot 1995; Sword et al. 2012). Pregnancy is an especially powerful “teachable moment” for the prevention and promotion of healthy body weight (Alexander and Kotelchuck 2001). The schedule of prenatal visits (11–14 over the course of pregnancy) means that women are in frequent contact with their healthcare providers. Obstetrician–gynecologists, family physicians, nurses and midwives are well positioned to advise on healthy eating and physical activity (Phelan 2010).

Current professional guidelines for the management of obesity in pregnancy include informing and counselling women prior to pregnancy about healthy BMI, which includes nutritional counselling, dietary records, and regular moderate exercise (Davies et al. 2010). Little is

known about the impact of obesity in obtaining prenatal care (Levine et al. 2013). Few studies have investigated the impact of obesity on women’s experiences with prenatal care in primary care.

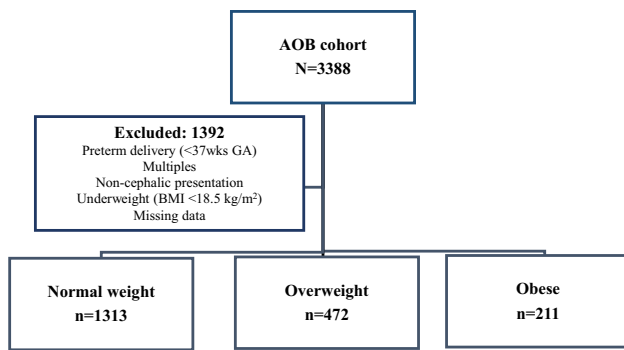
This study was undertaken to determine women’s recall of the prenatal advice they received focusing on nutrition and other lifestyle factors. The objectives of this study were to: (i) determine which domains of prenatal counselling (nutrition, vitamin and mineral supplements, exercise, weight gain, smoking, working during pregnancy, alcohol, and drug use) women reported discussing with their health care provider; (ii) determine if recall of different prenatal counselling domains, particularly those related to nutrition, exercise, weight gain and vitamins/minerals differed by pre-pregnancy BMI. This research will provide health care providers with information about women’s recall of prenatal counselling and contribute to improvements in communication during the prenatal period.

## Materials and Methods

### Study Participants

We conducted a secondary analysis of data collected from the All Our Babies Cohort (AOB), a prospective community-based pregnancy cohort that recruited study participants from Calgary Metro area, Alberta, Canada. Details about the participant recruitment, eligibility, and data collection for the cohort are provided elsewhere (Gracie et al. 2010; McDonald 2013). Women were invited to participate if they were eligible to receive prenatal care in primary care offices, were 18 years or older, able to read and write in English, and <24 weeks pregnant at the time of recruitment (McDonald 2013). Self-administered questionnaires in early (<25 weeks gestation), and late pregnancy (32–36 weeks gestation), collected information on women’s demographics, pregnancy and health history, maternal lifestyle, and health care utilization, including women’s experiences with prenatal counselling. Data from questionnaires were linked via unique identifiers (i.e. provincial health care number) to provincial electronic health records for labour and delivery, that contain additional details on pregnancy complications and birth outcomes not captured by the surveys.

From the 3388 women included in the All Our Babies cohort, 1996 women met the inclusion criteria for the present study. Women with multiple pregnancies, non-cephalic presentations, preterm deliveries, pre-pregnancy BMI <18.5 kg/m<sup>2</sup>, or missing information regarding prenatal counselling (N = 1423), were excluded from the analysis (Fig. 1).



**Fig. 1** Flowchart of study design

## Data Collection

The survey administered in the third trimester of pregnancy included questions regarding prenatal care. Two initial questions explored the level of comfort of patients in dealing with their health care provider and if the information received was conveyed in a way that women could understand: (i) do you feel comfortable asking a question to your prenatal care provider about your pregnancy; (ii) are you able to get an answer that you are satisfied with and can act on if necessary.

Counselling on eight different domains of prenatal care as identified by SOGC (Davies et al. 2010) was assessed with dichotomous, yes or no, answers. The women were asked whether they had been counselled on nutrition, vitamin and mineral supplements, alcohol consumption, exercise and active living, appropriate weight gain throughout pregnancy, working throughout pregnancy, non-/prescription drug use, cigarette smoking, and exposure to second hand smoking.

## Measures

Maternal pre-pregnancy BMI was calculated as weight (kg)/height (cm)<sup>2</sup> and categorized according to Institute of Medicine (IOM) classification in: normal weight (BMI 18.50–24.99 kg/m<sup>2</sup>), overweight (BMI 25.00–29.99 kg/m<sup>2</sup>), and obese (BMI ≥30.00 kg/m<sup>2</sup>) (World Health Organization 2000; Health Canada 2003).

The socio-demographic variables included in the statistical analyses were: maternal age (≤34, ≥35-year-old), marital status (married/common law or single), level of education (high school or less, some or completed post-secondary), annual household income (<\$60,000 or ≥\$60,000), ethnicity (Caucasian or Other, non-Caucasian ethnicity), and time living in Canada (<5 years, born in Canada, or living in Canada ≥5 years). Nulliparous were women who did not have any previous births, multiparous were women who had at least one previous birth.

## Statistical Analysis

Descriptive statistics, proportions, means and standard deviations, were generated for continuous and categorical variables for the sample characteristics and outcomes as appropriate. Bivariate analyses assessed the relationship between women's socio-demographic and pregnancy characteristics and maternal pre-pregnancy BMI category.

Multivariable logistic regression analysis evaluated the association between pre-pregnancy BMI and the type of prenatal counselling received, controlling for confounding variables: age, education, income, parity, time in Canada. Odds ratios and 95% confidence intervals were calculated for all models, which included only significant predictor variables for the considered outcomes. All statistical analyses were performed using the IBM SPSS for Windows statistical software package, version 22.0 (IBM SPSS, Chicago, IL).

## Results

From 1996 women included in the analysis, 1313 (65.8%) were normal weight, 472 (23.6%) were overweight, and 211 (10.6%) were obese. The majority of women in the study were Caucasian (1602; 80.4%), younger than 35 years (1579, 81.0%), married or in a common-law relationship (1901; 95.2%), had a level of education at the level of post-secondary or higher (1802, 90.5%), and had a household income higher than \$60,000 (1648, 85.0%). A little over half of women were nulliparous (1032, 53.0%) (Table 1). Participant socio-demographic characteristics stratified by pre-pregnancy BMI category are shown in Table 1. We found no difference between normal weight, obese and overweight women with regard to maternal age, income and parity. However, obese women were more likely to be Caucasian ( $p=0.004$ ), have a level of education of high school or less ( $p=0.001$ ), and to be either born in Canada or have lived here for more than 5 years ( $p=0.010$ ), than were women with normal BMI.

Our survey showed that more than 98% of women were comfortable asking their health care provider questions about pregnancy and received satisfactory answers to the inquires (Table 2). Most women were satisfied with the answer received on their queries and felt they could act on it if necessary. Approximately 98.4% of all women reported receiving advice in at least one of the prenatal counselling domains. The percentage of obese women reporting receiving prenatal advice in at least one domain was, however, lower than the percentage of normal weight women (95.7 vs. 98.7%,  $p=0.003$ ). When asked about specific advice, less than half recalled counselling on alcohol consumption and smoking during pregnancy, a little over two-thirds

**Table 1** Population socio-demographic characteristics, stratified by pre-pregnancy BMI

Demographic characteristics	All women 1996 (100.0)	Maternal BMI kg/m <sup>2</sup>			p value
		Normal weight (18.5–24.9 kg/m <sup>2</sup> ) 1313 (65.8)	Overweight (25.0–29.9 kg/m <sup>2</sup> ) 472 (23.6)	Obese (≥30.0 kg/m <sup>2</sup> ) 211 (10.6)	
<b>Maternal age</b>					
≤34-year-old	1579 (81.0)	1040 (81.4)	365 (78.5)	174 (83.7)	0.222
≥35-year-old	371 (19.0)	237 (18.6)	100 (21.5)	34 (16.3)	
<b>Ethnicity</b>					
Caucasian	1602 (80.4)	1027 (78.4)	392 (83.2)	183 (86.7)	0.004*
Other	390 (19.6)	283 (21.6)	79 (16.8)	28 (13.3)	
<b>Time in Canada</b>					
Born/lived ≥5 years	1808 (91.0)	1169 (89.6)	441 (93.4)	198 (94.3)	0.010*
Lived < 5 years	178 (9.0)	135 (10.4)	31 (6.6)	12 (5.7)	
<b>Marital status</b>					
Married/common law	1901 (95.2)	1251 (95.5)	451 (95.6)	199 (94.3)	0.734
Single	92 (4.8)	59 (4.5)	21 (4.4)	12 (5.7)	
<b>Household income</b>					
<\$60,000	291 (15.0)	183 (14.3)	76 (16.6)	32 (15.5)	0.489
≥\$60,000	1648 (85.0)	1093 (95.7)	381 (83.4)	174 (84.5)	
<b>Education</b>					
High school or less	190 (9.5)	108 (8.3)	47 (10.0)	35 (16.6)	0.001*
Some/completed post secondary	1802 (90.5)	1201 (91.7)	425 (90.0)	176 (83.4)	
<b>Parity</b>					
Nulliparous	1052 (53.0)	700 (53.7)	246 (52.2)	106 (50.5)	0.640
Multiparous	933 (47.0)	604 (46.3)	225 (47.8)	104 (49.5)	

Data are presented as n (%); may not add to N = 1996 due to missing data

Other include all other ethnicity groups except Caucasian, Nulliparous no previous births, Multiparous at least one previous birth

**Table 2** Prenatal counselling, showing the proportion of women who responded “yes” to questions about prenatal advice stratified by pre-pregnancy BMI (kg/m<sup>2</sup>)

Prenatal counselling survey questions	All women N (%)	Normal weight (18.5–24.9 kg/m <sup>2</sup> )	Overweight (25.0–29.9 kg/m <sup>2</sup> )	Obese (≥30.0 kg/m <sup>2</sup> )	p value
Do you feel comfortable asking a question to your prenatal care provider about your pregnancy?	1907 (98.9)	1251 (98.8)	459 (99.1)	197 (99.0)	0.844
If yes, are you able to get an answer that you are satisfied with and can act on if necessary?	1804 (97.4)	1186 (90.3)	430 (91.1)	188 (89.1)	0.733
<b>During your prenatal visits, have you received advice on</b>					
Nutrition	1361 (69.3)	895 (68.2)	321 (68.0)	145 (68.7)	0.709
Vitamins/mineral supplements	1692 (86.1)	1114 (84.8)	401 (85.0)	177 (83.9)	0.804
Exercise and active living	1266 (64.4)	819 (62.4)	313 (66.3)	134 (63.5)	0.279
Alcohol consumption	971 (49.4)	637 (48.5)	239 (50.6)	95 (45.0)	0.584
Smoking	826 (42.0)	533 (40.6)	211 (44.7)	82 (38.9)	0.285
Non-/prescription drugs	1223 (62.2)	784 (59.7)	305 (64.6)	134 (63.5)	0.082
Weight gain	1333 (67.8)	871 (66.3)	314 (66.5)	148 (70.1)	0.218
Working in pregnancy	980 (49.9)	623 (47.4)	250 (53.0)	107 (50.7)	0.084

May not add to N = 1996 due to missing data. Data presented as n (%)

recalled advice on nutrition, exercise and active living, and non-prescription drugs, and approximately half on working during pregnancy. Over 85% of women recalled advice on vitamins and mineral supplementation during pregnancy. When analysed by prenatal counselling domain, we found no difference in any of the domains of prenatal advice interrogated in this study between women with increased BMI and those with normal pre-pregnancy weight.

As shown in Table 3, we further explored the relationship between socio-demographic factors, demonstrated to be potential barriers in obtaining preventive health care, and women's recall of prenatal counselling. Nulliparous women were more likely to receive advice on almost all prenatal counselling domains than women who had previous pregnancies ( $p \leq 0.001$ ), except for advice on vitamins and minerals supplementation. Women younger than 35 years old were more likely to recall advice about active living, and women with an educational attainment at the level of high school were more likely to recall advice about smoking during pregnancy. Women who were born or lived in Canada for more than 5 years, of Caucasian ethnicity, and with a household income  $< \$60,000$  were more likely to recall advice on alcohol consumption, smoking, active living and exercise, working, and weight gain in pregnancy. More of Caucasian and nulliparous women received advice on non-prescription drug use in pregnancy. Maternal age, education, ethnicity, time lived in Canada, or household income did not influence the recall of advice on nutrition, and vitamins and minerals supplementation during pregnancy.

Table 4 shows the adjusted odds ratio for the relationship between prenatal counselling and pre-pregnancy BMI, controlling for education, maternal age, income, parity and time in Canada. Multiple logistic regression models showed that obese women did not recall more counselling about nutrition, vitamins, alcohol use, exercise, weight gain working during pregnancy, and non-/prescription drug use, than women who had normal weight before pregnancy, when controlling for confounding variables. However, overweight women were 1.3 times more likely to recall additional counselling about working during their pregnancy (95% CI, 1.0–1.6) and non-/prescription drug use (95% CI, 1.0–1.6).

## Discussion

In this study, we assessed women's recall of prenatal counselling delivered by health care providers in primary care practices. The objective was to evaluate the relationship between pre-pregnancy BMI and the prenatal advice recalled. We found that recall of topics related to different domains of prenatal care ranged from 42 to 85%, with

information about vitamins and minerals noted by the majority of women ( $>85\%$ ). Advice in specific areas such as nutrition, active living, and weight gain in pregnancy was not related to pre-pregnancy BMI, although antenatal guidelines addressing specific recommendations in obese women have been developed. Our survey suggests that obese and overweight women do not report receiving additional prenatal counselling as compared to normal weight women.

Recall of advice from a prenatal care provider on nutrition, weight gain, physical activity, and substance use during pregnancy ranged from 60 to 70%. However, although the recording of pre-pregnancy body weight and BMI is a routine part of the prenatal visit assessment, health care providers do not provide additional and customized counselling to their overweight and obese patients about weight control, diet, and physical activity. This is especially problematic considering that: (i) recommendations for prenatal care provider for dealing with obesity in pregnancy (Davies et al. 2010; ACOG Antepartum Record 2003, ACOG Committee 33), along with gestational weight gain guidelines (National Research Council 2009; Health Canada 2010), are based on the calculation of pre-pregnancy BMI; (ii) inappropriate weight gain in pregnancy is associated with a lack of advice (Cogswell et al. 1999); and (iii) high pre-pregnancy BMI and inadequate weight gain in pregnancy are associated with perinatal complications (Vinturache et al. 2014, 2015; Chu et al. 2007a, b). Our findings are supported by a recent Canadian study that explored antenatal records documentation. Despite a predominance of women with excess weight, weight-related issues and other specific elements of prenatal care in these women were suboptimally documented across all maternal weight categories (McDonald et al. 2014).

Primary and specialist health care providers have the opportunity to identify women at risk of complications due to elevated BMI and counsel them on lifestyle changes, nutrition and exercise education, and weight management. Pregnancy and the postpartum period are unique opportunities to impact the health of the women and their families for the rest of their lives (Paden et al. 2012). A study exploring obesity prevention and treatment practices of US obstetricians and gynecologists showed that the majority of obstetrician-gynecologists appear to use BMI to screen for obesity and to counsel their patients about weight control, diet, and physical activity (Power et al. 2006). However, although more than 80% of practitioners ranked counseling as very important and agreed that it has a positive influence on pregnancy, only 35% believed that such prenatal counseling would significantly affect the incidence of obesity, and for only about 20% was it considered a high priority in their practice (Morgan et al. 2006). In another study, Honda found that over a period of 1 year, only 21.3 and 24.5% of

**Table 3** Association of participant demographics and domains of prenatal advice offered by health care providers

Domain of prenatal advice																
	Nutrition		Vitamins/mineral suppl.		Alcohol use		Exercise/active living		Weight gain		Working		Non-prescription drugs		Smoking/second hand smoking	
	n (%)	P*	n (%)	P*	n (%)	P*	n (%)	P*	n (%)	P*	n (%)	P*	n (%)	P*	n (%)	P*
<b>Maternal age</b>																
≤34 years old	1091 (69.1)	0.053	1343 (85.1)	0.238	780 (49.4)	0.128	1020 (64.6)	0.017	1061 (67.2)	0.469	789 (50.0)	0.104	984 (62.4)	0.062	674 (42.7)	0.021
≥35 years old	237 (63.9)		308 (83.0)		167 (45.0)		215 (58.0)		242 (65.2)		168 (45.3)		212 (57.1)		134 (36.1)	
<b>Ethnicity</b>																
Caucasian	1102(68.8)	0.271	1370 (85.5)	0.066	820 (51.2)	<0.001	1052 (65.7)	<0.001	1093 (68.2)	0.007	830 (51.8)	<0.001	1007 (62.9)	0.004	692 (43.2)	0.001
Other	257 (65.9)		319 (81.8)		150 (38.5)		213 (54.6)		238 (61.0)		149 (38.2)		214 (54.9)		133 (34.1)	
<b>Time in Canada</b>																
Born or lived ≥ 5 years	1239 (68.5)	0.168	1536 (85.0)	0.300	893 (49.4)	0.023	1165 (64.4)	0.002	1223 (67.6)	0.005	911 (50.4)	<0.001	1112 (61.5)	0.421	761 (42.1)	0.021
Lived <5 years	113 (63.5)		146 (82.0)		72 (40.4)		94 (52.8)		102 (57.3)		64 (36.0)		104 (58.4)		59 (33.1)	
<b>Education</b>																
Highs school or less	126 (66.3)	0.553	162 (85.3)	0.848	99 (52.1)	0.330	120 (63.2)	0.917	128 (67.4)	0.865	99 (52.1)	0.391	112 (58.9)	0.485	103 (54.2)	<0.001
Some or completed post-secondary	1233 (68.4)		1527 (84.7)		872 (48.4)		1145 (63.5)		1203 (66.8)		880 (48.8)		1109 (61.5)		723 (40.1)	
<b>Household income</b>																
<\$60 000	194 (66.7)	0.468	246 (84.5)	0.898	125 (43.0)	0.029	16 (57.7)	0.020	180 (61.9)	0.045	114 (39.2)	<0.001	165 (56.7)	0.073	126 (43.3)	0.491
≥\$60 000	1134 (68.8)		1398 (84.8)		822 (49.9)		1069 (64.9)		1118 (67.8)		842 (51.1)		1026 (62.3)		678 (41.1)	
<b>Parity</b>																
Nulliparous	754 (71.7)	<0.001	905 (86.0)	0.089	554 (52.7)	<0.001	727 (69.1)	<0.001	764 (72.6)	<0.001	565 (53.7)	<0.001	679 (64.5)	0.001	480 (45.6)	<0.001
Multiparous	597 (64.0)		777 (83.3)		409 (43.8)		531 (56.9)		559 (59.9)		406 (43.5)		533 (57.1)		338 (36.2)	

n (%) represent number and percentage of women from that group who reported receiving advice compared to women from the same group who did not recollect receiving advice in that domain  
 Other include all other ethnicity groups except Caucasian, *Nulliparous* no previous births; *Multiparous* at least one previous birth  
 P\* p-value



**Table 4** Unadjusted and adjusted odds ratio for the association between the eight domains of prenatal counselling and pre-pregnancy BMI categories

Areas of prenatal counselling	Overweight (25.0–29.9 kg/m <sup>2</sup> )		Obese (≥30.0 kg/m <sup>2</sup> )	
	uOR (95% CI)	aOR (95% CI)	uOR (95%CI)	aOR (95% CI)
Nutrition	0.9 (0.8–1.2)	1.0 (0.8–1.3)	1.1 (0.8–1.6)	1.1 (0.8–1.6)
Vitamins/mineral supplements	0.9 (0.7–1.3)	0.9 (0.7–1.4)	1.1 (0.7–1.8)	1.1 (0.7–1.7)
Exercise/active living	1.1 (0.9–1.5)	1.2 (0.9–1.5)	1.1 (0.8–1.6)	1.1 (0.8–1.6)
Weight gain	1.0 (0.8–1.3)	1.0 (0.8–1.3)	1.3 (0.9–1.9)	1.3 (0.9–1.8)
Working during pregnancy	1.2 (1.0–1.5)	1.3 (1.05–1.6)*	1.2 (0.9–1.6)	1.2 (0.9–1.7)
Alcohol consumption	1.08 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.7–1.2)	0.8 (0.6–1.2)
Non-prescription drugs	1.2 (0.9–1.5)	1.2 (1.04–1.6)*	1.2 (0.9–1.8)	1.3 (0.9–1.8)
Smoking	1.1 (0.9–1.5)	1.1 (0.9–1.4)	0.9 (0.7–1.3)	0.9 (0.6–1.2)

Confounding variables: education (reference category: some or completed post-secondary); maternal age (reference category: age 34 and younger); household income (reference category: \$60,000 or more); time in Canada (reference category: born in Canada/lived here 5+ years); parity (reference category: nulliparity)

uOR unadjusted odds ratio; aOR adjusted odds ratio

\*p value <0.05 compared to normal weight group, were normal weight (BMI 18.5–24.9 kg/m<sup>2</sup>) is reference

adults who visited their physician received advice about diet and exercise, respectively (Honda 2004).

One of the reasons for the low uptake of targeted antenatal care for obese pregnancies may be that the evidence of effectiveness of lifestyle interventions such as antenatal diet, physical activity, and behavioural changes, resulting in improved pregnancy outcomes, is conflicting. A systematic review and meta-analysis of the randomised and non-randomised trials, found that antenatal lifestyle interventions are associated with restricted gestational weight gain and a reduced prevalence of gestational diabetes in the overweight and obese populations (Dodd et al. 2010). Yet, no difference was found in other outcomes, such as caesarean delivery, large for gestational weight and macrosomia (Dodd et al. 2010). However, health care service providers and stakeholders are aware that evidence-based programmes that offer care pathways and protocols able to optimally care for pregnant women who are obese, by addressing the unique but unmet health needs of this population, need to be implemented (Clark and Ogden 1999). Health care and non-healthcare professionals would need to work together in designing and implementing multi-component interventions that focus on healthy eating, physical activity, and other behaviour changes, that are feasible for women of varying socio-demographic factors and backgrounds (Tanentsapf et al. 2011). Monitoring and evaluating such programs administered in one-on-one or group-based sessions, both antenatally and postnatally in community-based settings, would contribute to the evidence (Tanentsapf et al. 2011).

Only 60% of women from our study reported being counselled about nutrition during pregnancy, with no significant difference between women with increased and normal BMI. Our figures are similar to an American study

which found that approximately 64% of providers used their patients' pre-pregnancy BMI to inform their prenatal advice recommendations (Power et al. 2006). Because we surveyed only women's recall of nutrition counselling, the reason for the low uptake of nutritional counselling in our study is not apparent. Although we did not ask what type of advice women received about diet, when counselling about the diet, the most frequently dietary strategies reported by other studies were changing eating patterns, limiting intake of specific foods, and controlling portion size (Power et al. 2006). Some providers preferred to refer patients to behavioral weight loss therapy. It appears, however, that providers who believe that they can help patients lose weight are more likely to follow recommendations for the treatment of obesity (Gracie et al. 2010). Although it has also been suggested that dietary interventions targeting overweight and obese women should be more intense than the interventions targeting normal weight women, there is still uncertainty about the optimal intensity of these interventions. A series of systematic reviews and meta-analyses attempting to summarize the evidence of antenatal dietary interventions in obese women on maternal and infant health outcomes provided inconclusive results (Dodd et al. 2008, 2010). There is limited information available about the benefits and harm associated with dietary and lifestyle interventions for overweight and obese pregnant women (Dodd et al. 2008; Kramer 2000). As such, no reliable recommendations for clinical practice may explain the low uptake of nutritional advice as part of the prenatal counselling of pregnant women with higher than normal BMI.

Approximately half of women in our cohort were counselled on substance use in pregnancy, with no differences between women from different BMI categories, although slightly less obese women recalled advice on alcohol use

and smoking and more recalled advice on non-/prescription drugs as compared to normal weight women. These findings mirror reports of substance misuse in general population which show similar trends in obese and normal weight individuals (Barry et al. 2009; Sansone and Sansone 2013). From the three domains of substance abuse we surveyed, the domain in which women recalled lowest advice was smoking (42.0%) and highest was drugs consumption (62.2%). Our findings are similar to reports from other Canadian studies that show that between 38–48% of physicians are prepared to discuss risks of smoking, alcohol and drug use with women of childbearing age during prenatal counselling and/or during pregnancy (Tough et al. 2008). Although women expressed comfort in asking questions, it is not known whether the counselling each woman received was part of the standard of care or if it was prompted in response to the woman's questions or knowledge of the woman's health or behavioral history. More women recalled receiving counselling on smoking, alcohol consumption, and recreational drugs in pregnancy as compared to women who report any of these substance use (5.1, 0.8 and 0.2%, respectively) (Vinturache et al. 2014) suggesting that health care providers counsel on these domain as part of the standard care, although it may appear irrelevant to individual women. Asking about substance consumption is the first step in assessing and recording the level of risk that should lead to advising pregnant women about the adverse effects on pregnancy and offspring and assisting them to stop or reduce smoking, alcohol and drug consumption, arranging for further support, referral and follow up, and treatment where is required (Payne et al. 2014).

### Limitations and Strengths

While interpreting our findings, we acknowledge several limitations. Self-reporting of health status and prenatal advice may have potentially introduced underreporting bias. However, this may have been leveraged by the prospective data collection. Our sample of well-educated women with a household income above the Canadian average may have skewed the health care provider-patient interaction. That is to say, higher socio-economic status may have influenced the topics approached by the health professional, who would have assumed that women were already aware and informed of those issues. However, the demographic characteristics of our study align with the pregnant and parenting population of an urban center in Canada (McDonald et al. 2013). We did not explore the specific advice women received, or what type of intervention, if any, was proposed. In addition, we did not inquire the number of times a provider may have addressed each domain with each woman, or if the provider has addressed the specific domain needs of individual women. However, it is

likely that with the opportunity to ask questions to address particular needs, women may have received individualised counselling and advice, thus overcoming this limitation of our study.

These limitations point out to additional studies that are warranted for a more in-depth picture of prenatal care of obese women in the province of Alberta. Future lines of inquiry should explore the relationship between the type of prenatal care provider (specialist, family physician, nurse, midwife), number of prenatal appointments attended and women's recall of their prenatal counselling experiences, stratified by maternal pre-pregnancy BMI. Our study provides, however, insight into the prenatal care obese women with healthy, uncomplicated pregnancies receive in primary care settings. This contemporary cohort renders our results relevant to current clinical practice, providing information for future evidence-based interventions related to provision of nutritional and lifestyle counselling as part of the antenatal health assessment to all women, and especially to those with increased BMI.

### Conclusions

In conclusion, our study suggests that pre-pregnancy BMI may not be related to prenatal counselling across a range of domains including nutrition, active living and exercise, smoking and alcohol consumption. Pre-pregnancy BMI is not associated with recall across domains of prenatal counselling. Health care professionals are well positioned to identify and advise pregnant women on the preventable and modifiable risk factors of obesity. Additional studies are needed to produce evidence-based recommendations for clinical practice to improve access of these women to targeted counseling and prevention programs.

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**Author Contributions** AEV conceived the idea and designed the study with input from AW and SCT. AW analysed the data and compiled the results with supervision from AEV, who wrote the final report. All authors read and approved the final manuscript.

### Compliance with Ethical Standards

**Conflict of interest** The authors declare no competing interests.



**Ethical Approval** This study was obtained from the Conjoint Health Research Ethics Board at the University of Calgary (ethics ID 22128/24.10.2010). Signed informed consent was obtained from all study participants prior to the start of data collection.

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